Installation guide

Ultrastar 36XP

Multi-mode SE/LVD

Models: DRHS-36V
DRHS-36D

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Introduction

This manual was prepared to help you install your IBM Ultrastar 36XP hard drive in most computer systems. If you do not feel comfortable installing this drive yourself, contact a qualified installer to assist you.

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Hardware description

The Ultrastar 36XP is available in various models with the following options:

- Capacity of 36GB
- 68 pin or 80 pin (SCA) connectors
- 68 pin SCSI connectors use the SCSI P connector which supports wide data transfers
- 80 pin SCSI connectors use the SCA-2 connector

Capacity	Model	SCSI Pins/Connector Type	SCSI Electrical Signal Type
36GB	DRHS-36V	68 / Unitized Connector	Low Voltage Differential (Ultra2)
36GB	DRHS-36V	80 SCA-2	Low Voltage Differential (Ultra2)

These drives offer an advanced LVD interface that supports transfer rates of up to 80 MB/sec. To take advantage of the higher transfer rate of 80 MB/sec, your computer will need to have a controller that supports the LVD interface. If you have a SCSI controller that does not support this interface, the drive will still function, but will be limited to data transfer speeds significantly lower than 80MB/sec due to the lower speed of your controller. If you have a slower controller, you may wish to purchase an LVD controller card to take advantage of Ultrastar's 80 MB/sec data transfer rate. An LVD controller card will fit into any available slot in your computer.

If you currently have wide SCSI drives (single-ended) and a non-LVD controller, you may still attach the LVD model Ultrastar 36XP to the existing cable. However, single-ended wide SCSI drives cannot be added to the same bus as an LVD drive if that bus is connected to an LVD controller.

To determine if your current controller card is LVD, see the documentation that came with your controller or contact the controller manufacturer for this information.

These drives are 3.5" drives designed to work in NT and Unix workstations and servers. They are ideal for use by video producers and movie editors. The Ultrastar 36XP family is designed to work with MMX systems. Compatibility listings are included in the appendix. Before you begin installation, please read the "Hard disk drive handling guide" on the following page.

Hard disk drive handling guide

These notes are designed to provide a simple overview of the need for cautioun when handling a disk drive.

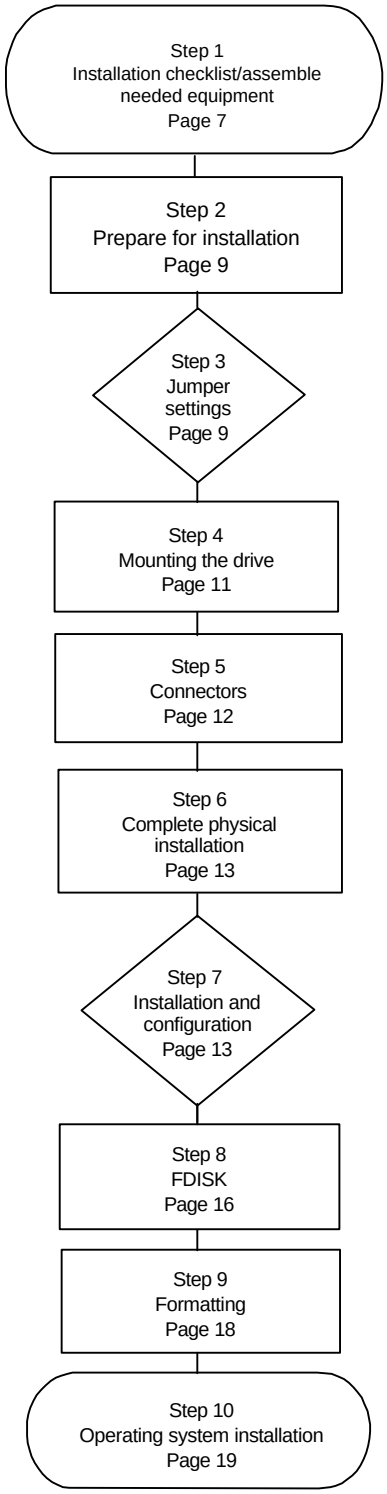
Disk drives can be easily damaged by electrical static shock or rough handling. In order to minimize the risk of damage to a disk drive, it is essential that the drive be handled while resting on a cushioned surface (which is electrostatically safe). Many such static safe mats are available, examples are 3M's 8210 table mat or 3M's "First Touch" computer pad.

Great care should be taken when handling disk drives. Do not bump them against any object. When attaching brackets or mounting the drive in the computer, be very careful. It is *very easy* to unintentionally introduce shocks which exceed specifications.

Please note that the capacity of each disk drive to withstand electrical or mechanical shock varies according to its design. The IBM Hard Disk Drive Technical Support Center can advise you on the suitability of your Ultrastar drive for a specific application.

Damage incurred to a drive might not be immediately evident and could cause the drive to fail long after the damage occurred.

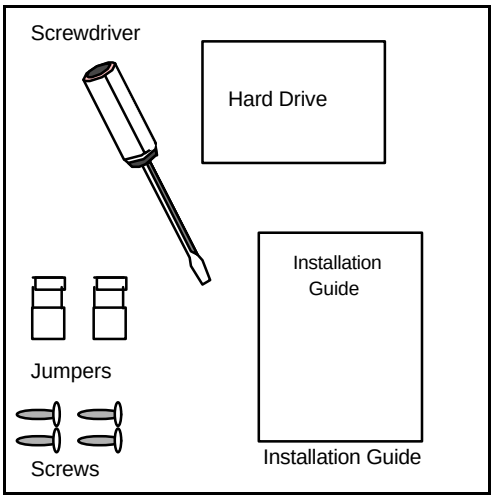
Hard disk drive installation flow chart



Step 1: Installation checklist

To install the Ultrastar drive you may need the following items, depending on your computer's components:

1) __ The installation kit (as shown in the diagram below) containing the Ultrastar drive, 4 mounting screws, and any related publications. Save the box the drive came in.



2) __ The documentation that came with your computer or storage enclosure.

3) __ A small, flat-blade screwdriver.

4) __ A SCSI controller, which is either built-in or an adapter inside your computer, and any related documentation.

5) __ Mounting brackets, if required for your computer. Contact your place of purchase if you are unsure if mounting brackets are required.

6) __ A bootable DOS diskette. (See the section entitled *Making a bootable diskette* in the appendix.)

7) __ If you are replacing an older internal drive with the new Ultrastar drive and want to copy all of the files from the older drive to the new drive, you may need additional software. (See the section entitled *Drive copy* in the Appendix.)

Continue installation with the following procedures:

1) __ Backup your existing drive to avoid any loss of data during installation. (See the section entitled *Backup and restore* in the Appendix.) After completing backup, shut down as normal.

2) __ Unplug your system from the electrical outlet.

3) __ Discharge static electricity by establishing a common voltage between your body and the hard drive. Simultaneously touch an unpainted metal surface on the outside of your computer system with your bare hands and the hard drive in its anti-static bag. Avoid excessive movement until the drive has been mounted.

4) __ DO NOT LOW-LEVEL FORMAT YOUR DRIVE! IBM drives are low-level formatted by the manufacturer and reformatting may cause permanent damage to your drive and your system. (See the section entitled *Utilities* in the Appendix.)

5) __ Record the following information:
Drive Model _____ Date of Purchase_____
Drive P/N _____ Place of Purchase_____
Serial # _____

Step 2: Prepare for installation

Opening your computer

1. Turn the system off.
2. Unplug the power cord from the wall outlet.
3. Remove all cables from the back of your computer, labeling them if necessary.
4. Remove the cover from your computer. (Consult your user's guide for instructions if needed.)

Unpackaging your hard drive

1. Remove the drive from the anti-static package that it was shipped in.
2. Handle the drive by the sides only.
3. Do not touch the main computer chip board.
4. Do not drop. A drop from *only 1/4 inch* could permanently damage your hard drive.
5. If available, use an ESD (Electronic Static Discharge) wrist strap while handling your drive.
6. Place the drive carefully on a static free area.

Step 3: Jumper settings

The jumper settings are found on the hard drive on the opposite end of the interface connector (see diagram page 12). They are physical settings that must be changed for different uses of a hard drive.

SCSI ID Jumpers

Each SCSI device will need to have its own SCSI ID. You can use ID 0 through ID 15, reserving ID 7 for your controller card. Follow the table below to set an ID on your SCSI drive.

