

SDS 2290 FAMILY OF  
8" DISK DRIVES

User's Manual

June 1, 1987

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2290 8" Family of Disk Drives  
User's Guide

WARNING

This equipment generates, uses and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause interference to radio communications. It has been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when used in a commercial environment. Operating this equipment in a residential area may cause interference. In that case, the user, at his own expense, must take measures to correct the interference.

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## HOW TO USE THIS MANUAL

This manual provides information concerning the installation and operation of the SDS 2290 8" disk drives.

- Chapter 1      Discusses the disk drives, the disk controller and the concept of disk platters, sectors, tracks and addressing. A brief discussion of the principles of disk operation is presented.
- Chapter 2      Provides specific instructions on receiving, unpacking and installing the 2290 disk system.
- Chapter 3      Explains the controls and indicators used to operate the drive. Provides specific instructions on starting and stopping the drives.
- Chapter 4      Discusses handling, labeling, storing, installing and removing the 2290 31MB Removable Data Pack.
- Chapter 5      Explains Formatting and Verifying the data platters.
- Chapter 6      Explains the maintenance procedures for the disk drives.
- Appendix      Lists the Model 2290 8" disk families' operational and physical specifications.



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## The 2290 8" Family of Fixed/Removable Disk Drives

The 2290 8" Family of Fixed/Removable Disk Drives provide high performance, low cost data storage alternatives for the customer who needs high performance, has large data storage requirements and desires the flexibility and convenience of removable media.

Each drive in the 2290 8" Family contains both a removable data cartridge and a fixed storage section. The removable data cartridge contains one hard platter providing 2 recording surfaces which are configured as 2 logical disk addresses. The fixed storage section contains one, two or three hard platters providing up to six recording surfaces which are configured as up to six logical disk addresses.

The capacity and operating parameters of the removable platter is identical to the capacity and operating parameters of a fixed platter. This allows convenient platter to platter backups without requiring complicated backup and recover routines. It also allows temporary or high security applications to be run from a removable cartridge without loss of performance.



Model 2290 8" Disk Drive

## The Model 2290-60 Disk Drive

The Model 2290-60 Fixed/Removable Disk Drive supports a 31.3MB removable data cartridge and 31.3MB of fixed storage. The 2290-60 drive's fixed storage section contains 2 recording surfaces. The 2 removable and 2 fixed surfaces are configured as 4 disk addresses.

## The Model 2290-90 Disk Drive

The Model 2290-90 Fixed/Removable Disk Drive supports a 31.3MB removable data cartridge and 63MB of fixed storage. The 2290-90 drive's fixed storage section contains 4 recording surfaces. The 2 removable and 4 fixed surfaces are configured as 6 disk addresses.

## The Model 2290-120 Disk Drive

The Model 2290-120 Fixed/Removable Disk Drive supports a 31.3MB removable data cartridge and 94MB of fixed storage. The 2290-120 drive's fixed storage section contains 6 recording surfaces. The 2 removable and 6 fixed surfaces are configured as 8 disk addresses.

## The Model 2290-180 Storage System

The Model 2290-180 Storage System contains two Fixed/Removable Disk Drives and supports two 31.3MB removable data cartridges and 125MB of fixed storage. The 2290-180 system's fixed storage section contains 8 recording surfaces. The 4 removable and 8 fixed surfaces are configured as 12 disk addresses.

## The Model 2290-210 Storage System

The Model 2290-210 Storage System contains two Fixed/Removable Disk Drives and supports two 31.3MB removable data cartridges and 157MB of fixed storage. The 2290-210 system's fixed storage section contains 10 recording surfaces. The 4 removable and 10 fixed surfaces are configured as 14 disk addresses.

## The Model 2290-240 Storage System

The Model 2290-240 Storage System contains two Fixed/Removable Disk Drives and supports two 31.3MB removable data cartridges and 188MB of fixed storage. The 2290-240 system's fixed storage section contains 12 recording surfaces. The 4 removable and 12 fixed surfaces are configured as 16 disk addresses.

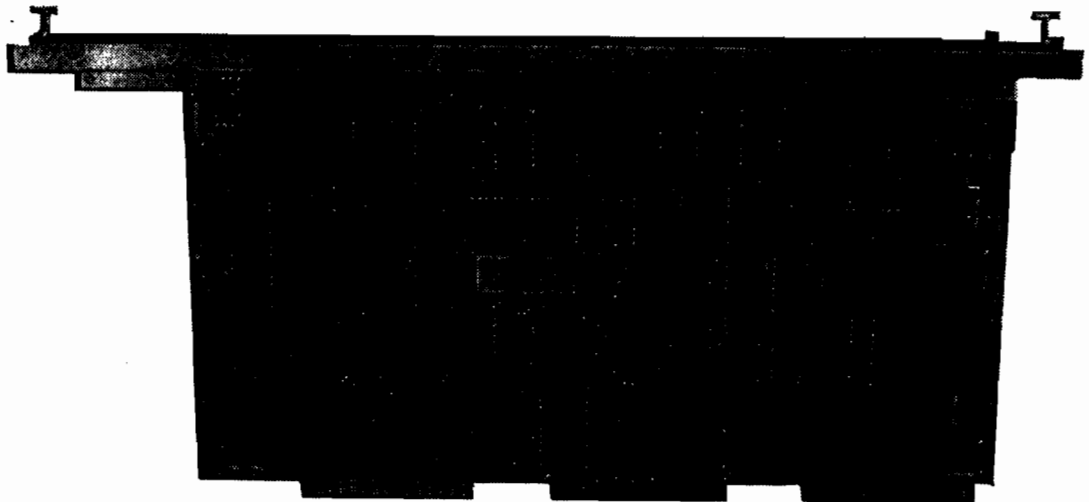


## The Disk Controller

The 229X-SMD2 disk controller is a disk processing unit (DPU) which can be installed in any available I/O expansion slot on the CS/2200 series central processing unit (CPU). The 229X-SMD2 is an intelligent controller which connects one or two Model 2290-xxx disk drives to any CS/2200 processor. It also provides a large high speed memory which may be configured as a data cache and controller resident RAM/Disk.

The 2290-SMD2 disk controller is also available with the 2290-MUX option which allows additional CS/2200 processors or PC's to share the 2290 disk system.

The 229X-SMD2 controls data transfer between the disk drive and the CS/2200 system CPU, provides data buffering between the CPU and the disk drive, and controls all disk functions such as read, write, format, copy and verify. The 229X-SMD2 also performs extensive error checking and correction.



229X-SMD2 Disk Controller

## The Disk Platter

The 2290 8" disk drives use one or more "disk platters" to store information in a manner similar to storage on magnetic tape. A disk platter is a thin circular plate which is coated on both sides with a magnetic material.

The removable cartridge contains a single platter which is protected by a sealed plastic case. The fixed storage section contains one or more platters which are installed at the factory and cannot be removed from the unit.

