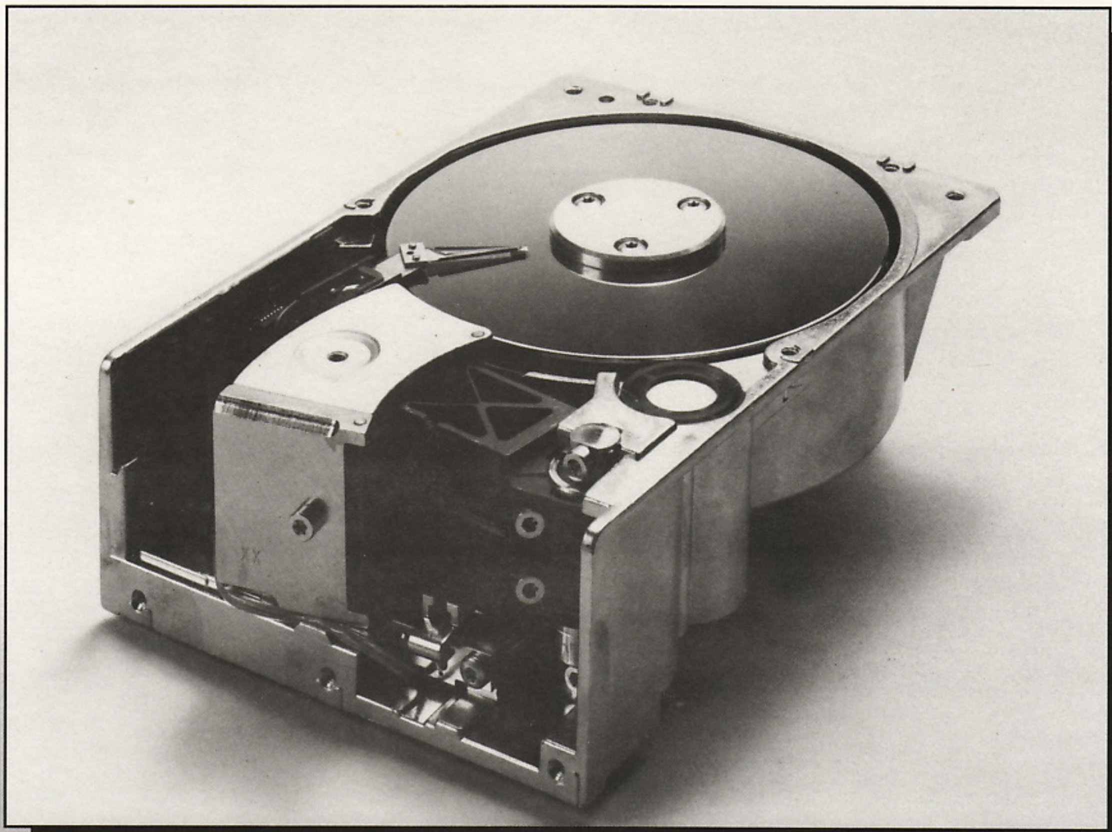
HARD DRIVE *Bible*

THIRD EDITION

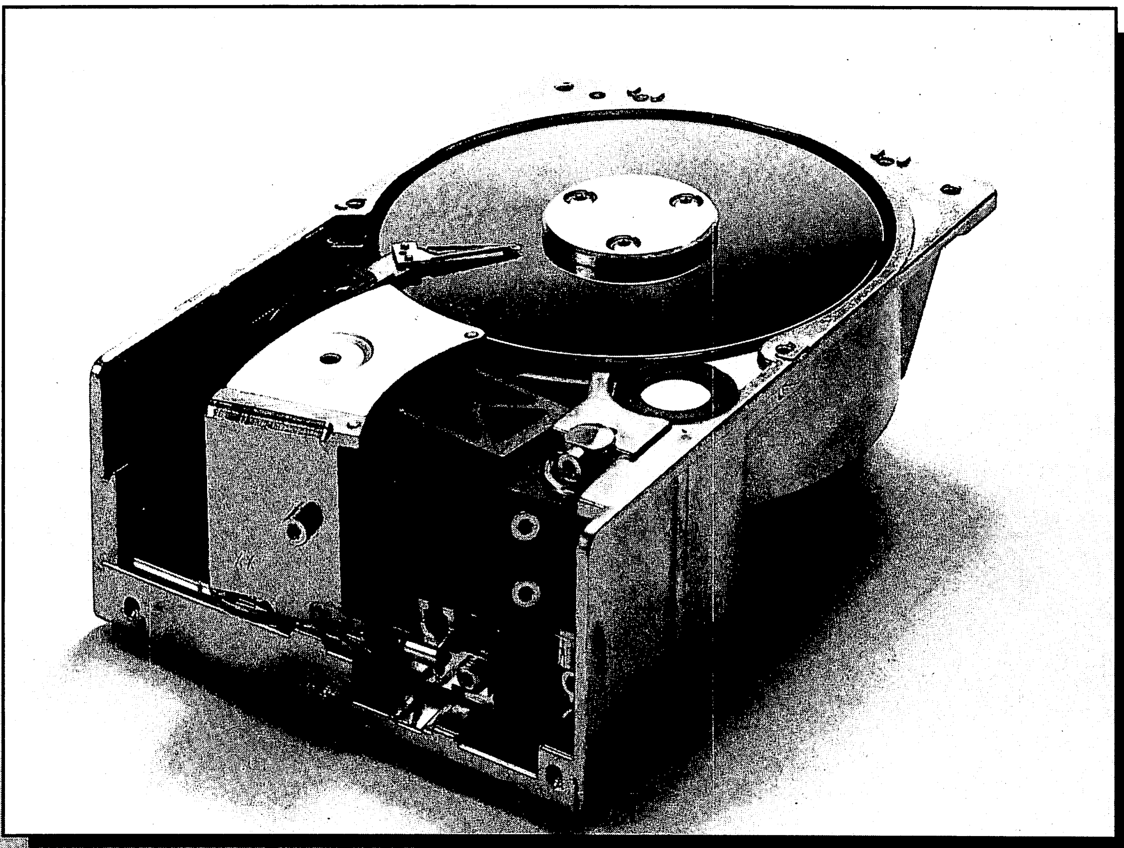


CORPORATE SYSTEMS CENTER

730 North Pastoria Avenue
Sunnyvale, California 94086
(408) 737–7312
FAX (408) 737–1017

HARD DRIVE *Bible*

THIRD EDITION



CORPORATE SYSTEMS CENTER

■

730 North Pastoria Avenue
Sunnyvale, California 94086
(408) 737–7312
FAX (408) 737–1017

Contents

The History of Disk Drives

The magnetic recording technology used in today's disk drives can be traced back to around 500BC when the mineral magnetite was discovered. Magnetite is a naturally magnetic material first used in compasses. Electro-magnetism was put to little use until the 1800's. It was in this era that magnetic technology was pioneered by experimental geniuses like Hans Orested and Michael Faraday who discovered the principal of electromagnetic induction.

The first practical magnetic recording device was the telagraphone built by Vladimir Poulsen in 1900. The telagraphone was a crude audio recorder that wasn't put to much use until World War I. As World War I approached, the German war effort assumed leadership in magnetic recording technology. The German firm AEG was the first to use plastic strips for magnetic recording. This same technology is used in today's high resolution audio and digital tape drives.

In 1955, realizing that magnetic recording density was limited by the number of linear stripes (tracks) on the tape, two brilliant engineers, Charles Ginburg and Ray Dolby at Ampex Corporation developed the helical scan recording system. This ingenious system uses a spinning magnetic head that packs recording tracks diagonally onto the tape. This packing technique provides an extremely high recording density. Helical scan recording in now used in every video recorder and digital audio tape drive.

The revolution in disk based magnetic recording technology was pioneered mainly by IBM in the 60's and 70's. The "diskette" was produced by IBM in 1970 as a time saving device to replace punched cards and paper tapes. These original diskettes stored only a few kilobytes. Improvements in mechanical alignment and media have boosted the capacity of standard diskettes to 2.88MB. Floptical drives will soon be available with 40MB capacity in a standard 3.5" form factor. With over 10 million floppy drives manufactured annually, the diskette is now the standard medium for information interchange.

