DAVONG

Universal Disk System

IBM® PC
128K Minimum

Owner's Manual

A0384-03-200045

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Copyright notice

WARNING

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been type-tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Contents

Appendixes

Preface

This manual is a guide to installing the Davong Universal Disk System (UDS) hardware on an IBM® PC computer. It also contains technical information for applications developers who must modify the standard drive system. After you install the disk drive hardware, you will install the software according to the software installation instructions.

Chapter 1 lists your equipment requirements and explains the precautions to follow when handling your drive unit.

Chapter 2 describes how to check the voltage selection switches and how to install the 1.5 Amp fuse if you have 230 or 240 VAC settings. *You must check the voltage switches before you install the unit.* Chapter 2 also describes how to check your UDS Adapter Card switch settings.

Chapter 3 contains the instructions for installing the system in your IBM PC computer.

Appendix A contains troubleshooting advice to follow if you have a hardware problem with your disk drive.

Appendix B describes how to remove and replace the IBM computer cover.

Appendix C contains the installation procedure for the Alternate UDS Adapter Kit.

Appendix D contains application information for use by application developers who must modify the standard system.

A Glossary and an Index are included at the back of the manual.

How To Use This Manual

Use the information in this graph to determine which chapters you should read. You may fall into more than one category.

If You Are:	**Read Chapter:**						
	1	**2**	**3**	**A**	**B**	**C**	**D**
the person installing the equipment	✓	✓	✓		✓		
an installer with the alternate bracket	✓	✓	✓		✓	✓	
a systems programmer or applications developer							✓
a troubleshooter or repair person	✓			✓			

Chapter

1

Before You Begin

Adding a Davong Universal Disk System (UDS) to your IBM® PC provides a large amount of fast, dependable data storage. Your disk drive system offers flexibility, too. When your storage needs increase, you can upgrade your unit and install from one to three slave drives.

To protect your drive and your product warranty, you must follow the warnings and the handling instructions in this chapter.

WARNING:

Do not drop the disk drive unit. Winchester drives are very reliable, but they are extremely sensitive to shock and vibration. Dropping the unit as little as 1 inch can destroy the drive. Treat the drive gently when installing and moving it. *Never slide* the drive across a desk or table top—*always lift* the unit if you have to move it.

Not a computer technician? You don't have to have experience to install and use a Davong UDS unit. Just carefully follow the instructions in the manuals shipped with your system.

Unpacking Your System

Davong ships your drive unit in special packaging which protects it from shock and vibration. Save the original packing materials. You will need them if you move your unit from one place to another, or if you ship your drive for service. Shipping the drive in other materials could result in loss of the product warranty. Follow these steps to unpack your system.

1. Carefully unpack your drive unit and your adapter kit.

2. Determine which adapter kit you received by checking the items listed in Table 1-1 and Table 1-2. Check to make sure all items are present.

3. Save all packing materials.

Table 1-1. UDS Adapter Kit Hardware Components

Item	Part Number
1 IBM/UDS adapter card	1x-000061
1 black interface cable	63-300046

Table 1-2. Alternate UDS Adapter Kit Hardware Components

Item	Part Number
1 IBM/UDS adapter card	1x-000026
1 black interface cable	63-100021
3 part strain relief bracket	
3 bracket screws	

Turn to the Purchase Record on the last page of this manual and enter the date and place of your purchase. Make a note of the size of your drive in megabytes.

WARNING:

Never open the sealed portion of the drive unit. The disk surfaces of Winchester drives are completely enclosed to protect them from contamination. Breaking the seals or opening the drive cover voids your product warranty.

Equipment Requirements

To install the UDS on your IBM® Personal Computer, you must have the following equipment.

- A minimum of 128K bytes of memory in your computer
- A Davong master hard disk unit (DS012-xxx) with AC power cord
- A UDS Adapter Kit or Alternate UDS Adapter Kit
- A medium flat-blade screwdriver

If you are using your IBM PC for the first time, follow all of the installation instructions in the IBM *Guide To Operations*. Contact your IBM dealer if you have any problems. Don't attempt to install the Davong UDS until your computer is up and operating.

Environmental Requirements

Under normal conditions, the drive unit does not require any maintenance. Davong recommends that you use the drive in a relatively cool and dust-free environment where air circulation is not restricted.

The drive may not operate reliably at room temperatures over 85 degrees Fahrenheit.

The Correct Power On Sequence

Follow this power on sequence to ensure that the operating system loads correctly.

1. If you have a Davong Tape Backup System, power on the tape unit first (press switch to **1** or **ON**).

WARNING:

Never power on a tape drive *after* you power on the disk drive. Damage to your disk directory could result and you would have to reformat your disk.

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2. Power on your hard disk unit (press switch to **1** or **ON**).

3. Power on any other computer peripherals.

4. Power on your IBM computer last.

If you don't follow this sequence, the operating system may not load correctly. Although this does not damage your equipment, it does mean you must power off, then power on again in the correct sequence.

The Correct Power Off Sequence

Follow this power off sequence to protect the life of your drive unit.

1. If you're using Davong software, use the PARK utility to park your disk heads.

2. Power off the disk drive first.

WARNING:

Never power off a tape drive *before* you power off the disk drive. Damage to your disk directory could result and you would have to reformat your disk.

3. Power off any computer peripherals and the computer.

Summary Of Installation Steps

You will perform the following procedures to install the standard adapter kit hardware. (Refer to Appendix C for the alternate adapter kit installation.)

1. Check, and if necessary, set the voltage switches on the drive unit back panel (Chapter 2).

2. Check, and if necessary, set the two switches on the IBM/UDS adapter card (Chapter 2).

3. Power off the IBM computer and any peripherals. Remove all AC power cords from the computer and the wall outlet.

4. Power off the drive unit before you install it (press switch to **0** or **ON**).

5. Remove the computer cover (Appendix B). Install the adapter card in any available card slot.

6. Replace the computer cover (Appendix B).

7. Attach the interface cable to the connector in the adapter card bracket and to the connection on the drive unit back panel.

8. Plug in the AC power cords you removed. Plug the disk drive power cord into the drive unit and the wall outlet.

You may want to attach slave disk units to your master unit. Install your master drive first as described in this manual. Power on the drive to make sure it is properly installed and running. Then contact your Davong dealer about upgrading your drive to accommodate slave drives.

When you complete the instructions in this manual, use the software installation instructions to install the drive software.

Chapter

2

Getting Started

You must follow the instructions in this chapter before you begin Chapter 3.

Section 1 describes how to check your hard disk drive voltage switch setting. *You must check your voltage switch setting before installing the unit.*

Section 2 describes how to install the 1.5 Amp fuse required with the 230 or 240 VAC settings. If your system doesn't require the 1.5 Amp fuse, you may skip this section.

Section 3 describes how to check the switch settings on your IBM/UDS Adapter card. You must check these settings before you install the card.

Section 1 Checking Your Voltage Switches

The disk drive power switch is located on the rear panel of the unit.

- To power on the drive unit, press the power switch toward **1** or **ON**.

- To power off the unit, press the switch toward **0** or **OFF**.