Bit 3	Bit 2	Bit 1	Bit 0	Address
off	off	off	off	0
off	off	off	on	1
off	off	on	off	2
off	off	on	on	3
off	on	off	off	4
off	on	off	on	5
off	on	on	off	6
off	on	on	on	7*
on	off	off	off	8
on	off	off	on	9
on	off	on	off	10
on	off	on	on	11
on	on	off	off	12
on	on	off	on	13
on	on	on	off	14
on	on	on	on	15

*Reserved for controller card

SCSI Address Determination

Drive Termination

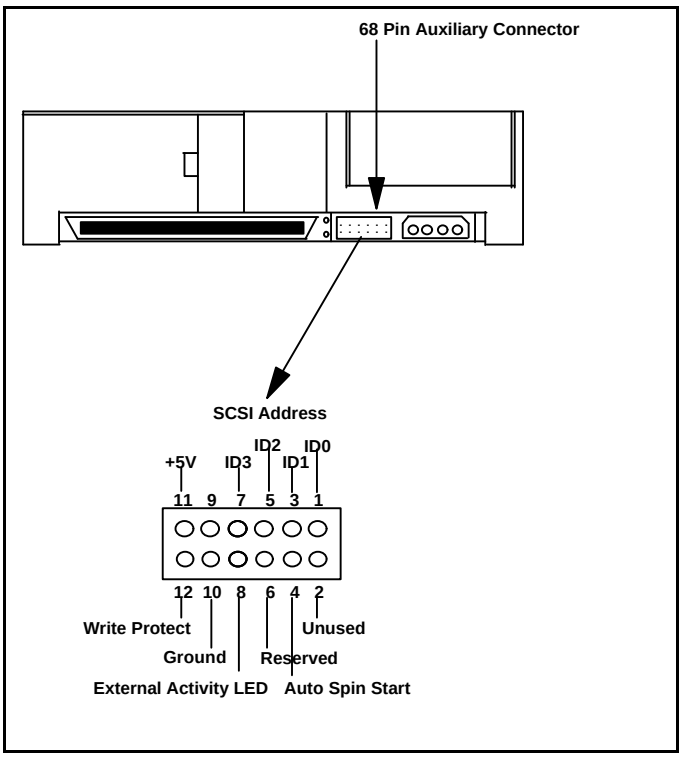
The SCSI bus will need to be terminated at both ends of the bus. The Ultrastar 36XP does not have onboard active termination. You will need to supply an external Ultra2 compatible terminator.

Termination Power

Some controllers may require the drive to supply 5 volts of power to the bus to aid termination. If your controller requires this, place a jumper on the Termination Power Enable jumpers to the side of the jumper block. These pins require a 2.54mm jumper shunt.

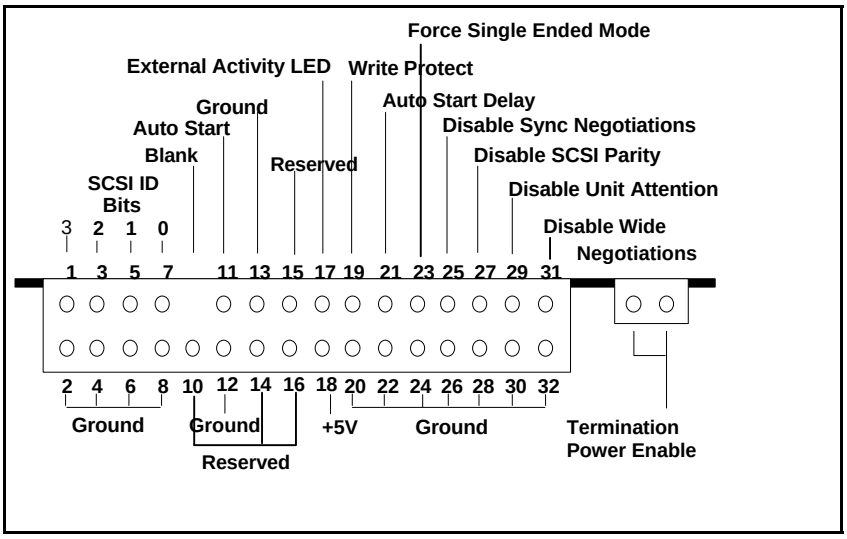
Auxiliary Option Jumper Block

The 68 pin models contain an auxiliary connector that replicates some of the functions provided by the front option jumper block. The auxiliary connector should only be used if you have a combination "ganged" switch, typically found in external drive enclosures. The front option block and the auxiliary option block may not be used simultaneously.



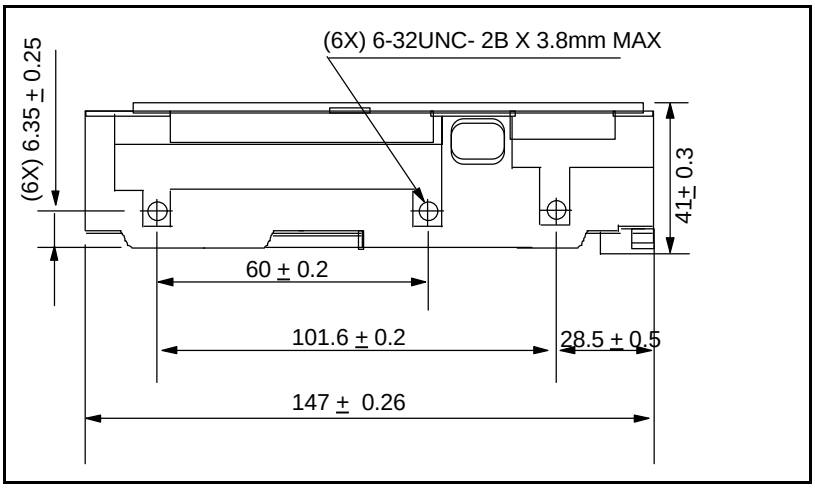
Additional Jumper Options

The Ultrastar drives offer additional options on the jumper block. See Appendix for details of the additional jumper options shown below.

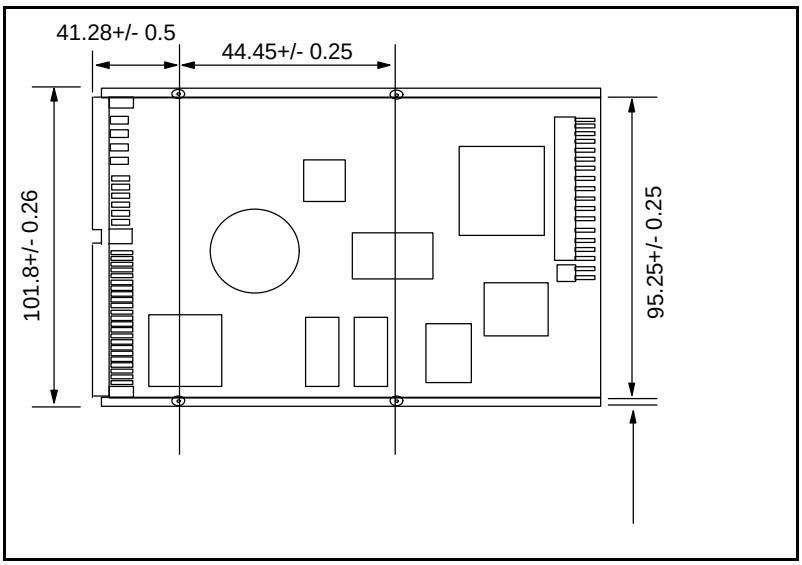


Step 4: Mounting

After setting the jumpers, mount the hard drive in your system. The Ultrastar drive can be mounted with any of its six surfaces facing down (right side up, upside down, sideways, etc.). See below for mounting hole locations.