Winchester hard disk drives were developed simultaneously by IBM and others in the early 70's. Seagate Technology was the first company to mass produce an affordable hard disk drive (the ST506). Hard drives are now the most common device for large capacity data storage.

Magnetic recording technology has now begun to give way to optical technologies. In the past few years, optical recording techniques similar to those used in consumer audio CD's have developed to the point where optical drives are becoming practical. As the cost and performance of these drives improve, the CD-ROM is sure to replace the floppy disk as the new standard medium for information interchange. Low cost writable optical drives are on the horizon.

Interface Standards

With every new developing technology comes the problem of standardization. The data storage industry has been influenced by standards from manufacturers and various groups including:

ANSI	-	American National Standards Institute
CCIR	-	International Radio Consultive Committee
NAB	-	National Association of Broadcasters
IBM	-	First in standards for drives and computers
IRIG	-	Interrange Instrumentation Group
Shugart Associates	-	Pioneer in floppy disk drives
Seagate Technology	-	Pioneer in hard disk drives

Some of the popular standards that have evolved are listed below:

ST-506/ST-412 Interface

Seagate Technology is the world's largest manufacturer of hard drives. Their first ST506 five megabyte full-height 5.25" disk drive was one of the first hard drives manufactured in volume. This drive used a 5 Mbit/second MFM encoded interface. The standard interface copied from this drive is still used in most low capacity MFM and RLL drives.

MFM and RLL Encoding

Modified Frequency Modulation (MFM) encoding was first patented by Ampex Corporation in 1963. MFM encoding is often called "double density" and is used to code data on floppy and hard drives. MFM is an attractive coding scheme mainly because it is simple to encode and decode. MFM is now the standard coding technique for floppy disk drives and some small capacity hard disk drives.

Run Length Limited (RLL) encoding is a group coding technique which provides an increase in data density over MFM encoding. RLL encoding eliminates high frequency flux transitions and permits an increased data density within a fixed recording bandwidth.

The most common RLL coding (RLL 2,7) provides a 50% improvement in recording density over MFM coding. For example, a drive which stores 10MB of data at 5Mbit/sec MFM data rate can be made to store 15MB of data using RLL encoding. The data transfer rate increases to 7.5MBit/sec using RLL 2,7, while the recording bandwidth stays at 5 Mhz.

Other RLL codings can provide even higher recording densities. RLL 3,9 (commonly called ARRL) provides a 100% improvement in recording density. Longer codes can provide even greater increases. Because RLL coding does not require an increased read/write channel bandwidth when compared to MFM encoding, RLL is now a popular coding technique used to increase capacity in many hard disk drives. Most modern ESDI, ST506-RLL and SCSI drives use RLL encoding.

Since RLL encoding provides higher data density in the same recording bandwidth, the data capture window is reduced. To accurately reproduce data in this smaller capture window, RLL encoding requires improved data separator and PLL circuitry. The rotational speed of the disk drive must also remain more constant. Simply put, there is less margin for error using RLL encoding. Because of this, only drives specifically designed for RLL encoding should be used with RLL controllers. Connecting an RLL controller to a drive designed for MFM applications can result in a loss of data integrity. Before RLL'ing a drive, check with the manufacturer to insure that the drive is RLL certified. Be very careful when using ARRL controllers.

ESDI Interface

The Enhanced Small Device Interface (ESDI) is basically an improved, high speed ST-506 interface. The combination of a 34-pin control cable and a 20-pin data cable from the ST-506 interface are retained, but the ESDI interface features improved actuator commands and data transfer rates.

The ESDI interface uses a data separator located on the disk drive itself. Older ST-506 designs used a data separator on the controller card instead. Moving the data separator to the drive improves compatibility and makes the ESDI interface independent of data rate. Providing the maximum data transfer rate of the controller is not exceeded, any speed ESDI drive can be connected to any controller. ESDI drives are commonly available with 10MHz, 15MHz, and 20MHz data rates.