## Sectors on the Disk Platter

The recording surface of the disk platter is divided into 928 concentric "tracks" for information storage. Each track is divided into 66 storage areas called "sectors", the smallest unit of storage on the disk.

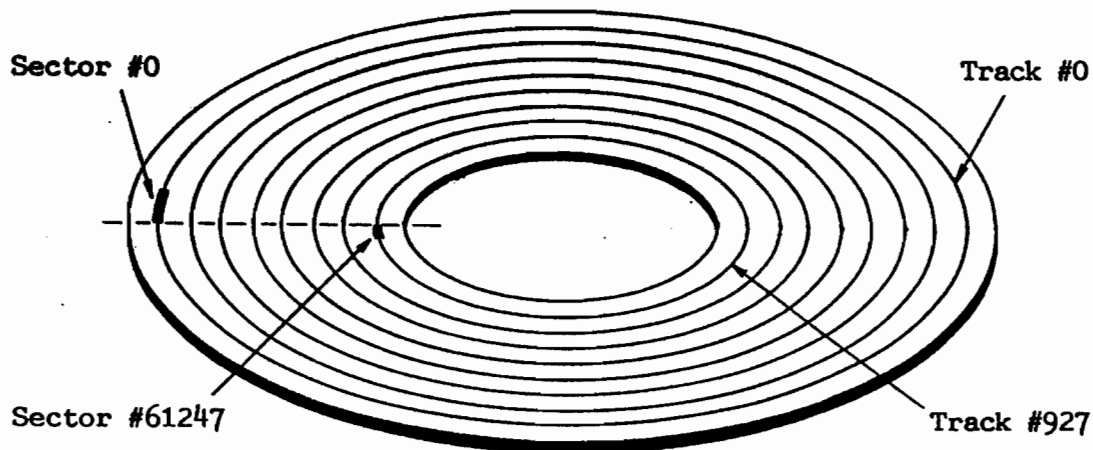
Each sector contains its own unique sector address and can be directly accessed by the system. Each sector also contains several bytes of control information, 256 bytes of user information and an error correcting code (ECC).

The ECC verifies the accuracy of data stored in a sector and provides information necessary to automatically correct certain types of data recording errors. The disk controller creates the ECC and the control information saved within each sector which are transparent to the user.

## Track and Sector Numbering

Each concentric track is numbered sequentially on each recording surface. The outermost track is designated as track #0, and the innermost track designated as track #927.

The sectors on each track are numbered independently from #0 at the beginning of track 0 to #61181 at the end of track 926. The user can access any sector up to sector #61181. The system keeps the alternate sector map and the alternate sectors on track 927, sectors #61182-#61247.



Track and Sector Numbering

<u>Track #</u>	<u>Sector #</u>	<u>User Accessible</u>
0	0 - 65	Yes
1	66 - 131	Yes
2	132 - 197	Yes
.	.	.
.	.	.
.	.	.
926	61,116 - 61,181	Yes
927	Alternate sectors	No

Sector Numbering on a 2290 8" Drive Disk Surface

When the disk platter is formatted, the sectors are numbered sequentially as indicated in the table above. Numbering sectors sequentially from the first track to the last track allows the programmer to access a sector without determining track location. All addressing of data stored on the disk is done in terms of sector addresses. When given a sector address, the disk controller automatically determines the track containing the requested sector and moves the heads to that track.

### Disk Access Time

In order to locate a sector of information on a disk, the system determines on which disk platter and in which track on that platter the information is stored. The disk drive moves the read/write head to the appropriate track and waits for the appropriate sector to rotate to the head. Access time combines two operations:

1. The track access time - the time required to move the read/write head over the appropriate track on the platter.
2. The latency time - the time the read/write head must wait for the appropriate sector in the track to rotate beneath it as the platter revolves.

The number of tracks the read/write head travels across to reach the desired track determines track access time. Average track access time is the time required to cross 464 (one half of 928) tracks. The minimum track access time is 0 (the head is already positioned over the desired track) and the maximum track access time is the time required to cross 927 tracks.

The rotational speed of the disk unit determines disk latency time. The average latency time is the time for one half of a disk revolution.

## Addressing The Model 2290 8" Drives

The Model 2290 8" disk storage systems contain from four to sixteen recording surfaces. Each recording surface has a unique disk address indicated by "Dxy" where "D" indicates the disk device type, "x" specifies the disk unit address and "y" specifies the surface.

Each 2290 disk drive unit connects to a disk controller (DPU) installed in an I/O expansion slot on the CS/2200 system. The controller can be set to disk unit addresses of either 1, 2 or 3. If two drives are connected to the disk controller, the second drive drive assumes a disk unit address of either 5, 6 or 7, depending on the disk unit address set for the first drive.

The table below shows the possible disk addresses for a Model 2290-240 Storage System where the disk unit address is set for "1".

<u>Type</u>	<u>Platter</u>	<u>1st Drive</u>	<u>Platter</u>	<u>2nd Drive</u>
Removable	1	D10 (B10)	9	D50 (B50)
"	2	D17	10	D57
Fixed	3	D11 (310)	11	D51 (350)
"	4	D12	12	D52
"	5	D13	13	D53
"	6	D14	14	D54
"	7	D15	15	D55
"	8	D16	16	D56

Table of 2290-240 Platter Addresses

The possible disk addresses for the other models can be determined by reading the maximum platter number available for each model in the table below, then refer to the table above.

<u>Model</u>	<u>Maximum Platter Number</u>
2290-60	4
2290-90	6
2290-120	8
2290-180	12
2290-210	14
2290-240	16

The tables above show the disk addresses available if the disk unit address of the controller is set to "1". This corresponds to the disk addresses available in the CS/2200 system when the base disk address is "310". The disk controller may also be set to "2" or "3" which would correspond to a base disk address of "320" and "330" respectively.

## CHAPTER 2

# UNPACKING AND INSTALLATION INSTRUCTIONS

### Step 1 Receiving the Drives

The disk storage system shipping container insures safe transport under most shipping conditions. Always check each carton received for visible damage. Note on the Bill of Lading any damage found. If any external carton damage is found then internal damage is probable. Make note on the Bill of Lading of possible internal damage. Contact Southern Data Systems for instructions BEFORE installing the unit. DO NOT proceed to step 2.

Place the unopened shipping carton in the room where it is to be installed, and allow it to stabilize to the ambient temperature of the room. Leave the carton unopened for at least 4 hours. If the carton is delivered when the difference between the inside and outside temperature is more than 30°F (16°C), leave the carton unopened for at least 8 hours.

### Receiving the Data Packs

Your Removable Data Packs are shipped in cartons designed to withstand normal shipping abuse. When you receive a data pack, examine the shipping container for possible shipping damage. Note on the Bill of Lading any damage found. If you find any, have a qualified service representative inspect the data pack prior to using it in a disk drive. This eliminates the possibility of serious damage to the disk drive.