Side mounting holes



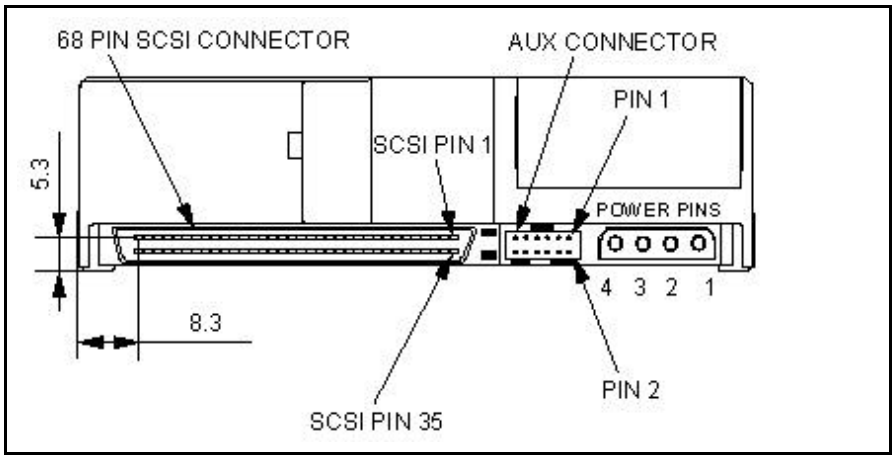
Bottom mounting holes

You must ensure that the drive has sufficient air flow. Mount the drive in the system using 4 6-32 UNC screws. The maximum screw length is 3.5 mm for the side holes and 6 mm for the bottom holes. Mount the drive securely enough to prevent excessive motion or vibration.

If you are mounting your drive in a 5 inch bay, you may need to purchase mounting brackets from your computer manufacturer for the drive to be mounted securely.

Step 5a: Connectors (68 pin drives)

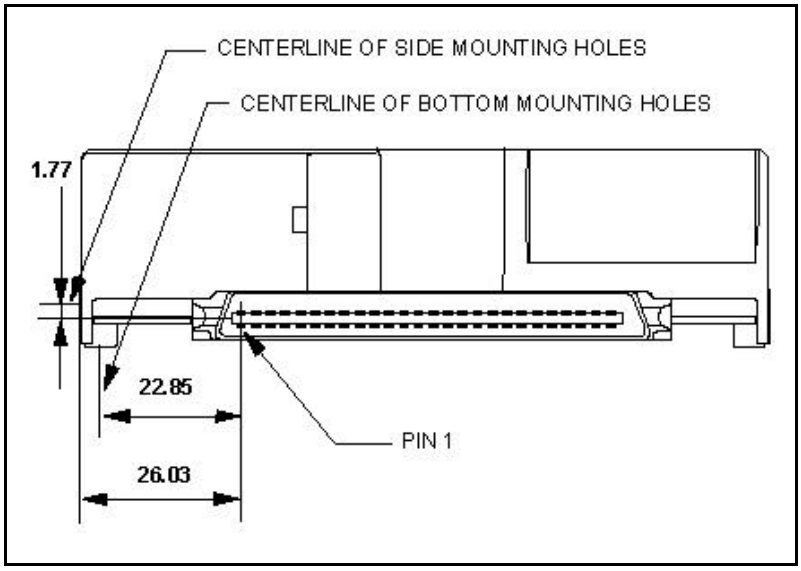
After the drive has been carefully mounted, connect the SCSI cable and the power cable to the drive. (Note that the SCSI connector and power connector are keyed for proper insertion.)



68 pin connector

Step 5b: Connectors (80 pin drives)

80 pin drives are to be plugged into backplanes of servers and require no cables. If you have an 80 pin drive that you want to connect to a 68 pin SCSI cable, you will need to purchase a converter.



80 pin connector

Step 6: Complete physical installation

Verify that the cable is properly connected to the SCSI controller. Replace the cover on the computer, connect all cables, and plug the power cord into the wall.

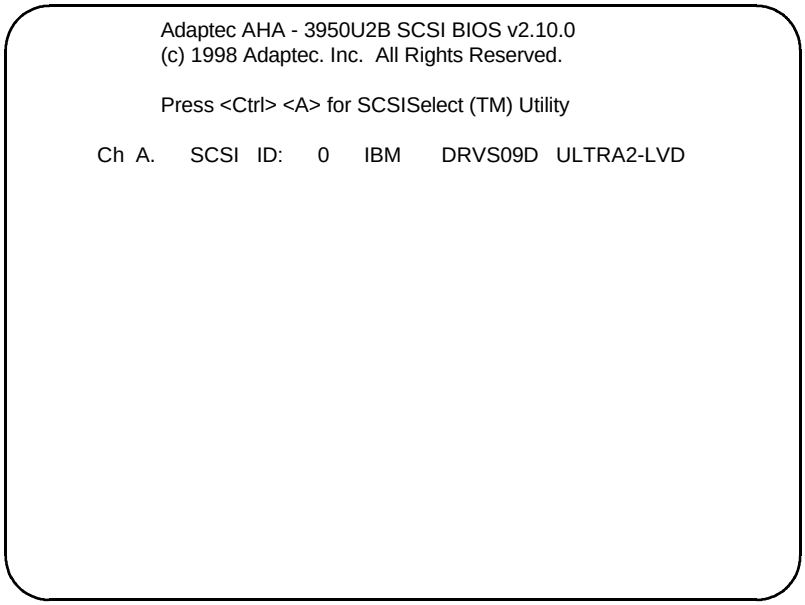
Step 7: Installation and configuration

If you have just added a SCSI controller card, follow the manufacturer's instructions to install the card.

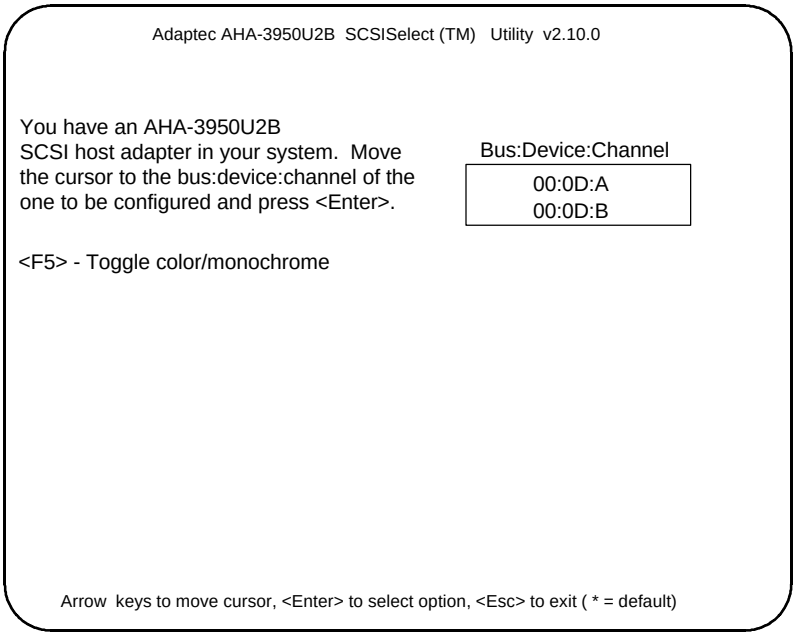
Boot computer

"Booting" means turning on your computer. Turn on your computer after you have inserted a bootable diskette. You should see the drive listed when the system is booting.

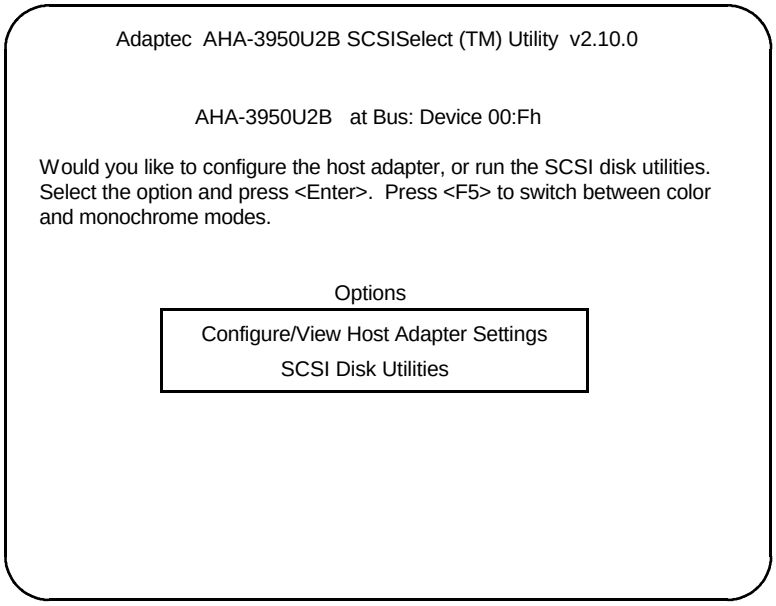
Note: The example on the next page uses the Adaptec 3950U2 controller and the Model DRVS-09D drive.