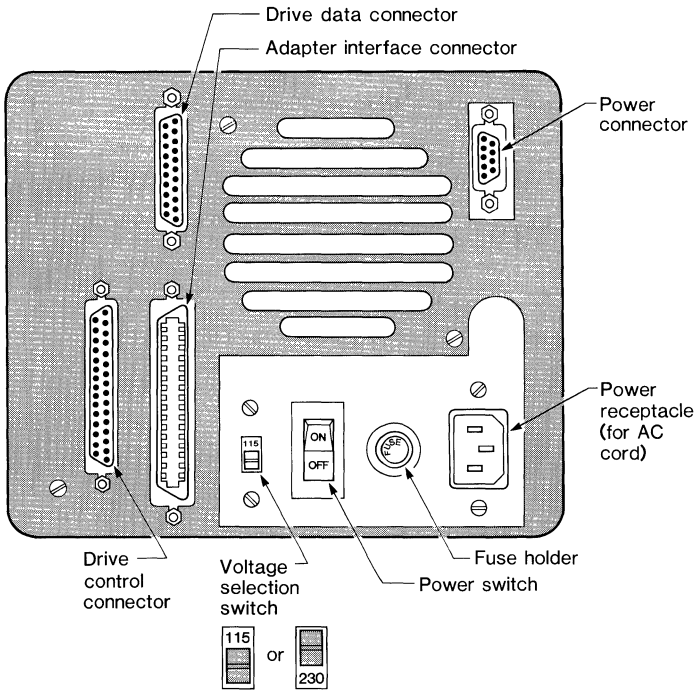
Press the switch toward off for the installation procedure.

Look at the back panel of the unit. If the back panel has only one voltage switch as shown in Figure 2–1, read the following information. If your tape unit has two voltage switches as shown in Figure 2–2, skip ahead to the subsection entitled "Drive With Two Voltage Switches."

Drive With One Voltage Switch

The incoming voltage at your wall outlet determines your voltage setting. If you have a drive with one vertical voltage selection switch (Figure 2-1), you will set your unit to 115 VAC or 230 VAC.

Figure 2-1. Back Panel With One Voltage Switch



If you live in the United States and have the standard voltage at your outlet, use the 115 VAC setting on your disk drive. Installations outside the United States sometimes require the other setting. Contact your Davong dealer if you have any questions about the correct setting for your area. Table 2–1 gives the incoming voltage ranges.

Table 2-1. Selecting The Correct Voltage Setting

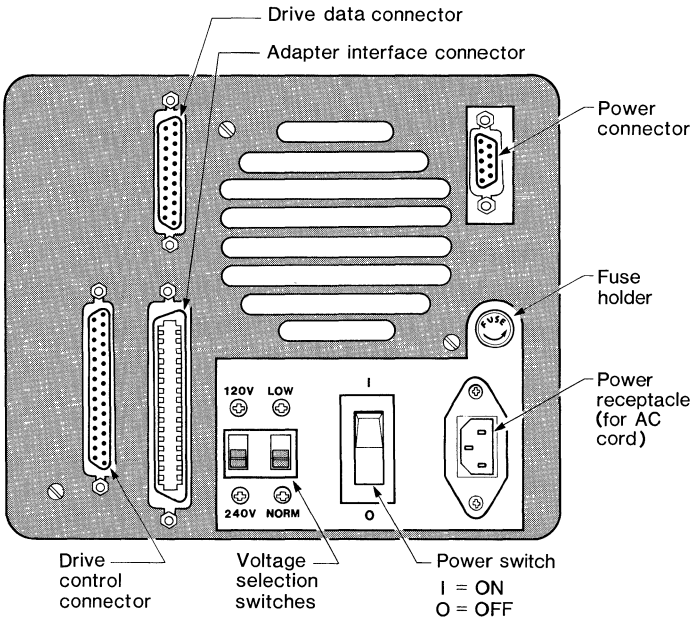
Voltage range	Use setting
90-132	115 VAC
198-264	230 VAC

To change the voltage setting, slide the switch to the appropriate setting. Your disk drive operates correctly with either 50 or 60 hertz.

Drive With Two Voltage Switches

The incoming voltage at your wall outlet determines your voltage setting. If you have a drive with two vertical voltage selection switches (Figure 2-2), you will select the correct line voltage setting from 120 NORM, 120 LOW, 240 NORM, or 240 LOW.

Figure 2-2. Alternate Back Panel With Two Voltage Switches



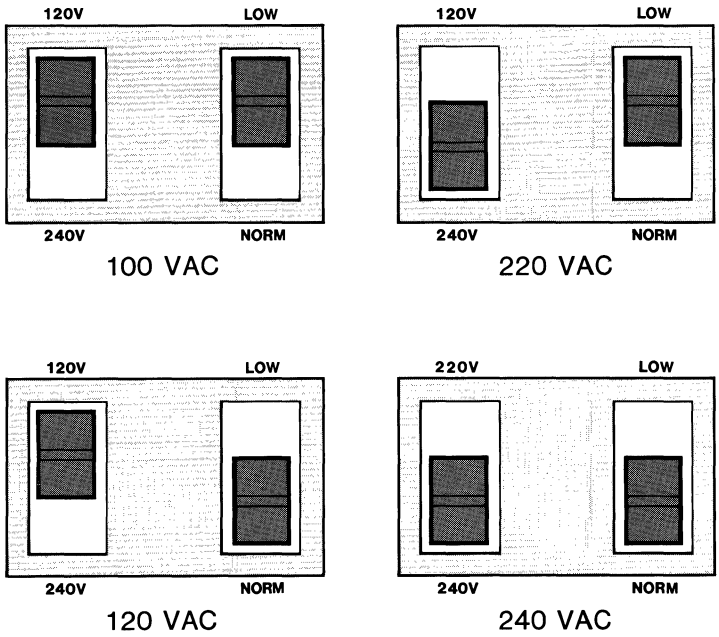
If you live in the United States and have the standard voltage at your outlet, use the 120 NORM setting on your disk drive. Installations outside of the United States may require the other settings. Contact your Davong dealer if you have any questions about the correct setting for your area. Table 2–2 gives the incoming voltage ranges.

Table 2-2. Selecting The Correct Voltage Setting

Voltage range	Setting	Voltage Switches
108-132	120	120 NORM
90-110	100	120 LOW
216-264	240	240 NORM
198-242	220	240 LOW

Select the voltage required by your outlet by sliding the switches to the required setting. The setting in Figure 2-2 is for 240 VAC NORM. Figure 2-3 shows all possible settings. Your disk drive operates correctly with either 50 or 60 hertz.

Figure 2-3. Setting The Voltage Switches



Section 2

Installing The Fuse For 230 And 240 Settings

Davong installed a 3 Amp fuse in your disk drive before it was shipped. If you have a 230 or 240 VAC setting, you must remove the existing 3 Amp fuse and install the 1.5 Amp fuse packaged with your unit.

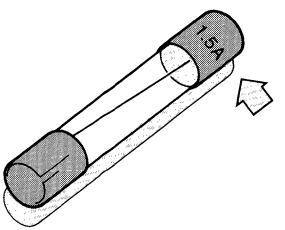
If you have a 115 or 120 VAC voltage setting, you do not need to check the fuse. You can discard the 1.5 Amp fuse you received and turn to the instructions in Section 3 of this chapter.