Read the instructions in Chapter 4, Installing a Data Pack, before installing a new data pack on your drive.

### Step 2 Unpacking

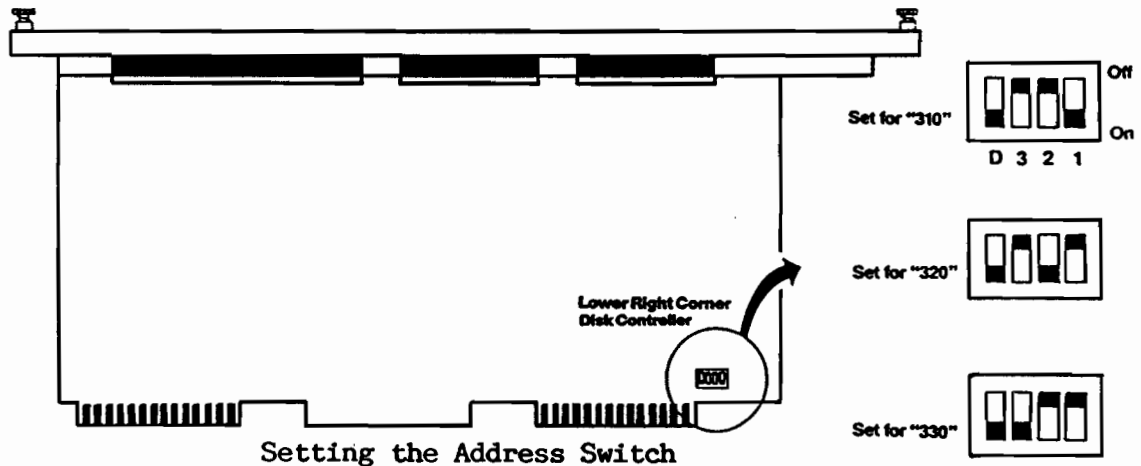
Special packing materials allow the unit to be delivered almost ready to plug in and turn on. Unpack and inspect according to the following instructions. Failure to follow these instructions may void the equipment warranty.

- A Cut the sealing tape on the top of the carton and open the top flaps of the carton. Remove the top shipping pads. Remove the disk controller, cables, power cord and data cartridge, if your order included these items.

- B Remove the foam shipping protection block from the top of the disk drive. (Keep these packing materials and the carton for later use if needed.)
- C Lift the drive unit from the carton, and set it on a desk or table top. Be careful to lift the drive unit only from the sides, NOT from the front and rear. The drive unit weighs approximately 38 pounds.
- D Remove the plastic shipping bag and other packing material from the drive. Place the drive in the desired location. Leave at least a three inch clearance between the back of the unit and the wall to ensure proper air circulation.
- E Inspect the drive cabinet and the disk drive for possible shipping damage. Proceed with the installation only if no damage is evident.

### **Step 3** Installing the Disk Controller

- A Remove the "SDS Disk Controller" board from the shipping bag and inspect it for any visible damage.
- B Set the address switch on the disk controller to the correct position for base disk address 310, 320 or 330 according to the diagram below. The disk controller is shipped from the factory with the switches set for 310.



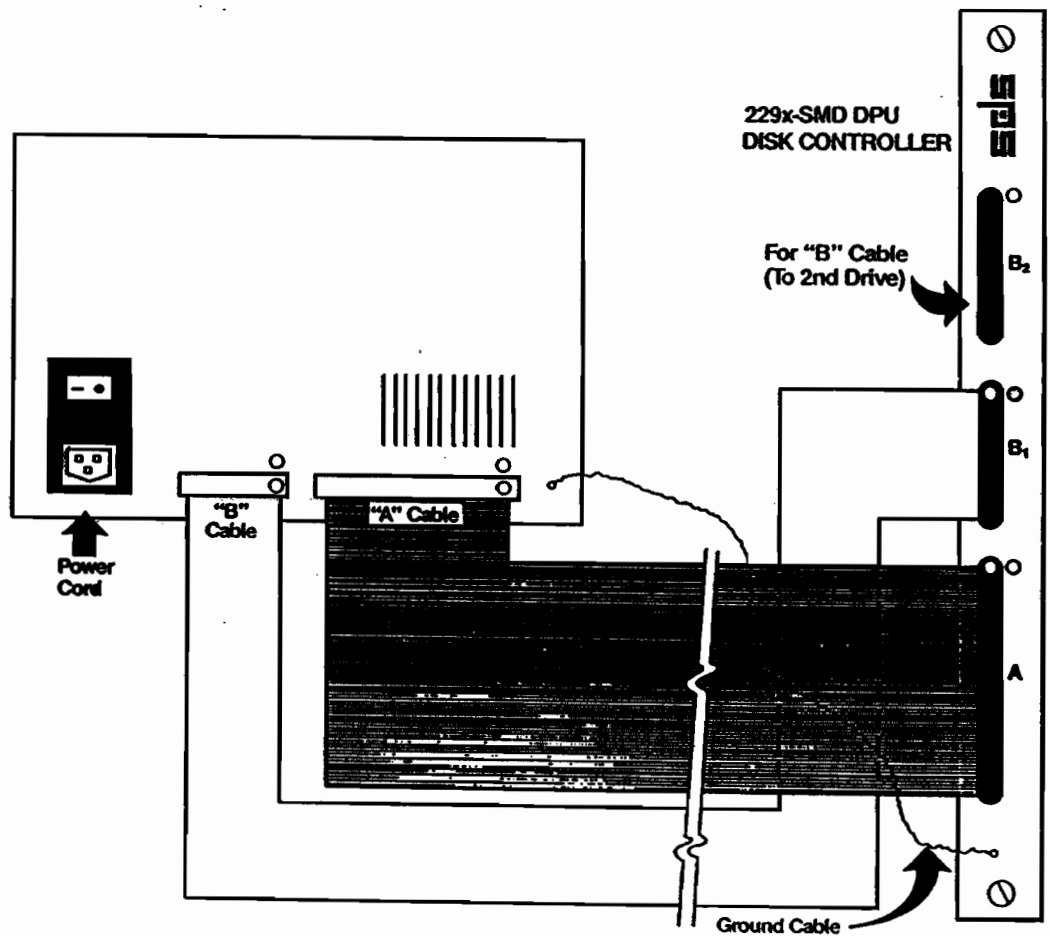
- C Turn off the power to your CS/2200 CPU and unplug the power cord. Install the disk controller board in any available I/O expansion slot on your CPU. Line up the gold tabs (fingers) on the board with the connectors inside the CS/2200 chassis. Firmly press the board in while applying a slight rocking motion to seat the board completely in the connector. Align the screws on the metal rail with the threaded holes on the edge of the CPU chassis, and screw them in securely.