SCSI Interface

The Small Computer Systems Interface (SCSI) is best known as the interface used for Apple Macintosh peripherals. Actually, SCSI has been used for quite some time in workstation applications and is rapidly gaining popularity in the PC marketplace.

SCSI is basically a high-speed bidirectional 8-bit parallel interface that has been standardized by ANSI. The SCSI bus allows addition of up to 7 devices using a daisy-chained cable. Unfortunately, though most manufacturers of SCSI peripherals adhere to the ANSI hardware specifications, SCSI software compatibility varies from manufacturer to manufacturer. A new ANSI standard, SCSI-II has been announced in an attempt to standardize the SCSI software interface.

Good termination and shielding allows the SCSI bus to operate at speeds in excess of 5MB/sec. Since most existing SCSI peripherals only sustain data rates of around 1-2MB/sec, the SCSI interface has the data bandwidth to handle higher speed drives in the future.

The proposed SCSI-II standard offers a wider bus and sustained transfer rates above

40MB/sec. This new version of SCSI offers more than adequate throughput for any storage device that might appear in the near future.

The SCSI interface offers the flexibility and room for future expansion, but brings with it all the problems of a developing technology.

IDE Interface

With the emergence of IBM compatible PC's as a hardware standard, drive manufacturers have recently started to integrate much of the IBM controller hardware onto their disk drives. These drives are called Intelligent Drive Electronics (IDE) drives. Drives with an 8-bit IDE interface are often called "XT Interface" drives, and drives with a 16-bit interface are often called "AT Interface" drives. By imbedding an AT controller card into the drive, a significant manufacturing cost savings occurs. Many parts (including line drivers and even a microprocessor) may be eliminated.

Conner Peripherals and Compaq computers were among the first companies to ship IDE drives in volume. Since then, acceptance of the IDE interface based on their original design has grown.

Since the imbedded controller on an IDE drive is optimized to run efficiently with the drive it is attached to, IDE interface drives often operate with improved performance over their comparable MFM or RLL counterparts. Sacrifices are made in MFM/RLL controller and drive design to insure compatibility with a large range of drives. Imbedded controllers are usually faster due to optimization.

It is clear that IDE drives will rapidly replace MFM and RLL drives in IBM-AT compatible applications in the near future. These drives may also displace the larger capacity ESDI drives in the future.

Although the IDE interface is somewhat standard, some IDE drives are incompatible with some paddle boards, mostly due to different buffering or decoding. See the pinout in the Connector Pinouts section for more information on IDE drives.

SMD Interface

The Storage Module Device (SMD) interface is the most popular interface for the 8" drives used in mainframe, minicomputer, and workstation applications. Variations include an improved data transfer rate (HSMD). SMD drives are gradually being replaced by SCSI in most applications.

IPI Interface

The Intelligent Peripheral Interface (IPI) is a mainframe disk drive interface standard used mainly on 8" and 14" drives. It is popular in IBM workstation and minicomputer applications.

QIC-36 Interface

This 50-pin tape drive interface is now an industry standard thanks to companies like Wangtec and Archive that pioneered it. The pinout is listed in the Pinout Section.

QIC-02 Interface

This QIC-02 interface is a software standard for tape drives. Most PC based controllers use a QIC-02 command set.

SA-400 Interface

As with Seagate and the ST-506 Interface, the SA-400 interface is named after the originator of the first mass produced floppy disk drive. Shugart Associates manufactured the SA-400 in 1978 and the SA-400 was the first disk drive to gain wide acceptance. The interface used a simple 34-pin cable with 17 pins connected to ground for noise reduction and shielding.

This 34-pin interface was modified to create the ST-506 hard disk drive interface discussed earlier in this section. The pinout of the interface used in modern floppy disk drives is shown in the Pinout Section. Although additional functions have been added since the original SA-400 drive (mainly DISK_CHANGE, SPEED_SELECT, and DRIVE_READY), this pinout is still affectionately referred to as the SA-400 interface.