Table 2-1 shows the correct fuse for each voltage selection. Check the number on the fuse to determine the amperage rating.

Table 2-1. How To Determine The Correct Fuse Rating

Voltage	Fuse Required
120 NORM or LOW	3 Amp
115	3 Amp
240 NORM or LOW	1.5 Amp
230	1.5 Amp

Figure 2-4. Checking The Fuse Rating



Follow these steps to install the 1.5 Amp fuse for the 230, 240 NORM, or 240 LOW settings.

1. Power off (**0** or **OFF**) your drive unit (if it is powered on). Disconnect the black AC power cord from the back panel and the wall outlet (if attached).

2. Locate the black fuse holder on the back panel of the unit. Turn the holder counterclockwise and remove it from the back of the unit.

3. Remove the existing fuse and discard it.

4. Place the 1.5 Amp fuse in the holder. It doesn't matter which end goes first.

5. Reinsert the fuse holder into the unit and turn it clockwise.

This completes the procedure for inserting the 1.5 Amp fuse.

Section 3

Checking The Adapter Card Switches

You must check the settings of the two switches on your adapter card before you install it. The board locations of the switches are **SW1** (Switch 1) and **SW2** (Switch 2). Although Davong sets these switches before shipment, you must check the settings before installing the card. If the settings don't match Figures 2-5 and 2-6, change them using a ballpoint pen.

If you're not sure how to change the settings, turn to the next page and follow the instructions.

If you already know how to set switches, make any needed changes; then turn to the next chapter.

Figure 2-5. Correct Switch 1 Setting

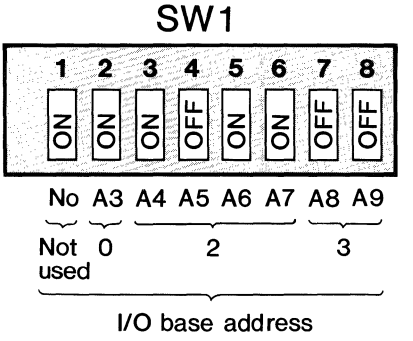
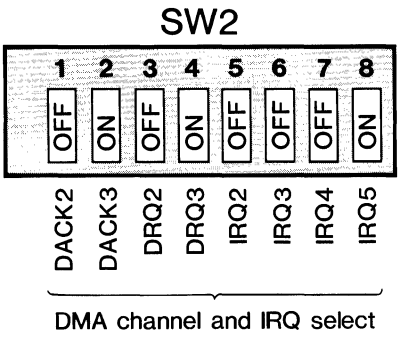


Figure 2-6. Correct Switch 2 Setting



Setting A Switch

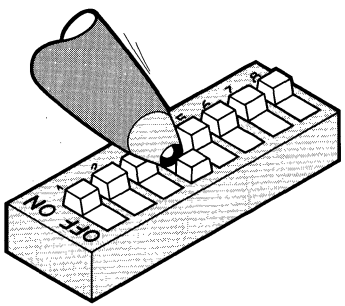
First you must determine what type of switch you have. Check your adapter card in location SW1 to see if you have:

- a slide switch (Figure 2-7)
- a rocker switch (Figure 2-8)

Setting A Slide Switch

If your card has the slide switches (Figure 2-7) and you need to change the settings, follow these directions. To set an individual nub on a switch to the on position, use the pen to push the nub toward the **ON** side of the switch. To set a nub to the off position, use the pen to push the nub toward the **OFF** side.

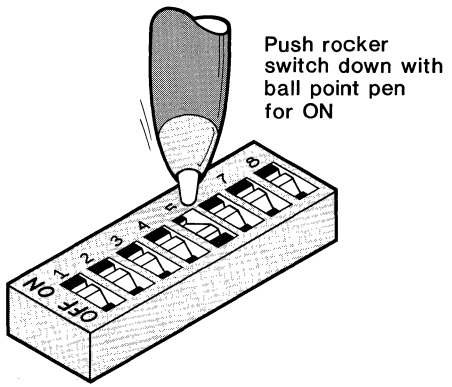
Figure 2-7. Setting A Slide Switch To **OFF**



Setting A Rocker Switch

If your card has the rocker switches (Figure 2-8) and you need to change the settings, follow these directions. To set an individual rocker to the on position, use the pen to push down on the **ON** side of the rocker. Notice that when a rocker is **ON**, a red mark is visible on the **OFF** side of the rocker. To position a rocker to off, press down with the pen on the **OFF** side of the rocker. This makes the red mark visible on the **ON** side.

Figure 2-8. Setting A Rocker Switch To **On**



Locate Switch 1 at board location **SW1**. Set the switch as shown in Figure 2-5.

Locate Switch 2 at board location **SW2**. Set the switch as shown in Figure 2-6.

This completes the procedures you must follow before you install the adapter card in your computer.

Chapter

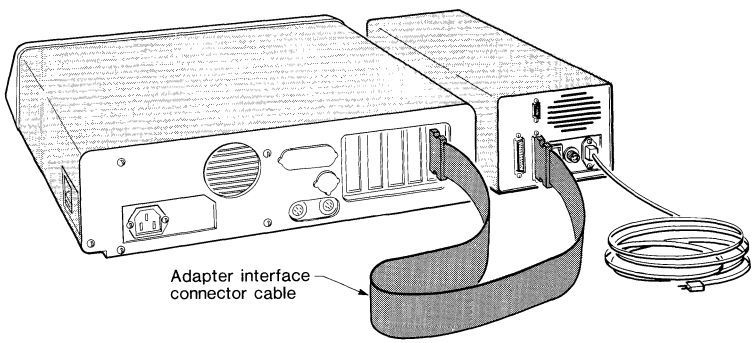
3

Installing The Drive Unit

This chapter explains how to install the standard Davong Universal Disk System (UDS) hardware on an IBM PC computer. To install the Alternate UDS Adapter kit with the alternate interface cable and three-part strain relief bracket (Table 1-2), turn to Appendix C.

This procedure consists of inserting the IBM/UDS Adapter card in an expansion slot and attaching the black interface cable between the card and the drive unit.

Figure 3-1. Installing An External Disk Drive



WARNING:

Make sure you power off your IBM PC and any peripherals attached to your workstation before you begin.

1. Remove all AC power cords from the back of your computer.

2. Remove the cover from your IBM PC. Refer to Appendix B if you don't know how to do this.

3. Choose any available expansion slot for your Adapter card. Use the screwdriver to remove the IBM slot cover. Save the screw. You will use it to secure the adapter card.

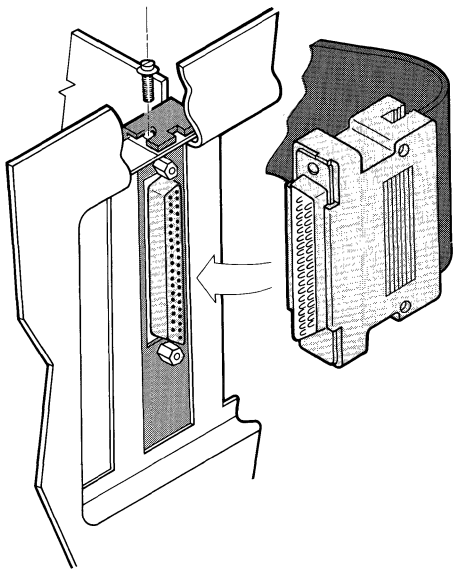
4. Gently insert the IBM/UDS adapter card into the slot. Make sure the edge fingers seat firmly in the socket.