**Step 4** Connecting the Cables

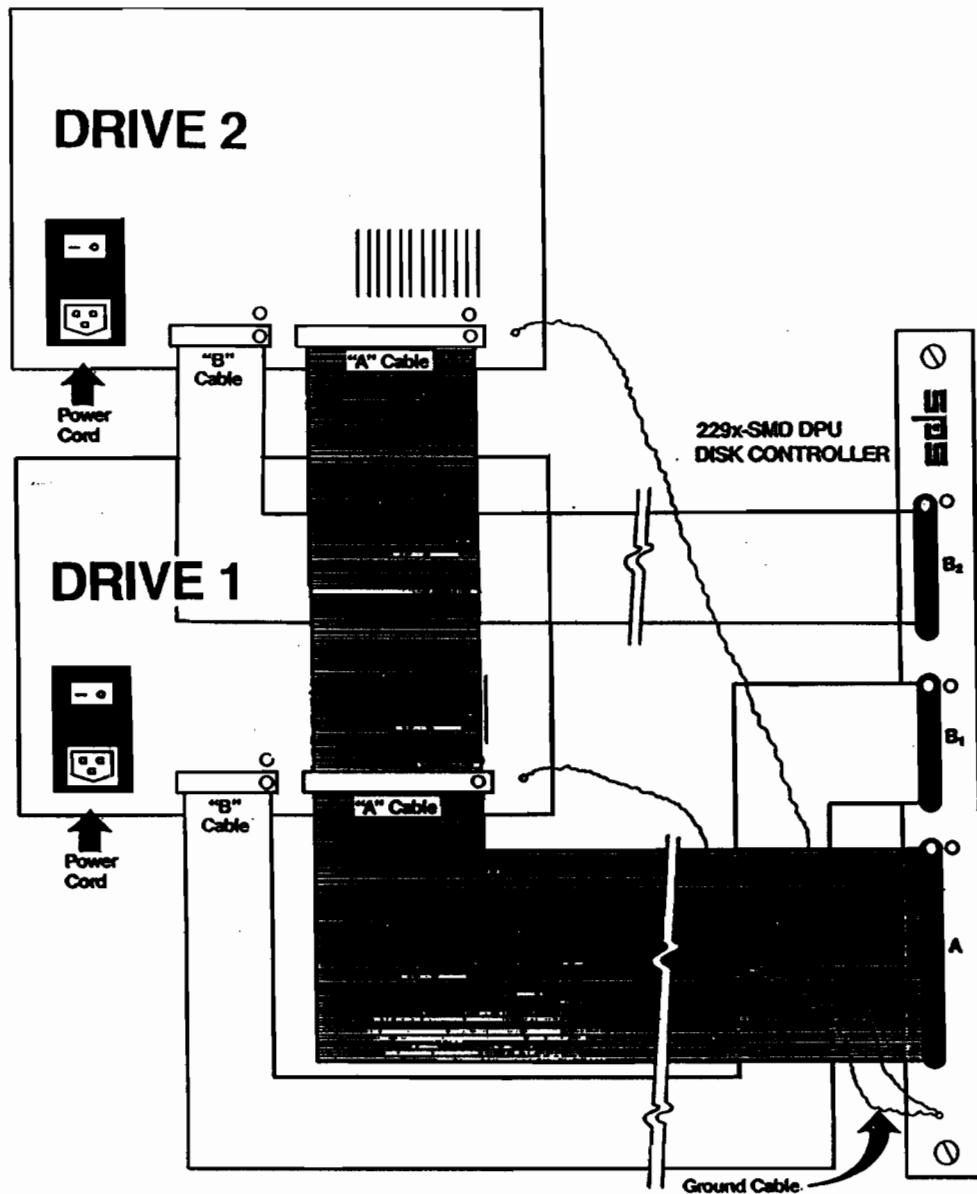
A Each Model 2290-60, 2290-90 and 2290-120 Storage System requires 2 data cables for connection to the disk controller. Refer to the single drive diagram below.

Each Model 2290-180, 2290-210 and 2290-240 Storage System requires 3 data cables for connection to the disk controller. Refer to the double drive diagram below.

These cables are called "A" and "B" cables. Each data cable shipped with the drive has a 'RED' dot on one edge of the connector. This 'RED' dot edge is to be 'up' if plugged into the DPU or to the 'right' if plugged into the disk drive. Align the cables with the connectors and plug them in.



Connecting the Cables for Single Drive Systems



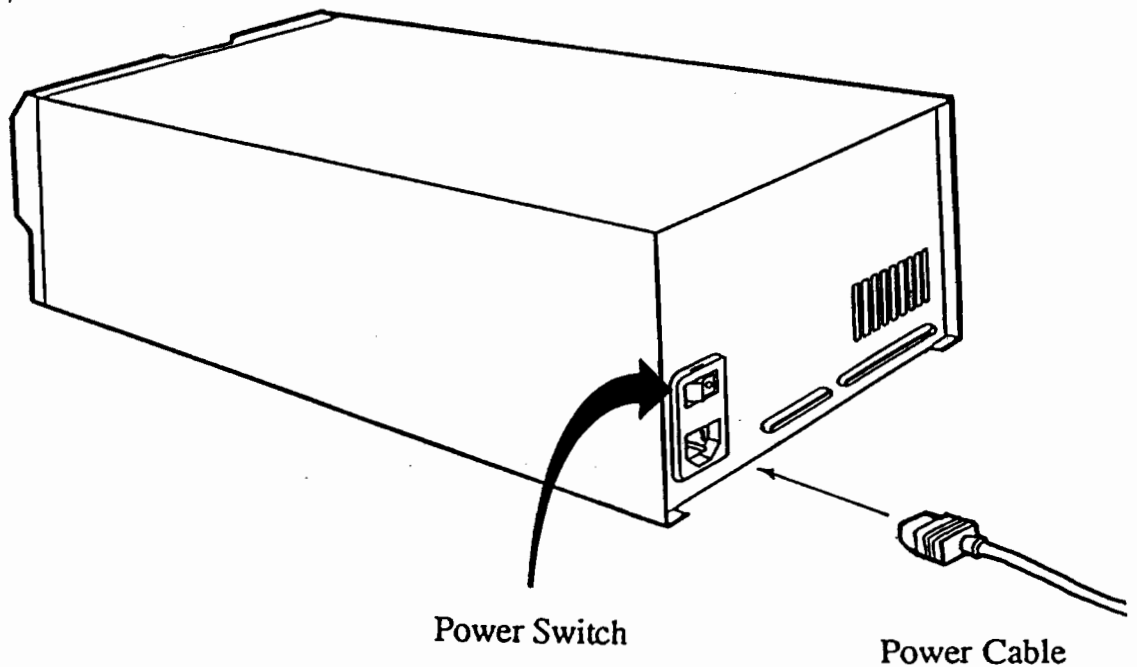
**Connecting the Cables for Double Drive Systems**

- B. Connect one end of the system ground cable supplied with your drive to the ground screw on the face of the metal rail on the disk controller. The other end is to be connected to the ground connector on the rear of the 2290 disk drive. In double drive systems, a second, shorter ground cable is supplied to connect the two drives.
- C. Plug the disk drive power cord into a grounded (three-hole) outlet. The power requirement for the 2290 8" disk drive is 120 volts AC, 60 Hz. 220 volts AC, 50 Hz units are also available.
- D. You can now plug in the system power cord.