The Future

Currently the most popular disk drive interface for small capacity hard drives is ST-506 RLL. In the future, ST-506 sales will decrease and lower cost IDE drives will replace the RLL drives.

The most popular interface for high performance, large capacity drives in now ESDI. In the future, as SCSI software standards evolve, most of these ESDI drives will be replaced by SCSI.

In workstations and high-end PC applications, it seems clear that SCSI is the interface of the future. For example, all of the popular optical and DAT drives use the SCSI interface. We look forward to the time when small computer peripheral interfacing is simplified by the new SCSI standards.

Basic Drive Operation

All hard drives perform three basic functions. They spin, seek, and transfer data.

Disk drives use many types of spindle motors. The spindle motor used determines the spin-up time and heat dissipation in the drive. Some early drive designs were plagued with stiction or heat problems caused by inadequate spindle motors. Newer designs have resolved this problem by providing spindle motors with higher startup torques and lower power consumption.

All disk drives use either a stepper motor or a voice coil actuator to position the head carriage. Stepper motors are rotary actuators that rapidly move in small discrete steps (usually .8 to 4 degrees). Stepper motors provide a simple, reliable positioning system that is inexpensive to manufacture. The stepper motor shaft connects to a flexible metal band that converts the rotary shaft motion into linear motion of the head carriage. Stepper motors are ideal positioners for floppy disk drives and low cost hard drives. They are not used in high capacity hard drives because of their high mass which slows access times.

A voice coil actuator uses a permanent magnet and a voice coil similar to that used in an audio speaker to move the head carriage. In order to keep the head carriage accurately aligned with each track of data, a voice coil type drive uses a servo system.

Electronics on the drive, monitor a prerecorded servo pattern on the disk. As the heads move in and out of alignment, a microprocessor on the drive monitors this changing pattern and calculates the movement necessary to keep the heads on track. This information is fed back to the voice coil actuator which forces the head carriage back into alignment.

Voice coil actuators permit more accurate track alignment than is possible with a stepper motor actuator. Accurate track alignment is particularly important in high capacity drives with higher track densities. Voice coil servo drives also offer faster access times than stepper motor drives. These drives use a number of servo feedback systems.

The most common type is called a dedicated servo. In a dedicated servo system, one side of one disk is reserved exclusively for the servo pattern. For example, a dedicated servo drive which has four disks will have eight heads. Seven heads are used for reading and writing data, and one is used for servo information. If you see an odd number of heads listed in the drive table, or an access time under 28ms, you can be sure the drive uses a voice coil servo.

Another voice coil servo feedback technique is called an embedded servo. This scheme uses a servo wedge recorded between each sector of data on each track to position the heads. This is popular in many of the newer large capacity 3.5" drives because the mechanical alignment of one head relative to the others may change.

Read/Write systems are basically identical for all hard drives. A single magnetic head is used for both reading and writing data to the drive. When recording data to the drive, a clock signal is mixed with the data. When data is read back from the drive, the output signal is run through a data separator which separates the clock and data signals. In MFM and RLL drives, the data separator is placed on the controller card. The ESDI interface places this data separator on the drive itself. Thus, ESDI controllers operate with any speed ESDI drive (providing the maximum data rate of the controller is not exceeded).

Data is stored in concentric rings around the disk.