5. Tighten the bracket screw with the screwdriver.

6. Replace the IBM cover. If you don't know how to do this, refer to Appendix B.

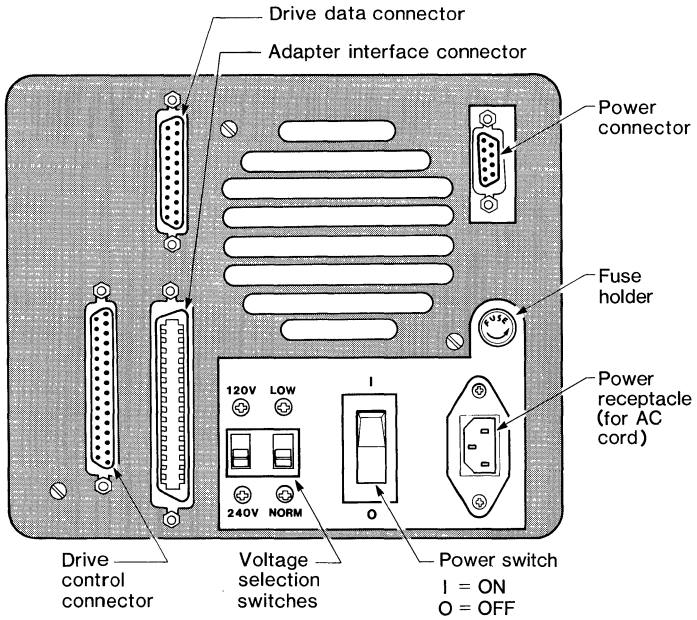
7. Attach the smaller end of the 37-pin black interface cable from your adapter kit to the connector on the bracket of the IBM/UDS Adapter card. This connector fits only one way.

Figure 3-2. Attaching The Interface Cable



8. Attach the other connector on the interface cable to its connection on the back panel of the UDS unit (Figure 3-3). This connector only fits one way.

Figure 3-3. Back Panel of the External Hard Disk



9. Tighten the screws on the two connectors. Your drive may not operate correctly if you do not tighten the connectors evenly.

10. Plug the black AC power cord for the drive unit into its receptacle on the back panel of the drive. Plug the cord into the wall outlet. Use properly grounded 3-prong outlets.

11. Plug the AC power cords you removed back into the computer and the wall outlet.

12. Power on the unit by pressing the power switch toward **1** or **ON**.

This completes the hardware procedure for installing a Davong UDS unit on an IBM PC computer. Use your software installation instructions to install the software.

Appendix

A

Troubleshooting

Follow the steps in this appendix if you are having a problem with your hard disk system. If your hardware was damaged in shipping, or if you cannot solve the problem using this appendix, contact your Davong dealer.

Check Your Cables

A bad connection anywhere in the hard disk system cabling can cause performance problems. Check the screws on both ends of the black interface cable to make sure they are tightened evenly. If any of the connector screws are not tight, the cable connectors may not seat properly and your disk drive will not function.

Check Your Switch Settings

Check the switch settings for the IBM/UDS Adapter card and the IBM system board. The correct settings are given in Chapter 2. Your IBM PC must have 128K of RAM. Most installation problems are due to incorrect cabling or switch settings.

If you are using an expansion board which was not manufactured by Davong or IBM, the I/O address, DMA channel, or interrupt line requirements may conflict. Contact your Davong dealer for alternate switch configurations.

Try A Cold Restart

Hard disk systems are sensitive to line voltage fluctuations. Power fluctuations can put "stray" data bits into the registers on your adapter card. In general, this causes no problem; however, during boot up the registers must be zero.

If you have this problem, or suspect you do, power off your hard disk and your IBM PC. Then power on your hard disk and your PC. This simple step often solves boot up problems. Make sure you always follow these power on and off sequences.

Check For Incorrect Drive Parameters

If you are still having trouble with your installation, you may have incorrectly specified your parameters during software installation. A common mistake is specifying an incorrect drive size. Reboot and check your software installation.

Isolate The Problem

Make sure the hard disk is the failed component in your system. A failed expansion card may result in a hard disk malfunction. If you have a non-IBM or non-Davong memory board, there may be compatibility problems.

Carefully remove all boards in the expansion slots except for the floppy controller, monitor adapter, and hard disk adapter card. Use your hardware installation manuals as references. Then check the hard disk in this environment.

Note:
If the above procedures don't solve the problem, suspect your line voltages. Ask your dealer about installing an uninterruptable power source, or a power line conditioner to improve the performance of your hard disk system. Your dealer will know if this is recommended in your geographical area.

Appendix

B

Removing And Replacing The IBM Cover

Follow the instructions in this appendix to remove the IBM computer cover. After you complete the hardware installation instructions in this manual, follow the instructions to replace the cover.

WARNING:

Make sure you have powered off your computer and any peripherals attached to your computer before you begin this procedure.

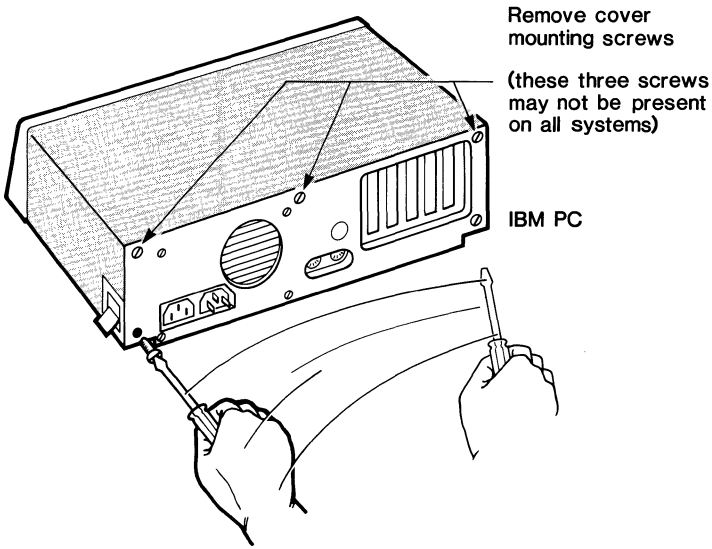
Removing The Computer Cover

1. Turn your computer so you can see the back panel.

2. Remove all AC power cords from the back of the computer and from the wall outlet.

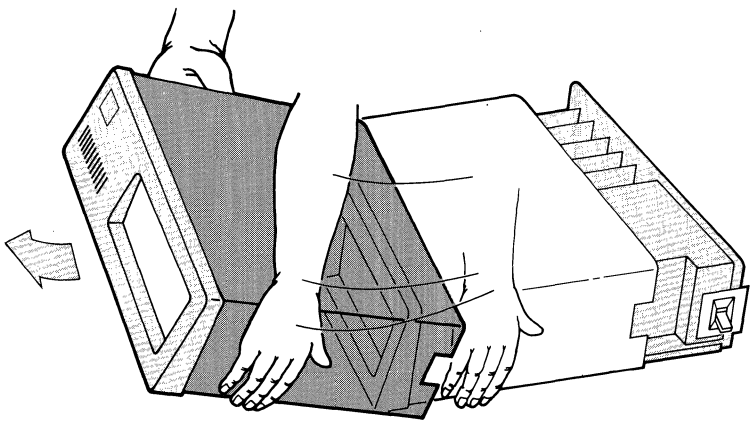
3. Use your screwdriver to remove the cover mounting screws from your cover as shown in Figure B-1. Put the screws in a place where you can find them again.