### The Power Switch

The power switch for each disk drive is on the rear of the drive cabinet. The power switch is part of the power connector module which includes the on/off switch, the power cord connector, a fuse and EMI filter. The 2290 drives are designed to operate on 115 volt AC, 60 Hz single phase power. A six foot, 3 conductor power cord is standard with each drive. The drive may also be equipped to operate on 220 volt AC, 50 Hz single phase power.

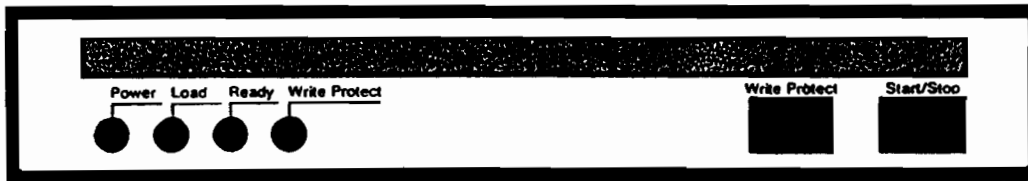


The Power Switch and Power Connection

### Operator Control Panel

There are two switches and four indicator lights located on the operator control panel. The operator control panel is located on the front of the drive below the removable data pack access door.

When the indicators are 'on' and not flashing, they indicate the status condition of the drive. When any of the indicators are flashing, they are indicating an error condition has been detected.



### Operator Control Panel

The normal operating status conditions of the drive are defined in the following table:

<u>Indicator</u>	<u>Function Description</u>
<b>POWER</b>	The POWER indicator is turned on when the power on/off switch on the rear of the drive is in the ON position.
<b>LOAD</b>	The LOAD indicator is turned on when the START/STOP switch is in the STOP position, the drive is not spinning and the data pack door is unlocked. The removable data pack can be changed only when the LOAD indicator is ON. DO NOT try to open the data pack door when the LOAD indicator is turned OFF.
<b>READY</b>	The READY indicator is OFF when the drive is stopped. When you place the START/STOP switch in the START position to start the drive, the drive will execute the startup sequence and the READY indicator will light continuously when the drive is up to speed and ready for operation.
<b>WRITE PROTECT</b>	The WRITE PROTECT indicator is turned on when the Write Protect switch is ON or when the write protect tab on the removable data pack has been removed.

Fault or Error conditions are indicated by flashing the front panel indicators in a repeating pattern. The pattern of the flashing indicators is an error code which may be important in determining and correcting any problem in the drive.

Some error conditions may be corrected by switching the 'Write Protect' switch off and on. Other error conditions may require that the power to the drive be switched off and on to clear the error. If turning the power off and on does not clear the error condition, call your Southern Data Systems authorized service representative for assistance.

The function of the two switches on the operator control panel are defined as follows:

<u>Switch</u>	<u>Function Description</u>
START STOP	Placing the START/STOP switch in the STOP position while the drive is READY will initiate the STOP sequence. The READY indicator will turn off.  The start function initiates the disk startup sequence only if the disk drive power switch is ON, a data pack is installed and the door is closed and latched and no fault conditions exist.
WRITE PROTECT	The WRITE PROTECT switch disables writing to all the disk platters on the drive. This protects the platters from accidental over-writing.

## Starting the Drives

- A Be sure that the disk START/STOP switches are in the STOP position. NEVER turn the power ON or OFF when the drive is in START mode.
- B Turn the power switch ON for all peripherals on your system, including the disk.
- C Turn the power switch ON for the CPU. This starts the MASTER INITIALIZATION process for the CS/2200 system.
- D Install a data pack and close the pack access door. Otherwise the drive will not operate. Refer to the Data Pack Installation procedure before proceeding.
- E Place the START/STOP switch on the disk drives in the START position. The READY indicator will light once the unit is up to speed and the read/write heads are loaded.

## Stopping the Drives

- A Place the START/STOP switch in the STOP position to stop the drive. The READY indicator light will go off.
- B When the LOAD indicator lights, the disk drive power down sequence is complete. If you want, you may remove the Data Pack according to the directions given later in this manual.
- C If you are through using the drive, turn the power switch on the rear of the drive OFF.

ALWAYS switch the drive OFF before switching the CPU OFF.