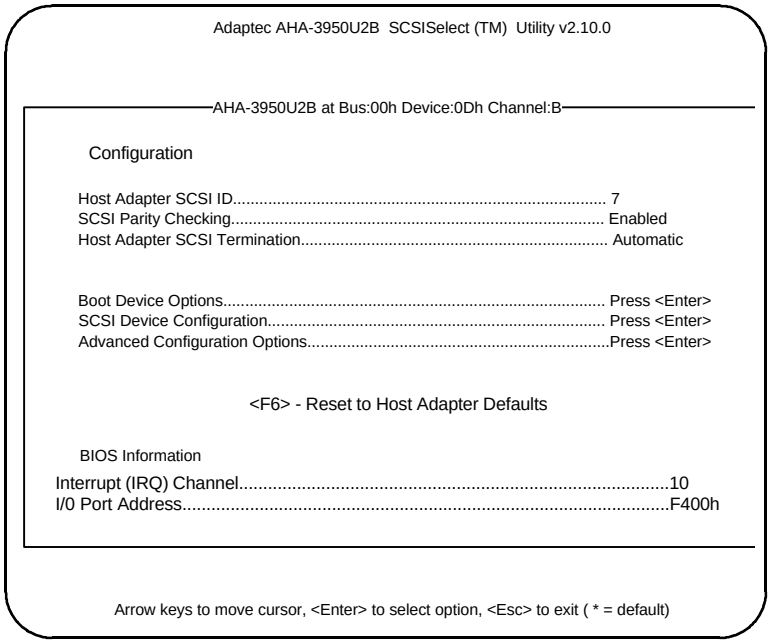
You can, at this time, press [CTRL] [A] to enter the Adaptec SCSI setup utility. The following screen will appear.



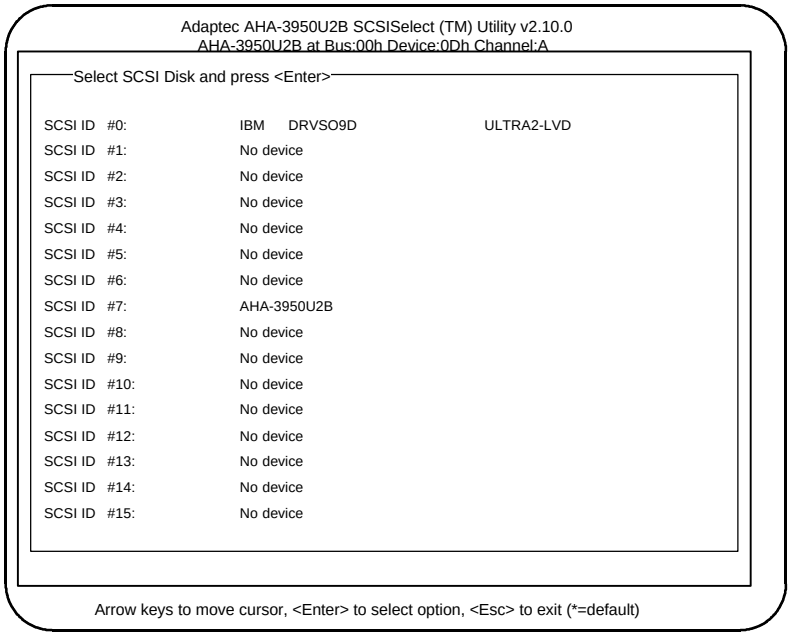
Select the channel to which your drive is attached. The screen on the next page will follow.



Select the first option *Configure/View Host Adapter Settings.* The next screen is shown below with the default settings.



You can accept the default settings with *Host Adapter SCSI Termination* set to Automatic. If you wish to accept the default settings, press [ESC] to return to the previous menu. Select the SCSI utilities.

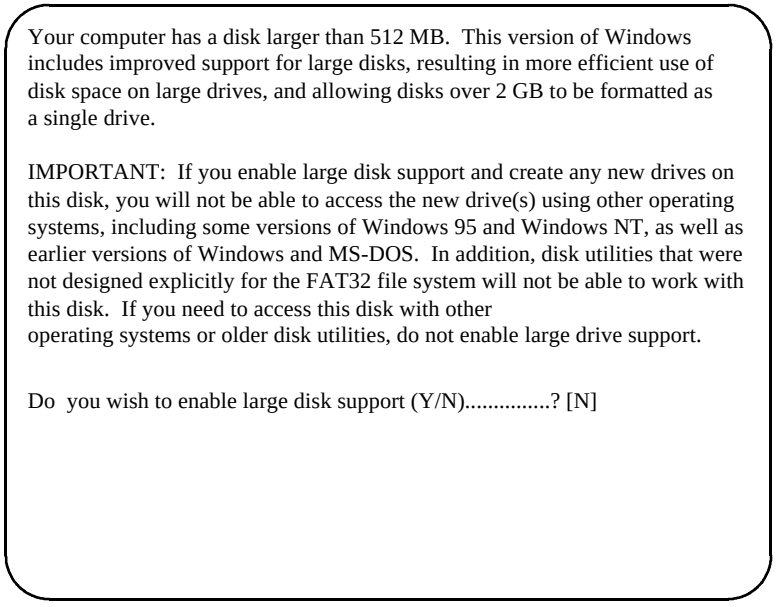


This shows all devices attached to the Bus. To perform a *Verify Media*, highlight the drive you would like to verify and press [ENTER]. Select *Verify Media* from the options.

If you wish to accept all settings, press [ESC] to exit out of the Adaptec settings.

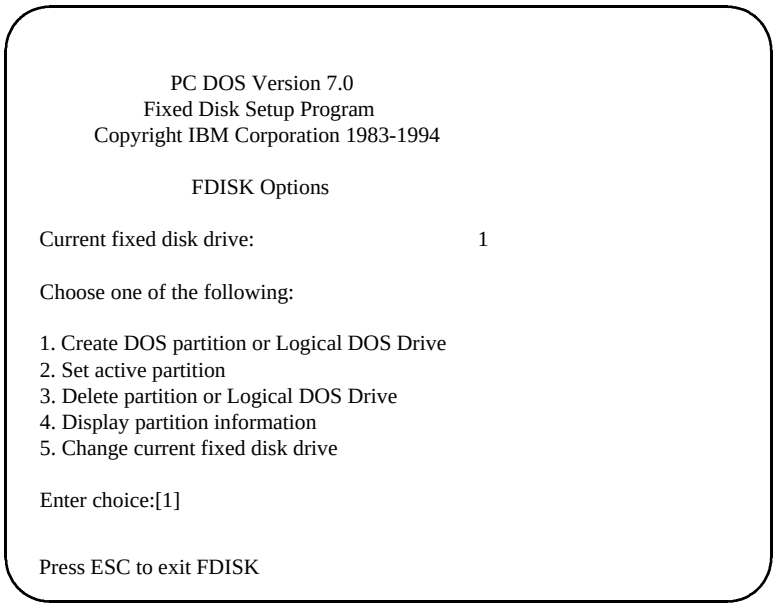
Step 8: FDISK

Boot to a bootable diskette and type FDISK at the A:\ prompt. If Windows® 95 OSR2 or Windows® 98 are used, the following screen will appear.

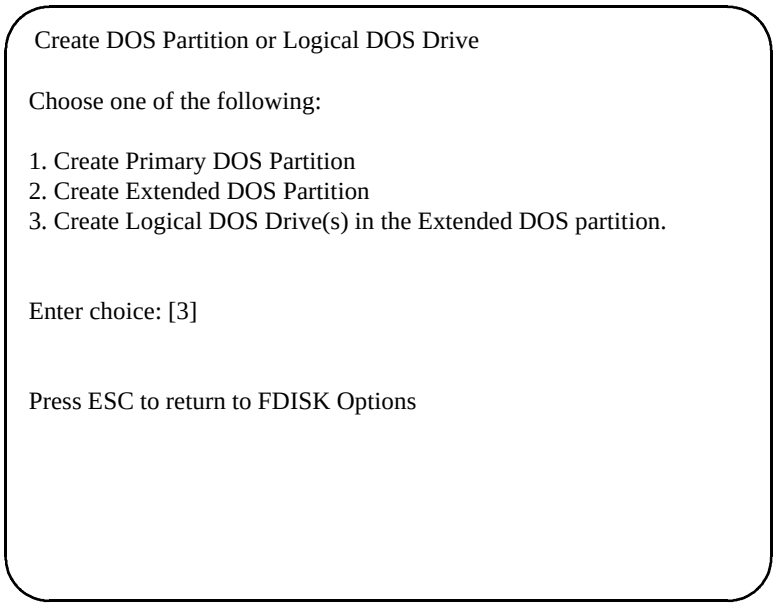


Type *Y* to select the FAT 32 file system. Type *N* to select the FAT 16 file system.