Figure B-1. Back Panel Of The IBM PC



4. Move to the front of the computer. Carefully slide the cover toward you. When it will slide no further, tilt the cover up and remove it from the base.

Figure B-2. Removing The Computer Cover



5. Set the cover to one side.

6. Touch the metal frame of the computer before handling any printed circuit boards. Always do this to dissipate any static electricity in your body. ROM chips are especially sensitive to these charges, so protect your components by taking this precaution.

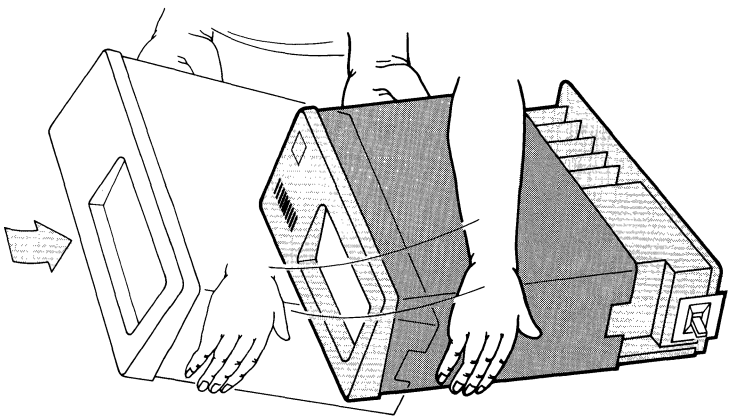
This completes the instructions for removing the IBM computer cover. After you complete the hardware installation instructions in the manual, return to this appendix for directions in replacing the IBM cover.

Replacing The Computer Cover

1. Check to make sure that all power switches are off (press the disk drive power switch to **0** or **OFF**).

2. Replace the computer cover by tilting the cover up and sliding it onto the computer. Lower the cover and slide it back into position. Refer to Figure B-3.

Figure B-3. Replacing The Computer Cover



3. Replace the cover mounting screws.

4. Reconnect the AC power cord(s) you removed.

This completes the instructions for replacing the IBM computer cover. Return to the main part of this manual for further instructions.

Appendix

C

Installing The Alternate Adapter Kit

This appendix describes how to install the Alternate UDS Adapter Kit described in Table 1-2. You will follow these instructions only if you received the alternate interface cable with the three-part strain relief bracket.

The alternate bracket hardware includes the main bracket (largest piece), a slotted bar, the bracket cover, and three bracket screws.

You will be clamping the interface cable in the strain relief bracket, connecting the cable to the adapter card, and installing the card in a card slot. After you tighten the bracket screws, you will attach the cable to the drive unit.

Do not begin this procedure if you haven't checked your adapter card switch settings (Chapter 2).

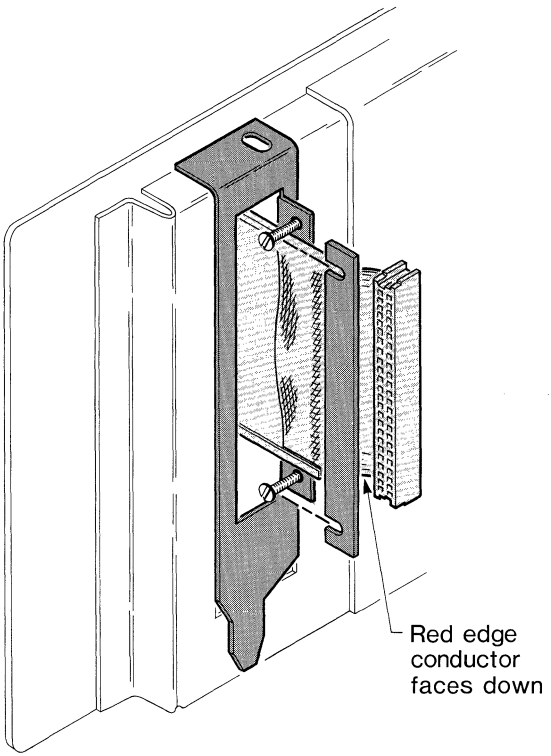
1. Power off your computer and remove the AC power cord(s) from the back.

2. Remove the IBM computer cover. Refer to Appendix B if you don't know how to do this.

3. Select an expansion card slot to use. Although the board functions in any slot, slot **J1** is recommended.

4. Hand start a bracket screw from your Adapter Kit into each of the two holes in the main (largest) bracket piece (Figure C-1). A few turns are enough.

Figure C-1. Installing The Strain Relief Bracket



5. Fold back the copper mesh areas on the interface cable so they lie flat against the cable (Figure C-1).

6. Stand at the front left of the PC chassis. Slip the smaller end of the interface cable through the I/O slot. Make sure the 50-pin socket connector is on the right side of the card, with the connector socket holes facing you, and the red edge of the cable down.

7. Hold the cable next to the bracket with the copper mesh touching the bracket as shown in Figure C-1.

8. Clamp the interface cable into the bracket by slipping the slotted bar (Figure C-1) onto the two screws you started.

9. Slide the cable and bracket assembly into the I/O slot you chose.

10. Remove the card (if any) to the right of the slot as you look at the PC from the front. This gives easier access to the connector on the adapter card.

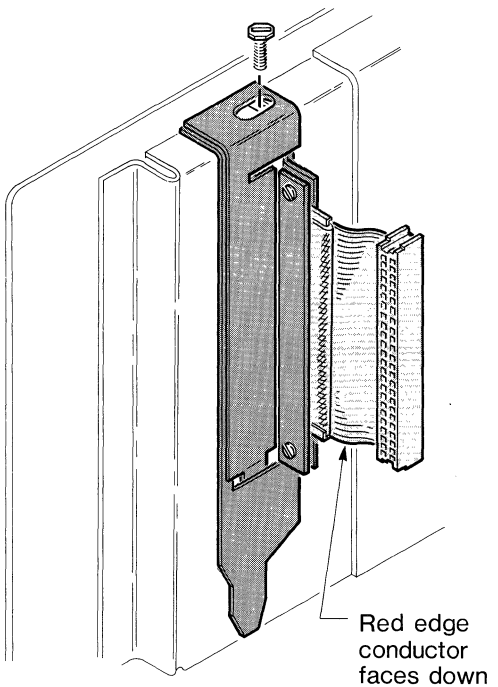
11. Install the 50-pin connector from the interface cable onto the gold pins of the pin header at board location J1. Make sure the red edge of the cable is down. Take care that all pins are connected and none are bent.