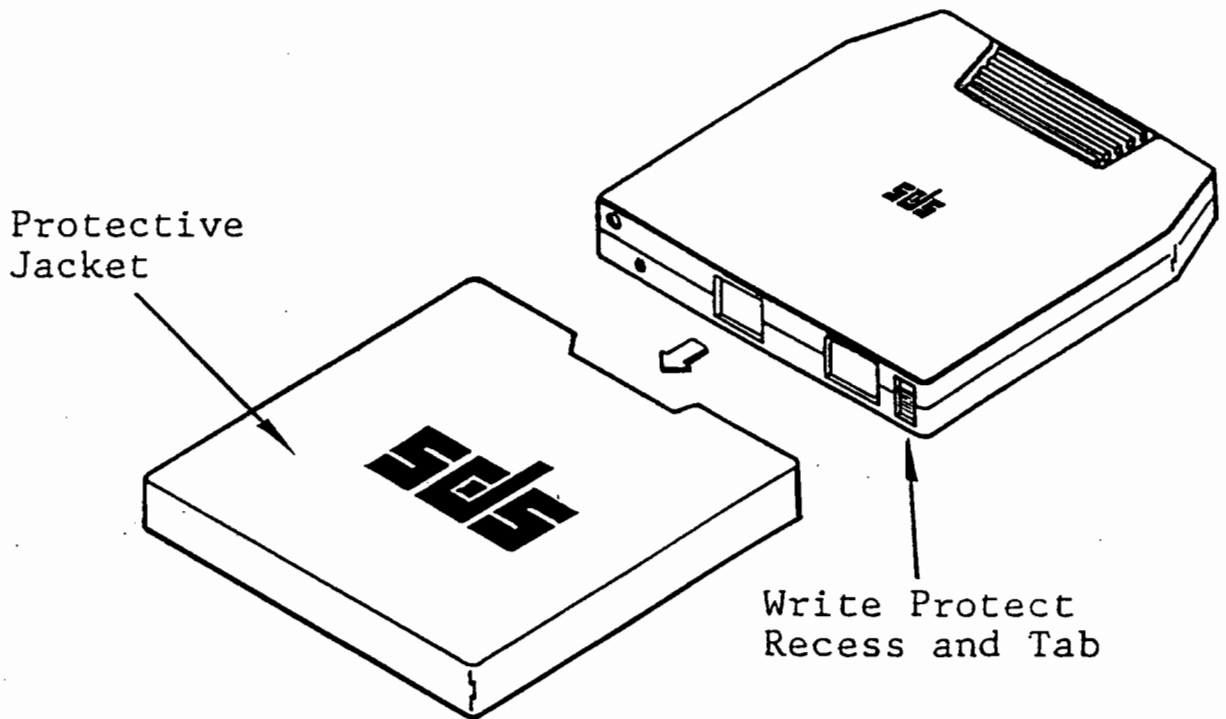


## CHAPTER 4

## THE 2290 REMOVABLE DATA PACK

Each Model 2290 Storage System drive contains a removable and a fixed storage section. The fixed disk portion is installed at the factory and cannot be removed from the disk unit.

The removable section uses a 31MB Data Pack, which can be taken out and replaced by the operator. The Data Pack contains a hard disk sealed in a plastic case. When installed in the drive, two access ports automatically open to allow the heads to enter and air to circulate through the data pack. The Data Pack has two surfaces for user data storage.



31MB Removable Data Pack

### The Data Pack Write Protect Tab

The 2290 Data Pack has a write protect tab which prevents writing on the pack. When the write protect tab is removed the "Write Protect" indicator on the front panel will be ON.

## Data Pack Handling

The Data Pack is manufactured to ensure that platter surfaces are extremely flat and smooth. Proper handling and storage of the Data Pack maintains this condition. The plastic case protects the disks from contamination but not from physical abuse. Observe the following guidelines for handling and storing your data packs.

- Clean the data pack case periodically with a clean, lint-free cloth to remove any dust.
- Replace cracked or otherwise damaged data packs.
- Keep food, beverages and smoking away from the data packs.
- Do not expose the data pack to strong magnetic fields. Information may be lost when the pack is exposed to magnetic field intensities of more than 50 Gauss.
- Do not store the data pack in direct sunlight or where temperature or humidity is extreme. Such exposure may deteriorate the recording surface.
- If a data pack is dropped or banged against something, DO NOT USE IT until a qualified Service Representative inspects it. Its use could seriously damage the disk drive.

## Carrying

Data packs can be carried like books. Do not apply too much pressure to the plastic case. Do not drop or bang the pack against another object.

## Labeling

Use the adhesive labels supplied with your data packs to mark them for identification. Apply labels only on the front edge of the data pack in the indented area. Labels placed in other positions may be scraped off and interfere with the drive's performance.

When removing a label, use isopropyl alcohol to remove adhesive residue from the case. Write on labels only with a pen or felt tip marker. NEVER use a lead pencil or a grease pencil. Additional supplies of labels are available from Southern Data Systems.

## Operating Environment

Store frequently used data packs in the same room with the 2290 disk drive. This ensures that the data packs are at approximately the same temperature as the disk drive. If data packs are not stored in the same room, place them in the same room temperature for two hours prior to installing on the 2290 drive. This ensures temperature stabilization.

## Storage

Store data packs in their protective sleeve on their edge like a book.

For short term storage, store the data pack on a shelf or in a bookcase in the same room or environment as the 2290 disk drive.

For long term storage, select a cabinet or storeroom where the temperature is between 32°F to 100°F (0°C to 38°C) and the relative humidity between 8% to 80% noncondensing. Also consider a storage location which does not allow the temperature to rise above 150°F (60°C) in case of fire.

Store data packs containing vitally important data or duplicate master records in a cabinet or storeroom that provides protection against catastrophic damage. Remember to keep "off-site" copies of all such information.

### **CAUTION**

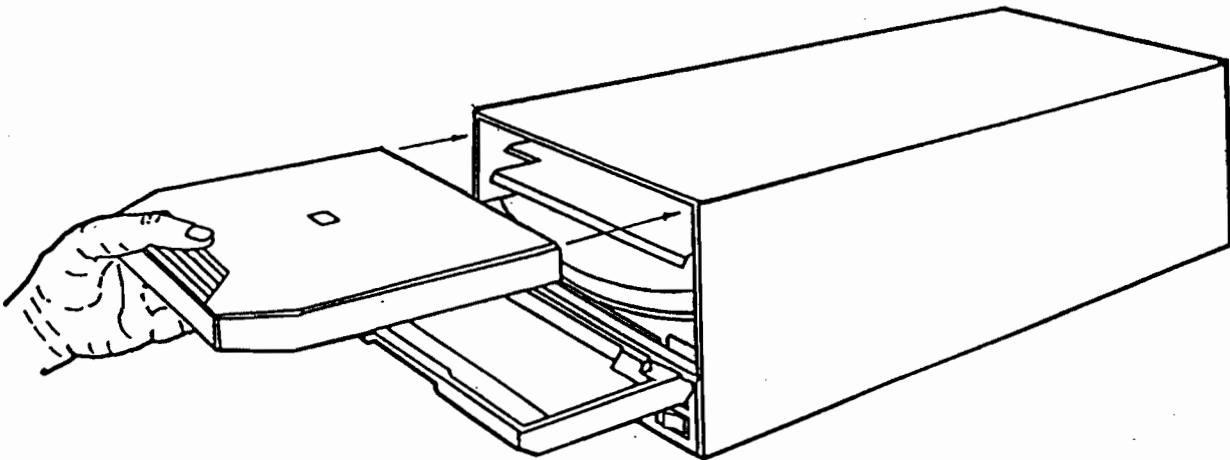
Install the 'RED Dummy Cartridge' in the drive whenever the drive is moved or when no data cartridge is installed. Always remove the data pack when the disk drive is moved from one location to another. Failure to do so could cause damage to the read/write heads and/or the data pack.

## Installing a Data Pack

Place the data pack in the same environment as the 2290 disk drive for a minimum of two hours prior to installing it in the drive. The data pack will reach the same temperature as the drive which prevents problems associated with dimensional changes due to temperature changes.

Install or remove data packs only when power to the drive is ON and the LOAD indicator is ON.

- Step 1** If the READY indicator is ON, press the START switch and wait for the LOAD indicator to light.
- Step 2** Open the pack access door. Remove the data pack or the 'Red Dummy Cartridge'.
- Step 3** Slide the new data pack in the pack receiver. The side of the pack with the metal hub should be facing toward the bottom. Push the pack completely in until it locks into place.
- Step 4** Release the pack access door, it will close automatically. Press the START switch to start the disk drive.



Data Pack Installation



## Removing a Data Pack

### **Step 1**

If the READY indicator is ON, place the START/STOP switch in the STOP position and wait for the LOAD indicator to come ON. You cannot remove the data pack if the READY indicator is ON or flashing.