The following screen allows you to create partitions. If you have more than 1 drive there will be 5 options. Option 5 allows you to select the drive you wish to partition.



Select option 1 to create a DOS partition. The screen below will appear.

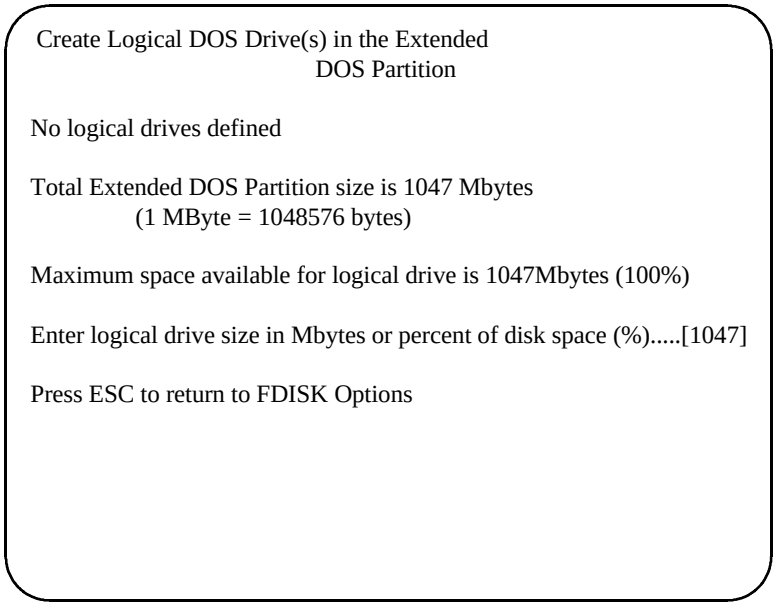


Select option 1 to *Create a Primary DOS Partition*. If this is to be the boot drive, set this partition to "Active".

Press *ESC* to return to the FDISK options. Create an *Extended DOS Partition* by selecting option 1 from the main menu and option 2 from the second menu. (Both menus shown above.)

Note: The Maximum Capacity shows only 8455 MB instead of 9130 MB. This is because the BIOS of some systems recognizes a Megabyte as 1,048,576 bytes (binary). Drive manufacturers recognize a Megabyte as 1,000,000 bytes (decimal). The capacities are the same in actual number of bytes.

After creating the *Extended DOS Partition*, press ESC to return to the FDISK main menu. Select option 1 to create a *Logical DOS Drive*, then option 3 to create a *Logical DOS Drive in an Extended Partition*.



Press *ESC* to return to FDISK and press ESC again to restart the system. You must restart the system for the partitions to be recognized.

Step 9: Formatting

The drive will need to be formatted before an operating system can be loaded. Format the Primary partition and any Extended partitions that have been made.

After booting from a bootable diskette, run FDISK, option 4 to display the partition information. This is helpful to review drive letter assignments. Note the drive letters to ensure proper formatting.

Press *ESC* to return to the main menu and exit FDISK. At the A:\ prompt type *format x: /s* (where x is the drive letter). The /s option will make your hard drive bootable by copying the system files to the hard drive. If you do not want this drive to be bootable, do not use the */s* command. You will see the following warning:

```
WARNING:  ALL DATA ON NON-REMOVABLE DISK
DRIVE C:  WILL BE LOST!
Proceed with Format (Y/N)?
```

Type *Y* for yes. There should be no data on the new drive. The time it takes to format the drive is dependent upon its size. When the drive has finished formatting, format the next logical drive, in this case D: by typing *format d:* You will get the same message. Select *Y.*

File Systems

FAT 16/FAT 32 (File Allocation Table)
The file allocation table is a group of sectors in a hard drive that contains address chains for the different files on a hard disk drive. There are usually two FATs (kept in different locations) on a hard drive. FAT32 is available in the Windows® 95 & Windows® 98 operating systems. FAT32 receives its designation because it allows 32 bits of addressing as opposed to 16 bits in the FAT16 file system.

HPFS (High Performance File System)
HPFS is the file system used by the OS/2 operating system.

NTFS (NT File System)
NTFS is an advanced file system used by Windows® NT.

Step 10: Operating system installation

After the drive has been formatted, install an operating system. You may encounter the following issues.

Windows® 95 / Windows® 98

In Windows® 98 the system may hang-up when trying to self-restart. A reset or power cycle is required.

Note: Some controllers, systems, or operating systems may expect ANSI SCSI-2 devices. The Ultrastar 36XP reports itself as a SCSI-3 device. Contact the IBM Hard Disk Drive Technical Support Center for a fix if you encounter this issue.

Appendix

Making a bootable diskette

If you do not have a DOS bootable diskette, you may want to make one. This will be necessary for installing your new hard disk drive and in case of system failure. The DOS bootable diskette will contain files necessary to boot your system. These files are called system files. You will also want some utilities on your bootable diskette. Following are the instructions needed to add both the system files and the other helpful utilities.

1) Make sure your computer is on and you insert a diskette in drive A.

2) At the C:\ prompt, type *FORMAT A: /S* and press ENTER

3) Press [ENTER] again, unless you want to label your diskette.

4) Add the utilities. To do so, use some simple copy commands.

   a) Type *cd Windows* at the C:\ prompt, press [ENTER].
   b) Type *copy fdisk.exe a:,* press [ENTER].
   c) Type *copy format.com a:*, press [ENTER].
   d) Type *copy sys.com a:*, press [ENTER].
   e) Type *copy chkdsk.exe a:*, press [ENTER].
   f) Type *copy debug.exe a:,* press [ENTER].

5) Type *cd.*

6) Remove diskette from drive A:

7) Write protect the diskette by sliding the small plastic tab on the diskette in the up position.

8) Test the diskette.

   a) Turn off your computer.
   b) Insert the diskette in drive A:
   c) Turn on your computer.
   d) When you get to the A:\ prompt *type c:*, press [ENTER].

9) If any of these steps did not work, start again at step 1.

Jumper block information

The jumper block is a block of pins located on the hard drive. When these pins are shorted with shunts (jumpers), the drive will behave in certain ways. A shunt is a small piece of plastic with metal inside that shorts out the connection between 2 pins when placed over them. These can be purchased at any local computer store. The pin pitch for all pins except for Termination Power is 2 mm. Termination Power pins have a pitch of 2.54mm.

Auto Start Delay

The Auto Start and Auto Start Delay pins control when and how the drive can spin up and come ready. When configured for Auto-Startup, the motor spins up after a SCSI reset without the need of a SCSI Start Unit command. For no Auto-Startup, a SCSI Start Unit comand is required to

make the drive spin and be ready for media access operations. When in Auto-Start Delay mode, the drive will delay its start time by a period of time multiplied by its SCSI address.

External Activity (LED) Pins
The LED pins can be used to drive an external Light Emitting Diode.

Write Protect Pin
If the Write Protect pin is jumpered to ground the drive will prohibit SCSI commands that alter the customer data area portion of the media from being performed.

Disable Synchronous Negotiation Pin
If a Disable Target Initiated Synchronous Negotiation pin is grounded then a host initiator is required to start a negotiation handshake if wide transfers (16 bit) are desired.

Disable SCSI Partiy Pin
Grounding this pin will disable SCSI partity checking.

Disable Unit Attention Pin
Grounding this pin will disable the drive from sending Unit Attention Sense information for commands immediately following a Power On Reset or SCSI Bus Reset.

Disable Wide Negotiations
Jumpering the pins will cause the drive to operate in single byte mode. The drive will not negotiate wide operation.

Force Single Ended Mode
Jumpering pin 23 to pin 24 will cause the 68 pin and 80 pin SCA LVD drives to operate in single ended mode only. The drive will not use the DIFFSENS line to determine SE or LVD modes

Controller information
The examples in this guide have used an Adaptec controller. You may have a chipset embedded into your motherboard. If this is the case, plug the cable into the port on the motherboard instead of the controller.