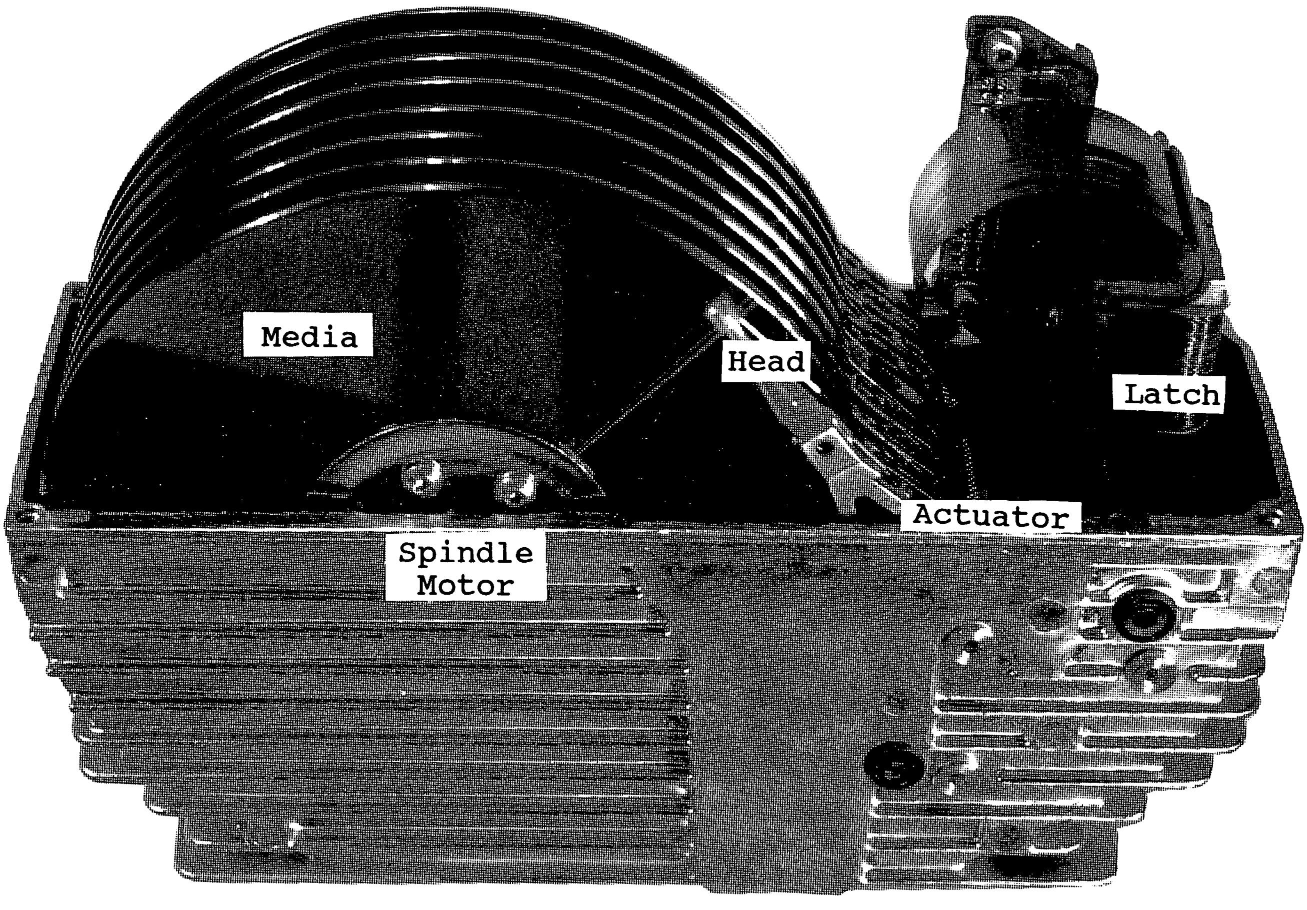


Figure 1 - Basic Drive Operation

Controller Setup & Jumpering

Controller jumpering is the first step in installing a new drive and controller. To correctly jumper the controller, you will need the controller board manual, as well as documentation on the other boards installed in the system. Settings for some controllers are provided in the Controller Information section of this manual.

You will need to jumper the controller board for one or more of the following settings:

Base I/O Address

The base I/O address of your controller can normally be left at the factory default setting unless you are installing two controller boards in the same system. If you are installing two boards, the first board must be set at the primary I/O address, and the second board can use any available I/O address. Be sure to check for conflicts with network boards, tape drive controllers, and video boards before selecting your secondary address.

Base BIOS Address

If your controller card has a ROM BIOS, you will need to select a starting address. When selecting a starting BIOS address, add the starting address of the card and the length of the required I/O space. Make sure that the address you select will not cause a ROM address conflict with any other boards (particularly VGA and network boards). If you are unsure of the length of the BIOS ROM on the controller, use DEBUG to dump the third byte of the ROM. This corresponds to the length of the BIOS in 512 byte blocks.