12. Use the screwdriver to tighten the two bracket screws. Make sure that the cable is perpendicular to the bracket.

13. Reinstall the card to the right if you removed one.

14. Insert the bracket cover into the strain relief bracket as illustrated in Figure C-2.

Figure C-2. Installing The Strain Relief Bracket Cover



15. Push the bracket cover over the cable. Secure the bracket and its cover with the mounting screw.

16. Replace the IBM cover. If you don't know how to do this, refer to Appendix B.

17. Make sure the disk drive power is off (power switch is pressed toward **0** or **OFF**).

18. Connect the black interface cable to the UDS unit by using the screwdriver to firmly and evenly tighten the connector screws. Make sure to tighten the screw directly above the connector. If the connector screws aren't tightened evenly, you may have performance problems with your drive.

19. Connect the drive unit AC power cord to the receptacle on the back of the unit and to the wall outlet. Use properly grounded 3-prong outlets.

20. Reconnect the AC power cords you removed from the back of the IBM computer.

21. Power on your drive unit by pressing the power switch to **1** or **ON**. The red "in use" light should flash on briefly. If it doesn't, recheck your switch settings (Chapter 2) and this installation procedure.

This completes the alternate hardware installation procedure. You may now refer to the software installation instructions to install the software.

Appendix

D

Technical Information

The Davong Disk System is an intelligent, high-performance random-access storage device. Winchester technology drives feature continuously loaded, low-mass, highly compliant head assemblies. Two or more non-removable rigid disk platters serve as the storage media. The permanently sealed contamination-free environment allows the read/write heads to fly a few microns above the media surface.

The information in this appendix is for use by applications developers who must modify the standard drive system. When the letter h appears after a number, the number is in hexadecimal.

The hard disk controller board provides the following features.

- Provides all *logic* for seeks, error retries, and formatting; allows DMA channel data transfers between the disk and computer memory; generates an interrupt at completion of all commands to the controller.

- Features an *I/O mapped register file;* uses eight consecutive I/O address locations for I/O mapped command/status/data registers; allows switch selection of the base I/O address on any 8 byte boundary from 000h to 3F8h; sets the I/O register file origin to a 320h default switch setting.

- Provides a *switch-selectable interrupt line* which can be any interrupt from IR2 to IR5, or no interrupt; selects IR5 for the default setting.

- Uses the *DMA channel* for moving data to be written or read from disk; selects channel 3 via a jumper as the default switch setting for hard disk DMA transfers (using channel 1 requires a board modification).

Section 1 Drive Characteristics

The controller design allows the use of a variety of standard 5¼-inch compatible drives. Davong disk drives have the characteristics listed in Table D-1. All numbers are given in decimal.

Table D-1. Characteristics Of Davong Disk Drives

Formatted Size (Mbytes)	**5**	**10**	**15**	**21**	**32**	**34**
Step Rate in μsec	30	30	30	30	30	30
No. of Heads	2	4	6	8/4	6	8
No. of Cylinders	306	306	306	320/640	640	512
Write Precomp Start	128	128	128	128/256	256	256
Write Precomp Register	32	32	32	32/64	64	64
512 Byte Sectors/Cyl	17	17	17	17	17	17
256 Byte Sectors/Cyl	32	32	32	32	32	32

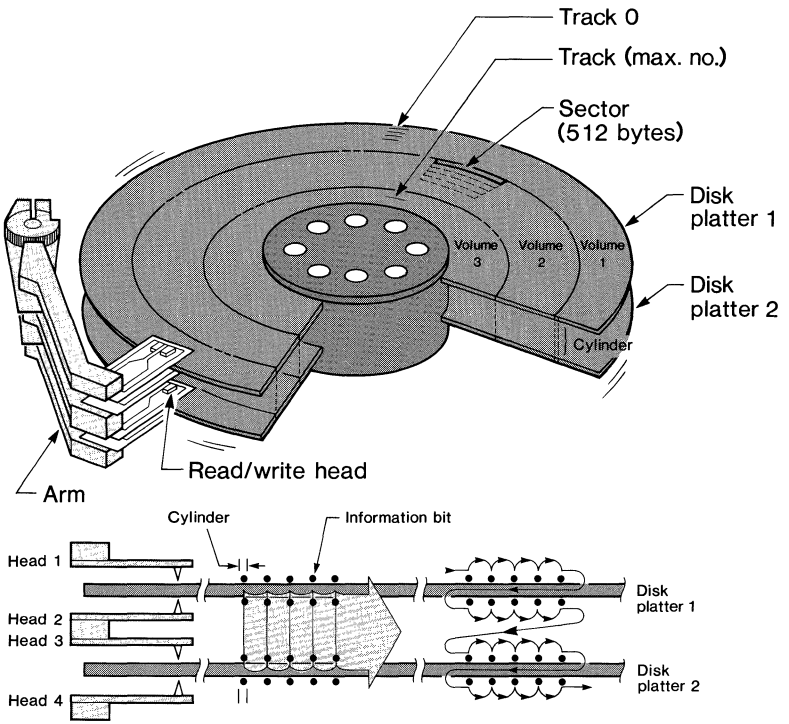
Disk Mechanics

The sealed portion of the drive unit contains the disk platters and the read/write heads (Figure D-1). The *disk platters* are flat circular recording surfaces that spin at approximately 3600 rpm. Figure D-1 illustrates a drive unit with two disk platters, but your drive may contain more. Each disk platter provides two *media surfaces* for recording information.

Each *read/write head* is attached to an *arm* which is positioned by a motor. When current is applied to the motor, it positions the heads a few microns above the media surface.

A *track* is a ring of constant radius on the media surface of a platter (Figure D-1). The width of a track is approximately 0.001 inches. The number of tracks on a drive depends on the size of the drive. Tracks are numbered from 0 to whatever the maximum number is for your drive.

Figure D-1. Disk Mechanics



Seeking information on a hard disk is done: cylindrically **not** linearly

A *cylinder* is a vertical set of tracks on the multiple disk platters (Figure D-1). The width of a cylinder is one track. During a seek, the drive unit reads an entire cylinder before the heads move to the next track. This approach provides fast, efficient data transfer and access because the heads read a maximum amount of data before moving (refer to detail in Figure D-1). Table D-1 lists the number of cylinders on your drive.

The maximum number track contains no data and functions as a *landing area* for the disk heads. When you execute the Davong PARK software utility, the heads land on this area and do not touch the data storage areas.

A track *sector* contains data stored in a serial bit stream. Sectors are small easily managed blocks of data on a track. Davong disk drives use soft sectors.

It is not possible for data bits to occupy all available bit positions on a track. An identification field or *gap* between sectors is required to compensate for spindle speed, writing oscillator tolerances, and other considerations. The position and length of these gaps is the *format* of the drive. When a drive is formatted, this information is written on all tracks and media surfaces on the drive.

The data bits recorded in the higher numbered tracks are closer to each other than the bits in the lower numbered tracks. When these bits are read back, a bit shifting problem would occur unless compensation is made. The *precompensation logic* automatically allows for the bit shifting which occurs when data is written to the inner cylinders.