If you are purchasing an add-on controller card, you will need to install the controller in one of the empty slots in your computer. Remove the screw holding the metal plate in place and insert the controller into the PCI, EISA or ISA slot on the motherboard, making sure the metal plate from the controller fits into the grooves on the computer frame. Replace the screw and connect the SCSI cables to the controller and then the hard drive. If you have any questions, refer to the installation manual enclosed with your controller.

Backup and restore

One of the most common methods of backup is tape backup. Tape drives are available from IBM and other major manufacturers. This method is preferred for overnight backups that run while your business is closed or while you sleep.

Another method of backup is the removable drive. There are several brands of removable drives. IOMEGA is one of the better-known manufacturers. IOMEGA manufactures the popular ZIP drive and the JAZ drive. These drives can be used for backup and hooked up or removed with little trouble.

Utilities

Your Ultrastar drive comes low-level formatted and free of defects. *Note: Do not attempt to low-level format your drive.* If data must be removed from the drive, there are 2 utilities available on the IBM Hard Disk Drive Technical Support Center FTP site at: http://index.storsys.ibm.com/hddtech

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ZAP
Zap is a utility that will 'zap' your boot sector by writing 0's to the first 128 sectors of your drive.

WIPE
Wipe performs the function of ZAP and also writes 0's to the entire drive.

These utilities should be sufficient to return your drive to factory-shipped condition.

Drive copy

If you are replacing an existing hard drive with the Ultrastar drive, you may want to copy all your files from the existing drive to the Ultrastar. There are several software programs available that copy one drive to another.

PowerQuest Drive Copy 2.0
(http://www.powerquest.com/product/dc.index.html)
This utility supports all operating systems, has mouse support, selective partitioning, selective sector copying, and automatically creates new DOS reboot disk. This utility is not limited by drive size.

QuarterDeck Systems DiskClone
(http://www.qdeck.com/qdeck/products/diskclone/indexreg.html)
This utility supports all operating systems and has mouse support.

ITS Systems EZ-Upgrader
(http://www.itechs-systems.com/)
This utility can be used with Windows® 3.1 andWindows® 95 operating systems.

Image Systems Solutions Drive-to-Drive
(http://www.img-systems.com/d2ddesc.htm)
This utility is for use with all operating systems, but is limited to copying drives with similar physical geometry.

FWB software Drive Up!
(http://www.fwb.com/)
This utility is used with Windows® operating systems only.

Compatibility matrix

The IBM SIT Lab thoroughly tests Ultrastar drives for compatibility with a wide variety of systems, controller cards, operating systems, and BIOS versions. Testing was done to demonstrate compatibility with the following hardware and software. Other combinations of hardware and software may function with this drive, but were not tested.

Systems

Acer AP53A
Apple Performa 6400/180
ASUS P2B-IS
Compaq Deskpro 6000
Compaq Professional Workstation 6000
Compaq Proliant 1500
Data General
Dell Dimension XPS D300
Dell OptiPlex Gxa 266MTbr
Dell Power Edge 4100
Digital Alpha Server 800 5/333
Digital Alpha Server 4100
Gateway 2000 P6-200
Gateway G6-200
HP Netserver LXPro
HP Kayak GM
IBM Intellistation Z-Pro
Micron ClientPro XLU
Micron Millenia MME
Micron Powerdign XSU
NEC Direction SPL 266
NEC Powermate Enterprise
SNI Primergy 460
Silicone Graphics Octane
SGI 02
SGI Octane
Sun Sparc Station 20
Tyan P5-166 Motherboard

SCSI controllers

Adaptec ARO Additional Storage
Adaptec 2940UW
Adaptec 2940U2W
Adaptec 3940W
Adaptec 3950U2B
Adaptec 7880
Adaptec AHA-7890
Adaptec AIC-7880
Adaptec Power Domain
AHA-3940UW v3
Buslogic BT-956
Compaq Wide-Ultra SCSI-2
Compaq Wide-Ultra SCSI-3
DG Proprietary
Diamond Fireport 40
DPT 2144UW
DPT 3334UW
EMC 80 Pin Ultra
Integral V.QL104B
Mylex DAC 960
Qlogic
Qlogic QLA1040B
Sun
Symbios Logic

Operating systems

Irix 6.3
Irix 6.4 Rel 6.5
Mac System 7.5.3
Mac System 7.6
Mac System 8.5
MS DOS 6.20
OS2/Warp V.4.20
Phoenix
SCO 5.0.2
SCO Unix 3.2.4.2
SCO Unix 5.0.2
SCO Unixware 2.1.1
SCO Unixware 2.1.2
SCO Unixware 5.0.2
Sun OS 5.5.1
Sun Solaris/Unix
Unix
Windows 95
Windows 95 OSR2
Windows 98
Windows NT 4.0, Build 1381
Windows NT 4.0

BIOSs

AlphaBios 5.64 971212.1414
AMI 1.00.02.DT05
AMI 1.00.11.CD0L
AMI 1.00.04.CS1T

Technical support

Before calling technical support make sure you have your drive part number, serial number, and system information.

Contact technical support via:

Web www.ibm.com/harddrive
Voice 888.426.5214 or 507.253.4110
Fax 507.253.4111
e-mail drive@us.ibm.com

Support is also available in Singapore at:

Voice (65) 840.9292
e-mail drive@sg.ibm.com

Automated Fax Back Service

U.S.A.	408.256.5218
Singapore	800.1100.383
England	0800.96.6948
Germany	0130.82.6089
France	0800.902229
Italy	167.875148

Warranty

Statement of Limited Warranty

Part 1 - General Terms

This Statement of Limited Warranty includes Part 1 - General Terms and Part 2 - Country-unique Terms. The warranties provided by IBM in this Statement of Limited Warranty apply only to Machines you purchase for your use, and not for resale, from IBM or your reseller. The term "Machine" means an IBM machine, its features, conversions, upgrades, elements, or accessories, or any combination of them. The term "Machine" does not include any software programs, whether pre-loaded with the Machine, installed subsequently or otherwise. Unless IBM specifies otherwise, the following warranties apply only in the country where you acquire the Machine. Nothing in this Statement of Warranty affects any statutory rights of consumers that cannot be waived or limited by contract. If you have any questions, contact IBM or your reseller.

Machine - Ultrastar HDD product.

Warranty Period* - Five year limited warranty.

To obtain warranty service for the Machine within the first thirty (30) days from the invoice date, contact IBM at 1-800-426-7235 ext. 4669. To obtain warranty service for the Machine after thirty days from the invoice date, contact IBM at 1-888-426-5214.

**Contact the above warranty telephone numbers for warranty service information. Some IBM Machines may be eligible for On-site warranty service depending on the country where service is performed.*

The IBM Warranty for Machines

IBM warrants that each Machine 1) is free from defects in materials and workmanship and 2) conforms to IBM's Official Published Specifications. The warranty period for a Machine is a specified, fixed period commencing on its Date of Installation. The date on your sales receipt is the Date of Installation, unless IBM or your reseller informs you otherwise.

During the warranty period IBM or your reseller, if approved by IBM to provide warranty service, will provide repair and exchange service for the Machine, without charge, under the type of service designated for the Machine and will manage and install engineering changes that apply to the Machine.

If a Machine does not function as warranted during the warranty period, and IBM or your reseller are unable to either 1) make it do so or 2) replace it with one that is at least functionally equivalent, you may return it to your place of purchase and your money will be refunded. The replacement may not be new, but will be in good working order.

Extent of Warranty

The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible. The warranty is voided by removal or alteration of Machine or parts identification labels.

THESE WARRANTIES ARE YOUR EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THESE WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS
AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF EXPRESS OR IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU. IN THAT EVENT, SUCH WARRANTIES ARE LIMITED IN DURATION TO THE WARRANTY PERIOD. NO WARRANTIES APPLY AFTER THAT PERIOD.

Items Not Covered by Warranty

IBM does not warrant uninterrupted or error-free operation of a Machine.

Unless specified otherwise, IBM provides non-IBM machines **WITHOUT WARRANTIES OF ANY KIND**.

Any technical or other support provided for a Machine under warranty, such as assistance via telephone with "how-to" questions and those regarding Machine set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND**.