### **Step 2**

Open the pack access door. When the door is opened fully, the data pack retainer releases the data pack and partially ejects it.

**NOTE:** The pack access door will not open if the drive power switch is not ON. If the drive power switch is ON, the START/STOP switch is in the STOP position, the LOAD indicator is on and the pack access door will not open, DO NOT FORCE the door open. Call your Service Representative for assistance.

### **Step 3**

Slide the data pack out of the pack receiver. Install another data pack or the 'Red Dummy Cartridge' and release the door so it will close automatically.

**NOTE:** DO NOT leave the pack access door open. This allows dust and other contaminants to enter the disk drive. Leave a data pack or the 'Red Dummy Cartridge' installed in the drive when the drive is not being used. The cartridge provides a seal for areas in the drive that must remain dust free.

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## CHAPTER 5

# FORMATTING AND VERIFYING THE 2290 DRIVE

All Model 2290 fixed and removable platters are formatted before shipment. Formatting a platter assigns a unique address to each sector on the disk platter and writes control information which maintains the disk and checks the validity of information stored on it. Zeros are written into the user data area of each sector.

Most data packs have a few defects which must be located and bypassed in order to use the remainder of the pack. Formatting also verifies the data storage capability of each sector on the platter and assigns alternate sectors to those sectors that do not meet certification specifications.

### The Format Function

If you determine that a platter must be re-formatted, the 229X-SMD2 disk controller (DPU) will format a Model 2290 disk platter. To begin formatting a platter, execute a \$FORMAT DISK statement. When all the sectors on the platter are formatted, the platter is ready for program and data storage. The format time for a platter is approximately 13 minutes.

The general FORMAT statement is:

```
$FORMAT DISK T/Dxy      Where "x" is the disk unit address  
                        "y" is the platter number.
```

#### CAUTION

Formatting a disk platter overwrites all data previously stored on the platter. Formatting should only be done by personnel familiar with the computer system and knowledgeable of the disk configuration. Take extra care to prevent accidental formatting of the wrong disk platter

## Error Correcting Code (ECC)

The 229X-SMD2 disk controller (DPU) writes an Error Correction Code (ECC) and control information in the control section of each sector. This combined information is used to verify the data integrity when the sector is read. This means that if a sector develops a "bad spot", the data in that bad spot might be reconstructed.

The ECC used in the 2290 disk storage system corrects errors of up to 12 bits in length on a read operation. If the bad spot is larger than 12 bits, the system generates an I96 error.

## The Verify Operation

The VERIFY statement reads a disk platter and determines whether the data written there is still correct. The VERIFY statement operates either on all sectors currently used on the disk or only over a specified range of sectors.

If an error is detected during the verify operation, the system can generate an error message which shows the address of the sector with the error. Some errors can be corrected by rewriting the error sector. If this does not correct the error, re-format the platter.

The general VERIFY statement is:

```
VERIFY T/Dxy, (start-sector, end-sector) (num-variable)
```

Where "x"	is the disk unit address
"y"	is the platter number.
"start-sector"	is an optional expression whose value equals the first sector to be verified.
"end-sector"	is an optional expression whose value equals the last sector to be verified.
"num-variable"	is an optional numeric variable. If used, sector errors are not displayed on the screen. This variable is set equal to the bad sector address +1 of the first sector which did not verify. If no errors are detected, this variable is set to zero. If not used the sector errors will be displayed on the screen.

## Preventive Maintenance Information

The 2290 8" Family of disk drives does not require any regularly scheduled preventive maintenance. However, a few simple rules of daily care will prolong the life of your system and insure continued reliable performance.

- Always have either a data pack or the 'Red Dummy Cartridge' installed in the drive.
- Operate the drive only in an area which meets the environmental specifications of the drive. See the Appendix for complete specifications.
- Store the removable data pack in a cool, dry location and always allow data packs to reach the same temperature as the drive before use.

The drive cabinet and the foam filter in the operator panel should be cleaned as necessary to prevent dust buildup. The cabinet should be cleaned with a damp cloth only. The foam filter should be vacuumed from the outside only.

The diagnostic programs built into the drive and the disk controller (DPU) will check out the storage system each time the power is turned on. If any operational problems are detected within the drive, the four indicator lights on the operator control panel will flash in a repeating pattern. The pattern of the flashing indicators is an error code which may be important in determining and correcting any problem in the drive.

Some error conditions may be corrected by cycling the 'Write Protect' switch off and on. Other error conditions may require that the power to the drive be switched off and on to clear the error. If turning the power off and on does not clear the error condition, call your Southern Data Systems authorized dealer for assistance.

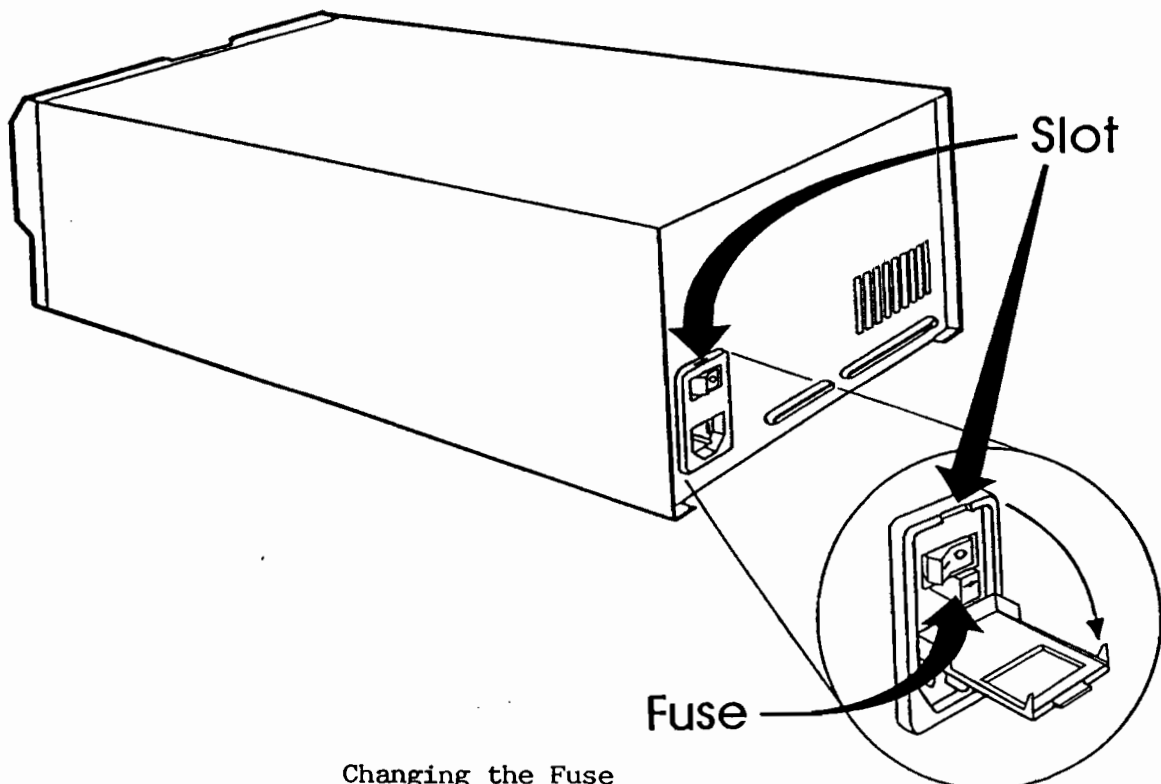
## Changing the Fuse

Operating the drive at the wrong voltage or the occurrence of a power fluctuation may blow the drive's power fuse. If the power cord is plugged into an active circuit of the correct voltage and