Section 2

Hardware Interface To The Computer

This section describes the switch functions of the IBM/UDS adapter board and the functions of the I/O mapped register file.

Switch Settings

Switch 1 **(SW1)** determines the computer base I/O address recognized by the controller board. The default address is 320hex. The switch is enabled when the high order 7 bits of the 10-bit computer I/O address match the switch settings for the board. Use of this switch is given in Table D-2.

Table D-2. Setting Switch 1 (**SW1**)

Nub 1	(not used)
Nub 2	ON matches A3 = 0
Nub 3	ON matches A4 = 0
Nub 4	ON matches A5 = 0
Nub 5	ON matches A6 = 0
Nub 6	ON matches A7 = 0
Nub 7	ON matches A8 = 0
Nub 8	ON matches A9 = 0

Switch 2 (**SW2**) determines the interrupt line and the DMA channel. Use of this switch is given in Table D-3.

Table D-3. Setting Switch 2 (**SW2**)

Nub 1	ON for DMA channel 2 (-DACK 2)
Nub 2	ON for DMA channel 3 (-DACK 3)
Nub 3	ON for DMA channel 2 (DRQ 2)
Nub 4	ON for DMA channel 3 (DRQ 3)
Nub 5	ON for interrupt 2
Nub 6	ON for interrupt 3
Nub 7	ON for interrupt 4
Nub 8	ON for interrupt 5

I/O Register File

The I/O register file is the software interface to the disk controller.

Address	R/W	Use
Base Addr + 0	R	Data Read from disk
+ 0	W	Data Write to disk
+ 1	R	Error Register
+ 1	W	Write Precomp Starting Cylinder/4
+ 2	R/W	Sector Count for Format
+ 3	R/W	Sector Number
+ 4	R/W	Cylinder Number (low byte)
+ 5	R/W	Cylinder Number (high byte)
+ 6	R/W	Size/Drive/Head Select
+ 7	R	Status
+ 7	W	Command

Command Register

The command register is used by the CPU to control the disk controller.

Command	Value
Restore	1Rh (where R is the step rate)
Seek	7Rh (where R is the step rate)
Read Sector	20h (non-DMA)
	28h (DMA mode)
Write Sector	30h
Format Track	50h

The stepping rate "R" is in 0.5 ms increments, from 01 for 0.5 ms to 0Fh for 7.5 ms. (R = 0 issues a step pulse every 30 microseconds for drives utilizing buffered seek.)

Status Register

The status register returns information about a completed command. This register must be read to determine if the command was completed correctly. The status register is read only. Reading this register resets the interrupt request line.

Bit	Use	Description
7 (=80hex)	Busy	Indicates a command is in progress. No other status bits of the register are valid when this bit is set.
6 (=40hex)	Ready	Indicates the ready status of the selected drive. No command is issued unless the ready bit is set.
5 (=20hex)	Write	Indicates the condition of the write line on the selected drive. No command is issued when this bit is set.
4 (=10hex)	Seek ready	Indicates the status of the seek complete line on the selected drive.
3 (=08hex)	Data ready	Indicates that the sector buffer is ready to accept a byte (write) or has a byte of data available (read). Used only for non-DMA data transfers.
0	Error	When set, indicates that one or more bits are set in the error status register. This bit is reset when processing of a new command begins.

Size/Drive/Head Select Register

The SDH register selects the drive, head, and sector size. This register has the following format.

Bits 7-5	Must be 00b sector size = 512 bytes.
Bits 4-3	Drive select. 00b to 11b for drives 0 through 3.
Bits 2-0	Head select. 000b to 111b for heads 0 to 7.

Cylinder Number Registers

The two cylinder number registers form the 10-bit cylinder number which positions the head for a Seek, Read, Write, or Format command. The cylinder low register contains the 8 least-significant bits. Bits 0 and 1 of the cylinder high register contain the two most-significant bits.

Sector Number Register

The sector number register must be loaded with the desired sector number before using a Read or Write com mand. Valid sector numbers are 0001b through 1001b. The maximum number of sectors is 17.

Sector Count Register

The sector count register must be loaded with the number of sectors to be formatted during a Format command. The register is decremented to zero during the format operation and must be reloaded before each format operation.

Error Register

The error register contains specific fault information about the last command. This register is valid only if the error bit in the status register is set. This register is read only.

Bit	Use	Description
7 (=80hex)	Bad Block	Indicates a bad block mark in the specified ID field. No data transfer has taken place.
6 (=40hex)	Data CRC Error	A CRC error was encountered in the data field during a read command.
5 (=20hex)	ID CRC Error	A CRC error was encountered in an ID field.
4 (=10hex)	ID Not Found	No ID field containing a specified cylinder, head, sector number, and sector size was found.
2 (=04hex)	Aborted Command	Indicates a valid command was received, but could not be executed based on the status information from the drive.
1 (=02hex)	TR000 Error	Set during a Restore command if the TRACK 000 line was not asserted within 1023 stepping pulses.
0 (=01hex)	DMA Not Found	Set during a read command if the Data Address Mark was not found within 16 bytes of the correct ID field.

Write Precomp Register

The write precompensation register holds the cylinder number where write precompensation logic begins. This register is loaded with the cylinder number divided by 4.

Data Register

The data register supplies data to be written or obtains data to be read from the disk. Although normal use is in conjunction with a DMA channel, the data register may be used directly by the computer processor to do non-DMA data transfers.

The data register is accessed once for each byte in the sector being transferred. When the DRQ (Data Request) line is asserted, the sector buffer contains data in a read command, or is waiting for data in a write command.

Section 3 Programming Considerations

This section provides information for systems programmers who want to modify the standard disk drivers or write their own disk drivers.

Controller Initialization

To initialize the controller, the Size/Drive/Head and Write Precomp registers must be set and a Restore command must be issued to set the step rate and initialize the hard disk cylinder position. After the Restore, no further positioning commands are required. The controller automatically positions the heads before executing a Read, Write, or Format command.

No error retries ever need to be done by the host system. The controller retries all commands, including a number of retries that start with a restore to track 0 and a reseek to the desired track.

Drive Select

Davong strongly recommends deselecting the drive except during data transfers. This greatly decreases the risk of losing data due to unexpected power outages.

DMA Channel Use

The DMA controller must be initialized before issuing any Read, Write, or Format command. The host computer may choose to do I/O mapped data transfers, but this substantially increases processing overhead.

If you use the Read DMA mode command, the controller status *must not* be interrogated until an interrupt is signalled. The interrupt controller status register may be read in polled I/O operations with DMA transfers to determine when the operation is complete.

WARNING:

The DMA channel will not cross 64K boundaries.

DMA commands and I/O addresses used depend on the DMA channel selected by the controller switches, as follows.