Warranty Service

To obtain warranty service for the Machine, contact your reseller or IBM. In the United States, call IBM at 1-800-IBM-SERV (426-7378). In Canada, call IBM at 1-800-465-6666. You may be required to present proof of purchase.

IBM or your reseller provides certain types of repair and exchange service, either at your location or at a service center, to keep Machines in, or restore them to, conformance with their Specifications. IBM or your reseller will inform you of the available types of service for a Machine based on its country of installation. IBM may repair the failing Machine or exchange it at its discretion.

When warranty service involves the exchange of a Machine or part, the item IBM or your reseller replaces becomes its property and the replacement becomes yours. You represent that all removed items are genuine and unaltered. The replacement may not be new, but will be in good working order and at least functionally equivalent to the item replaced. The replacement assumes the warranty service status of the replaced item.

Any feature, conversion, or upgrade IBM or your reseller services must be installed on a Machine which is 1) for certain Machines, the designated, serial-numbered Machine and 2) at an engineering-change level compatible with the feature, conversion, or upgrade. Many features, conversions, or upgrades involve the removal of parts and their return to IBM. A part that replaces a removed part will assume the warranty service status of the removed part.

Before IBM or your reseller exchanges a Machine or part, you agree to remove all features, parts, options, alterations, and attachments not under warranty service.

You also agree to

1. ensure that the Machine is free of any legal obligations or restrictions that prevent its exchange;
2. obtain authorization from the owner to have IBM or your reseller service a Machine that you do not own; and
3. where applicable, before service is provided
   i. follow the problem determination, problem analysis, and service request procedures that IBM or your reseller provides,
   ii. secure all programs, data, and funds contained in a Machine,
   iii. provide IBM or your reseller with sufficient, free, and safe access to your facilities to permit them to fulfill their obligations, and
   iv. inform IBM or your reseller of changes in a Machine's location.

IBM is responsible for loss of, or damage to, your Machine while it is 1) in IBM's possession or 2) in transit in those cases where IBM is responsible for the transportation charges.

Neither IBM nor your reseller is responsible for any of your confidential, proprietary or personal information contained in a Machine which you return to IBM or your reseller for any reason. You should remove all such information from the Machine prior to its return.

Production Status
Each IBM Machine is manufactured from new parts, or new and used parts. In some cases, the Machine may not be new and may have been previously installed. Regardless of the Machine's production status, IBM's appropriate warranty terms apply.

Circumstances may arise where, because of a default on IBM's part or other liability, you are entitled to recover damages from IBM. In each such instance, regardless of the basis on which you are entitled to claim damages from IBM (including fundamental breach, negligence, misrepresentation, or other contract or tort claim), IBM is liable for no more than

1. damages for bodily injury (including death) and damage to real property and tangible personal property; and
2. the amount of any other actual direct damages, up to the greater of U.S. $100,000 (or equivalent in local currency) or the charges (if recurring, 12 months' charges apply) for the Machine that is the subject of the claim.

   This limit also applies to IBM's suppliers and your reseller. It is the maximum for which IBM, its suppliers, and your reseller are collectively responsible.

   UNDER NO CIRCUMSTANCES IS IBM LIABLE FOR ANY OF THE FOLLOWING: 1) THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES (OTHER THAN THOSE UNDER THE FIRST ITEM LISTED ABOVE); 2) LOSS OF, OR DAMAGE TO, YOUR RECORDS OR DATA; OR 3) SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS OR SAVINGS), EVEN IF IBM, ITS SUPPLIERS OR YOUR RESELLER IS INFORMED OF THEIR POSSIBILITY. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

Statement of Limited Warranty
Part 2 - Country-unique Terms

ASIA PACIFIC

AUSTRALIA: The IBM Warranty for Machines: The following paragraph is added to this Section:
The warranties specified in this Section are in addition to any rights you may have under the Trade Practices Act 1974 or other legislation and are only limited to the extent permitted by the applicable legislation.

Extent of Warranty: The following replaces the first and second sentences of this Section:
The warranty does not cover the repair or exchange of a Machine resulting from misuse, accident, modification, unsuitable physical or operating environment, operation in other than the Specified Operating Environment, improper maintenance by you, or failure caused by a product for which IBM is not responsible.
Limitation of Liability: The following is added to this Section:
Where IBM is in breach of a condition or warranty implied by the Trade Practices Act 1974, IBM's liability is limited to the repair or replacement of the goods or the supply of equivalent goods. Where that condition or warranty relates to right to sell, quiet possession or clear title, or the goods are of a kind ordinarily acquired for personal, domestic or household use or consumption, then none of the limitations in this paragraph apply.

PEOPLE'S REPUBLIC OF CHINA: Governing Law: The following is added to this Statement:
The laws of the State of New York govern this Statement.

INDIA: Limitation of Liability: The following replaces items 1 and 2 of this Section:
1. liability for bodily injury (including death) or damage to real property and tangible personal property will be limited to that caused by IBM's negligence;
2. as to any other actual damage arising in any situation involving nonperformance by IBM pursuant to, or in any way related to the subject of this Statement of Warranty, IBM's liability will be limited to the charge paid by you for the individual Machine that is the subject of the claim.

NEW ZEALAND: The IBM Warranty for Machines: The following paragraph is added to this Section:
The warranties specified in this Section are in addition to any rights you may have under the Consumer Guarantees Act 1993 or other legislation which cannot be excluded or limited. The Consumer Guarantees Act 1993 will not apply in respect of any goods which IBM provides, if you require the goods for the purposes of a business as defined in that Act.

Limitation of Liability: The following is added to this Section:
Where Machines are not acquired for the purposes of a business as defined in the Consumer Guarantees Act 1993, the limitations in this Section are subject to the limitations in that Act.

EUROPE, MIDDLE EAST, AFRICA (EMEA)

The following terms apply to all EMEA countries.

The terms of this Statement of Warranty apply to Machines purchased from an IBM reseller. If you purchased this Machine from IBM, the terms and conditions of the applicable IBM agreement prevail over this warranty statement.

Warranty Service
If you purchased an IBM Machine in Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland or United Kingdom, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

If you purchased an IBM Personal Computer Machine in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Kirghizia, Federal Republic of Yugoslavia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, or Ukraine, you may obtain warranty service for that Machine in any of those countries from either (1) an IBM reseller approved to perform warranty service or (2) from IBM.

The applicable laws, Country-unique terms and competent court for this Statement are those of the country in which the warranty service is being provided. However, the laws of Austria govern this Statement if the warranty service is provided in Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Federal Republic of Yugoslavia, Georgia, Hungary, Kazakhstan, Kirghizia, Former Yugoslav Republic of Macedonia (FYROM), Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, and Ukraine.

The following terms apply to the country specified:

EGYPT: Limitation of Liability: The following replaces item 2 in this Section:
2. as to any other actual direct damages, IBM's liability will be limited to the total amount you paid for the Machine that is the subject of the claim.

Applicability of suppliers and resellers (unchanged).

FRANCE: Limitation of Liability: The following replaces the second sentence of the first paragraph of this Section:
In such instances, regardless of the basis on which you are entitled to claim damages from IBM, IBM is liable for no more than: (items 1 and 2 unchanged).

GERMANY: The IBM Warranty for Machines: The following replaces the first sentence of the first paragraph of this Section:
The warranty for an IBM Machine covers the functionality of the Machine for its normal use and the Machine's conformity to its Specifications.

The following paragraphs are added to this Section:
The minimum warranty period for Machines is six months.

In case IBM or your reseller are unable to repair an IBM Machine, you can alternatively ask for a partial refund as far as justified by the reduced value of the unrepaired Machine or ask for a cancellation of the respective agreement for such Machine and get your money refunded.

Extent of Warranty: The second paragraph does not apply.

Warranty Service: The following is added to this Section:
During the warranty period, transportation for delivery of the failing Machine to IBM will be at IBM's expense.
Production Status: The following paragraph replaces this Section:
Each Machine is newly manufactured. It may incorporate in addition to new parts, re-used parts as well.

Limitation of Liability: The following is added to this Section:
The limitations and exclusions specified in the Statement of Warranty will not apply to damages caused by IBM with fraud or gross negligence and for express warranty.

In item 2, replace "U.S. $100,000" with "1.000.000 DEM."

The following sentence is added to the end of the first paragraph of item 2:
IBM's liability under this item is limited to the violation of essential contractual terms in cases of ordinary negligence.