frequency and the power indicator does not light when the power switch is turn ON and the cooling fan does will not run, then the fuse may be blown.

The fuse is located in the power connector module located on the bottom corner of the rear panel between the power cord connector and the power switch. Follow these instructions to change the fuse:

1. Disconnect the power cord from the rear of the drive.
2. Insert a small flat-blade screwdriver in the slot at the top of the power connector module just above the on/off switch and open the fuse cover open by twisting the screwdriver slightly in either direction.
3. Pull the fuse holder out of the module. The fuse is located in a gray housing with a right-pointing arrow printed on its cover. This holder which may be extracted by gently pulling the housing from the unit with the tip of the screw driver.
4. Replace the fuse. In 110 volt systems, use a 3 amp, 250 VAC rating fuse. In 220 volt systems, use a 1.5 amp, 250 VAC rating fuse.
5. Reinstall the fuse in the power module and snap the cover closed.
6. Plug in the power cord and turn the power switch ON to verify that the drive will operate.



Changing the Fuse

## Service Life

The expected service life of the drives is 5 years or 20,000 power on hours, whichever occurs first. Complete factory overhauls are available from Southern Data Systems for drives reaching their design life usage. Contact your dealer or Southern Data Systems for details concerning a factory overhaul.

## Service Frequency

The Mean Time Between Failure (MTBF) for the 2290 8" disk drive exceeds 15000 hours. If a failure should occur, troubleshooting assistance is available from your authorized service representative. If a repair is required, arrangements can be made through your dealer for the necessary repair. The average time to repair a drive, assuming properly trained and competent service personnel, is one-half hour.

If you need to ship your drive for any reason, you should only use approved Southern Data Systems packaging. If the original packaging is not usable, you can order additional packaging material from your dealer or Southern Data Systems.

## Maintenance Agreement

Southern Data Systems, Inc. offers an Equipment Maintenance Agreement which ensures proper servicing when necessary. The agreement protects your investment and offers a fixed annual cost for all repairs. Further information can be obtained by contacting Southern Data Systems at (919) 781-7603.

If you do not purchase a maintenance agreement, you must request service as needed. Charges for any repairs will be based on current time and material rates and will depend on the work performed.

### **NOTICE**

*Southern Data Systems, Inc. does not guarantee or honor maintenance agreements for any equipment modified by others. Repair of damage to equipment incurred as a result of such modification is the financial responsibility of the user.*





Appendix

## APPENDIX A

### CAPACITY AND PERFORMANCE SPECIFICATIONS

<u>Capacity</u>	<u>2290-60</u>	<u>2290-90</u>	<u>2290-120</u>
Stated Capacity	63 MB	94 MB	125 MB
Sectors/Platter	61,248	61,248	61,248
# of Platters	4	6	8
Total Sectors	244,992	367,488	489,984
Bytes/Platter	15,679,488	15,679,488	15,679,488
Total Bytes	62,717,952	94,076,928	125,435,904

### Backup Parameters

# of Removable Surfaces	2	2	2
# of Fixed Surfaces	2	4	6
# Packs/Backup	1	2	3
Approximate time for backup	4 min	7 min	10 min
Annual Time for 1 Backup per week	3.4 hrs	6.1 hrs	8.6 hrs

The following parameters apply to all models.

Copy Time per Platter	1 min
Start-up time	
cold start	110 sec
warm start	72 sec
Stop time	20 sec

### Service Performance

MTBF	15000+ hours
MTTR	one-half hour
Service Life	5 years
Preventive Maintenance	none

## APPENDIX A

# CAPACITY AND PERFORMANCE SPECIFICATIONS

### Performance

#### All Models

Rotation Speed	3416 rpm
Seek Times	
Track to Track	7 ms
Average Access	27 ms
Maximum Access	45 ms
Latency Time	8.78 ms
Average Read Time	4.1 ms
Average Write Time	3.9 ms

### Size and Weight

Height	6 in
Width	9 in
Depth	20 in
Weight	38 lb

### Power Requirements

Voltage	120 volts AC, 60 Hz (220 volts AC, 50Hz also available)
Current	
Running	.8 amp
Starting	1.2 amps
Duration of Starting Current	20 sec
Watts Running	100

### Heat Output

Stand By (BTU/Hr)	205
Running (BTU/Hr)	340

### Operating Environment

Temperature Range	50°F - 104°F (10°C - 40°C)
Relative Humidity	20% - 80%

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## APPENDIX B

### DISK MULTIPLEXING USING THE 2290-MUX OPTION

When more than one CPU needs access to the data and programs stored on the 2290 Disk Drive, a disk multiplexer is required. The 2290-SMD2 disk controller may be ordered with multiplexer options adding one or two ports to allow sharing the 2290 storage system with multiple processors.

The 2290-MUX8 option allows two CS/2200 series processors or one CS/2200 processor and up to up to eight PC processors to share a Model 2290 Disk Drive.

The 2290-MUX16 option allows three CS/2200 series processors, two CS/2200 processors and up to eight PC processors or one CS/2200 processor and up to up to sixteen PC processors to share a Model 2290 Disk Drive.

Sharing CS/2200 processors are equipped with a 2290-SCX adaptor board. Sharing PC processors are equipped with a 2290-PCI or 2290-PCIMUX board. The SCX and PCI boards are connected to the 2290-MUX with a 'Mux' cable. Each CPU connected to the 229X-SMD2 DPU with the 2290-MUX option has equal access to the disk.

All disk addressing is the same as operation without the multiplexer. The disk response time will depend on the disk load from all the multiplexed CPUs.

The 2290-MUX8 or 2290-MUX16 option is installed on the 229X-SMD2 disk controller and does not require an additional I/O slot in the master CPU. It provides for connections to the 2290 disk drive as well as MUX ports for the sharing CPU's.

For more information about the 2290-MUX Multiplexer Option, refer to Southern Data System's 229X-SMD Disk Controller Manual.