DMA Channel Command Sequence

Function	Channel 1*		Channel 3	
	Addr	**Value**	**Addr**	**Value**
Clear first/last FF	0Ch	any	0Ch	any
Set DMA Mode				
Read disk *or*	0Bh	45h	0Bh	47h
Write/Format *or*	0Bh	49h	0Bh	4Bh
Verify	0Bh	41h	0Bh	43h
Set DMA Page Register	83h	high	82h	high
Set Address of Memory	02h	low	06h	low
Address Register	02h	middle	06h	middle
Set DMA Count	03h	FFh	07h	FFh
(Always 512-1)	03h	01h	07h	01h
DMA Channel Mask	0Ah	01h	0Ah	03h

*Use of Channel 1 requires a rework procedure. See your Davong dealer.

Interrupts

The hard disk controller generates an interrupt at the completion of any command. For a Read command, the interrupt is generated after all data has been transferred if the Read-DMA command is used, or before starting data transfer if Read-non-DMA is used. The interrupt line from the controller is lowered by input of controller status or output of a new command.

The 8259A interrupt controller must be initialized to allow interrupts from the hard disk controller. To do this, input a byte from 21H, clear the bit corresponding to the hard disk interrupt switch setting (refer to Table D-3), and output back to 21h. The bit numbering is from bit 0 (= 1) for IRQ0 to bit 7 (= 128) for IRQ7.

After an interrupt is generated and the IRQ line has been lowered by input of controller status, the interrupt controller must be reset by an output of 20h to I/O port 20h.

Read/Write Notes

To issue a Read or Write Sector command, the following conditions must be met: the Size/Drive/Head, Sector Number, Cylinder Low, and Cylinder High registers must be written; the DMA controller must be initialized; and the command register must be written. When the controller has completed the operation, it generates an interrupt (or the busy bit drops in polled operation).

Formatting Notes

The Format command is very similar to a disk write sector command. The only difference is that the data sent to the controller is a bad sector/interleave table. There are two bytes per sector: the first byte is the bad block flag (00h for normal, 80h for bad sector); the second byte is the logical sector number (normally 1 . . . last sector number). A full sector's worth of data must be sent, although the data following the sector table is ignored. The table must be in the correct interleave order.

The mapping from physical to logical sector numbers is used to determine which sector is to be read or written by a Read Sector or Write Sector command. The controller interprets the sector number register as the logical number of the sector to be read and looks for that number in the sector address mark. This mapping to logical sector numbers allows the hard disk sectors to be interleaved to optimize system performance.

Glossary

back panel The rear side of the disk drive chassis; contains the power switch, voltage switches, cable and power connectors, fuse holder, and AC receptacle.

byte A unit of information in the computer which is made up of a certain number of bits—usually the eight bits that represent a character in binary.

card A green printed circuit board which installs in a computer expansion slot.

connector A plug, socket, or jack which allows the connection of one hardware component to another.

cylinder The vertical set of tracks on multiple disk platters which is the width of one track at any head position; refer to *track, disk platter.*

data Information which represents facts, concepts, or instructions for use in a computer program; refer to *byte.*

default The value assumed when no other value is specified.

disable One of the two possible states of a switch on a computer processing unit (e.g., the disk controller) which prevents certain interruptions from occurring; contrast with *enable.*

disk platter The flat semirigid recording surfaces coated with magnetic material which reside inside the sealed portion of the disk drive.

enable One of two possible states of a switch on a processing unit which allows certain types of interrupts to occur; contrast with *disable.*

format The process of writing the gap information onto all tracks and media surfaces of a disk drive; refer to *gap, sector.*

gap An identification field required between track sectors; compensates for spindle speed, write oscillator tolerances and other considerations; refer to *sector.*

hard disk drive A high-capacity random access mass storage device which reads, writes, or erases data on nonremovable magnetic disk platters; allows you to record information in small magnetized areas on disk platters; refer to *disk platter.*

hardware The physical computer equipment consisting of electronic and mechanical devices; contrast with *software.*

heads The hard disk read/write recording mechanism attached to an arm inside the sealed portion of the drive unit; positioned above the disk surface by a motor.

interface The hardware and software components which connect the system and allow transfer of information; a shared boundary.

I/O (Input/Output) The process of transmitting data into or out of storage for processing.

K (Kilo) A unit of measure for memory capacity; two to the tenth power (1024 in decimal).

landing zone A circular area on the disk platter used to park the read/write heads when the DSI PARK utility is executed; prevents the heads from touching the disk platter in data storage areas.

M (Mega) A unit of measure for memory capacity; two to the twentieth power (1,048,576 in decimal).

media surfaces The flat recording surfaces of a disk platter; each platter provides two media surfaces; refer to *disk platter.*

Multi-OS The advanced operating system from Davong Systems that allows you to transfer files created with the IBM DOS, CP/M, concurrent CP/M, and Pascal operating systems.

operating system The software system that controls the computer's resources and allows you to execute computer programs; Multi-OS is Davong's versatile operating system.

precompensation logic A data compression technique which is required before data is written to disk; compensates for bit shift when data is written on the inner cylinders.

read To obtain data from a storage device or data medium such as floppy diskette.

sector A segment of track containing data stored in a serial bit stream; Davong drives use soft sectors; formatting gaps are required between sectors; refer to *format, gap.*

seek The selective positioning of the read/write heads over the disk platter; to search for information on the drive unit.

software The non-hardware components of the computer system including sets of programmed instructions and procedures which control the computer; contrast with *hardware.*

track A ring on the surface of a disk which has a constant radius and width; an area where data is recorded.

volume A fixed and contiguous area of a hard disk; the size of a volume is determined during disk formatting, or by accessing the HDMGR Create command.

Winchester technology A hard disk system with head assemblies which are continuously loaded, low mass, and highly compliant; a storage technology featuring a completely sealed, contamination-free environment which allows the read/write heads to fly a few microns above the disk platters.

write To record data onto a storage media, such as hard disk or floppy diskette.

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Limited warranty

This is to certify that Davong Systems, Inc. (DSI) warrants this Product to be free from all defects in material and workmanship for a period of one hundred eighty (180) days from the date of purchase from DSI or an authorized DSI dealer.

Within the period of this warranty DSI shall be obligated to replace or repair this Product should it prove to be defective in material or workmanship. Repair parts and replacement products will either be reconditioned or new and all parts so exchanged or replaced will become the property of DSI.

Warranty service may be obtained by delivering the Product during the warranty period to an authorized DSI dealer. You may contact DSI at the address appearing below for the name of the authorized DSI service center closest to you. If this Product is returned for repair, it must be accompanied by proof of purchase indicating the date of purchase and dealer's name from whom it was purchased. All returns must be prepaid and insured by you and must be appropriately packaged for safe shipment since DSI will not accept responsibility for loss or damage in transit.

This warranty does not apply to defects caused by negligence, misuse, accidents, or modifications.

DSI reserves the right to make changes and improvements in our Product without any obligation to similarly alter products previously purchased. DSI neither assumes nor authorizes any representative or other person to assume for us any other liability in connection with the sale of our products.

Warranties for this Product including any implied warranties of merchantability and fitness for a particular purpose, are limited in duration to a period of 180 days from the date of purchase. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

Your sole remedy shall be repair or replacement as provided above. In no event will DSI be liable to you for any damages, including any lost profits, lost savings, or other incidental or consequential damages arising out of the use of or inability to use such product, even if DSI or an authorized DSI dealer has been advised of the possibility of such damage, or for any claim by any other party.

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