IRELAND: Extent of Warranty: The following is added to this Section:
Except as expressly provided in these terms and conditions, all statutory conditions, including all warranties implied, but without prejudice to the generality of the foregoing all warranties implied by the Sale of Goods Act 1893 or the Sale of Goods and Supply of Services Act 1980 are hereby excluded.

Limitation of Liability: The following replaces items one and two of the first paragraph of this Section:
1. death or personal injury or physical damage to your real property solely caused by IBM's negligence; and 2. the amount of any other actual direct damages, up to the greater of Irish Pounds 75,000 or 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

Applicability of suppliers and resellers (unchanged).

The following paragraph is added at the end of this Section:
IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default shall be limited to damages.

ITALY: Limitation of Liability: The following replaces the second sentence in the first paragraph:
In each such instance unless otherwise provided by mandatory law, IBM is liable for no more than: (item 1 unchanged) 2) as to any other actual damage arising in all situations involving non-performance by IBM pursuant to, or in any way related to the subject matter of this Statement of Warranty, IBM's liability, will be limited to the total amount you paid for the Machine that is the subject of the claim.

Applicability of suppliers and resellers (unchanged).

The following replaces the second paragraph of this Section:

Unless otherwise provided by mandatory law, IBM and your reseller are not liable for any of the following: (items 1 and 2 unchanged) 3) indirect damages, even if IBM or your reseller is informed of their possibility.

SOUTH AFRICA, NAMIBIA, BOTSWANA, LESOTHO, AND SWAZILAND: Limitation of Liability: The following is added to this Section:
IBM's entire liability to you for actual damages arising in all situations involving nonperformance by IBM in respect of the subject matter of this Statement of Warranty will be limited to the charge paid by you for the individual Machine that is the subject of your claim from IBM.

TURKIYE: Production Status: The following replaces this Section:
IBM fulfills customer orders for IBM Machines as newly manufactured in accordance with IBM's production standards.

UNITED KINGDOM: Limitation of Liability The following replaces items 1 and 2 of the first paragraph of this Section:

1. death or personal injury or physical damage to your real property solely caused by IBM's negligence;
2. the amount of any other actual direct damages or loss, up to the greater of Pounds Sterling 150,000 or 125 percent of the charges (if recurring, the 12 months' charges apply) for the Machine that is the subject of the claim or which otherwise gives rise to the claim.

The following item is added to this paragraph:

3. breach of IBM's obligations implied by Section 12 of the Sale of Goods Act 1979 or Section 2 of the Supply of Goods and Services Act 1982.

Applicability of suppliers and resellers (unchanged).

The following is added to the end of this Section:
IBM's entire liability and your sole remedy, whether in contract or in tort, in respect of any default will be limited to damages.

Glossary

ANSI (American National Standards Institute)
ANSI is the lead organization for encouraging and developing technological standards. ANSI represents the United States in the IEC (International Electrotechnical Commission) and the ISO (International Standards Organization).

Backup
Storing information from a hard drive to another storage area in order to prevent data loss. Tape drives and Zip drives (IOMEGA) are two common mediums for saving vital information contained on a hard drive.

BIOS (Basic Input/Output System)
The BIOS is the first level of software contained in a computer. It provides basic, low level control for keyboards, video, hard disk drives, and floppy drives. It also provides the initial intelligence that allows the computer system to find an operating system to run.

Boot/Boot-up
To prepare a computer for operation by loading an operating system.

Capacity
The amount of information, expressed in bytes, that can be stored on a hard drive. Also known as *storage capacity*.

Compatibility
The capability of a hardware or software component to conform with the interface requirements of a given data processing system without adversely affecting its functions.

Cylinder
1) In an assembly of magnetic disks, the set of all tracks that can be accessed by all the magnetic heads of a comb in a given position. 2) The tracks of a disk storage device that can be accessed without repositioning the access mechanism.

Disk drive
The primary data storage device used by computers. Disk drives are used to record, store and retrieve digital information.

Electrostatic discharge
The rapid change in electrical energy caused by static electricity. This can damage or destroy electronic equipment or hardware. Electrostatic discharge can be prevented by grounding oneself before handling any electronic equipment.

FAT16/FAT32 (File Allocation Table)
The file allocation table is a group of sectors in a hard drive that contains address chains for the different files on a hard disk drive. There are usually two FATs (kept in different locations) on a hard drive. FAT32 is available in the Windows® 95 & Windows® 98 operating systems. FAT32 receives its designation because it allows 32 bits of addressing as opposed to 16 bits in the FAT16 file system.

FDISK
FDISK is a program run in DOS that allows a user to partition a hard disk drive. Partitioning your hard disk drive is essential for it to work properly.

Format
To prepare a hard drive so that it can store data. In the DOS formatting process, the computer verifies the clusters within a partition.

FTP (File Transfer Protocol)
In the Internet suite of protocols, an application layer protocol that uses TCP and Telnet services to transfer bulk-data files between machines or hosts.

Hard disk drive (HDD)
A stand alone disk drive that reads and writes data onto rigid disks and can be attached to a port on the system unit. Synonymous with *fixed disk drive* and *hard drive*.

Head
The tiny electromagnetic coil and metal pole used to create and read back magnetic patterns on the disk.

HPFS (High Performance File System)
The file system used by the OS/2 operating system.

Interface
A hardware or software protocol, contained in the electronics of the disk controller and drive, that manages the exchange of data between the hard disk drive and the computer. The most common interfaces for small computer systems are ATA (IDE) and SCSI.

Jumpers
Small pieces of plastic with a conductive center used to connect pins on a device.

Jumper settings
Different modes which are achieved by placing the jumper on particular pins on a device. These modes determine the behavior of the device. Settings are changeable by the user, but remain constant during operation. See *Jumpers.*

LVD (Low Voltage Differential)
A highly compatible computer disk drive interface that is faster and more reliable than SCSI. Also known as *Ultra2SCSI*.

Motherboard
Holds the computer's main processors and circuitry, and also contains thememory, BIOS, interconnection circuitry and expansion slots.

Multi-mode
A drive that can operate on an LVD bus or a Single-ended bus.

NTFS (NT File System)
An advanced file system used by the Windows NT operating system.

Operating system
Software that controls the execution of programs and may provide functions such as resource allocation, scheduling, input/output control, and data management. Although operating systems are predominantly software, partial hardware implementations are possible.

OS/2
A fully preemptive, multitasking operating system developed by IBM. OS/2 also supports HPFS.

Partition
A portion of a hard drive dedicated to a particular operating system or application and accessed as a single logical volume.

SCSI (Small Computer System Interface)
Pronounced “scuzzy”. An intelligent parallel peripheral interface characterized by its use of high level communication between devices.

Sector
On a hard drive, the minimum segment of track length that the hard disk drive can assign to store information.

Termination
The signals on a SCSI bus must be terminated at both ends of the bus. This is generally done automatically by the controller and requires an “external” terminator on the last connector of the bus.

Track
One of the many concentric magnetic circle patterns written on a disk surface as a guide for storing and reading data.

Wipe
Wipe is a software utility that writes zeros to every sector on a hard disk drive up to 8 GB. See *Zap.*

Windows® NT
Microsoft’s 32-bit server operating system.

Windows® 98
Microsoft operating system.

Zap
A utility in which the first 128 sectors of a hard drive are overwritten with zeros. See *Wipe.*

Zip drive
A drive which uses increased real density on floppy disk technology to increase storage capacity. Zip diskettes have a storage capacity of 100 MB.

www.ibm.com/harddrive

IBM Hard Disk Drive Technical Support Center
Dept. D8M
3605 Highway 52 North
Rochester, MN 55901
Telephone: 888.IBM.5214 or 507.253.4110
Fax: 507.253.DRIVE
E-mail: drive@us.ibm.com

Singapore Technical Support Center
Telephone: 65.840.9292
E-mail: drive@sg.ibm.com

IBM Storage Systems Division
5600 Cottle Road
San Jose, CA 95193
www.ibm.com/storage

Asia-Pacific Headquarters: 65.320.1234

European Headquarters: 44.01.705.561.871

Japan Sales Branch Office: 81.46645.1039

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IBM products use industry standard interfaces and are generally compatible with standard Systems, System Boards, SCSI Controllers, Operating Systems, and BIOS. This is not meant to be a complete list of compatible products. This information is believed to be accurate, but is supplied without guarantee.

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Date: 18th February, 1999