Note: Not all motherboard BIOS ROMs will support controller card BIOS addresses over E000H. If you experience problems, try choosing a BIOS address between A000 and DFFF.

DMA Channel

Most controller cards do not use third party DMA. Exceptions to this are some high performance SCSI and ESDI controllers. You may share a DMA channel with another device only if your software supports it. Make sure to set both DMAREQ and DMAACK jumpers identically.

Controller Interrupt

Most controller boards do not use interrupts in DOS applications, but a hardware interrupt is required for all Novell and most UNIX applications. Select any available interrupt, but be sure to define it correctly when running NETGEN.

Floppy Address

A secondary floppy address must be selected for two floppy controllers to peacefully coexist in the same system. You will not be able to use the second floppy controller without a device driver installed in your CONFIG.SYS file. If your floppy controller is compatible with the original IBM-XT architecture, you can use DOS DRIVER.SYS to control your extended floppies.

DOS DRIVER.SYS parameters are listed below. Enter all necessary parameters on the DEVICE=DRIVER.SYS line in your CONFIG.SYS file. For example, if you have one hard disk installed and wish to use a 1.44MB floppy as your third (ie. D:) drive, add the following line to your CONFIG.SYS:

DEVICE=DRIVER.SYS /T:80 /H:2 /S:18 /F:7 /C

The following switches are supported by MS DOS 5.0:

/T:X X=number of tracks
/C indicates that disk change is supported by the drive
/F:X X=drive form factor code:
0=360K 2=720K
1=1.2MB 7=1.44MB
/H:X X=number of heads
/S:X X=number of sectors per track

More detailed information on CONFIG.SYS can be found in your DOS manual.

A Tip for C & T and OPTI Motherboards

If you are using a motherboard based on the Chips & Technology 3 or 5 chip LSI chipset, or the newer OPTI chipset congratulations! The speed of your RAM and I/O channel can be altered to increase overall system performance by "fine tuning" your motherboard. You can select I/O clock speed and wait states by running the extended setup program that came with your motherboard and using the information in Table A. Be careful when setting I/O channel wait states on these motherboards. It is easy to outrun many controller boards by selecting SYSCLOCK/2 without wait states.

Once your controller is jumpered correctly, proceed to CMOS setup and then a low-level format. See the following section that corresponds to your drive type for setup and low-level formatting instructions.

Table A - Recommended C & T and OPTI Wait States

SYSCLOCK / N	I/O Channel Read/Write Wait States	16-Bit Bus Wait States
Over 8MHz	1 wait state	2 wait states
8 MHz or less	0 wait states	1 to 2 wait states

Note: SYSCLOCK is the CPU clock frequency of your motherboard. Use extended setup to choose between $\frac{\text{SYSCLOCK}}{2}$, $\frac{\text{SYSCLOCK}}{3}$, or $\frac{\text{SYSCLOCK}}{4}$ to adjust your bus clock frequency.

For example, a system clock of 25MHz and an extended setting of $\frac{\text{SYSCLOCK}}{3}$ will provide a bus clock speed of $\frac{25}{3}$ or 8.33 MHz.

Most Floppy Controllers will work at bus speeds up to about 10MHz. Many Hard Drive Controllers may not operate reliably much over 8 MHz.

Your C&T or OPTI motherboard extended setup may also permit disabling the ISA bus REFRESH line. REFRESH is a signal necessary for proper operation if your system contains any expansion cards that use dynamic memory. Cards which require this signal include:EMS cards, laser printer direct video boards, caching controller cards, and several other peripherals. Disabling this line will improve bus throughput by between 2% and 5%. Go ahead and disable it if you need this small performance increase, but be sure to remember it if you have compatibility problems in the future.

Drive Setup and Jumpering

DS0 or DS1 Confusion

Drive select jumpers are often a source of confusion and frustration. It seems that some manufacturers label their four drive-select jumpers DS0, DS1, DS2, and DS3. Others label them DS1, DS2, DS3, and DS4.

If you are installing a single MFM or RLL drive in your system, choose DS0 if your jumpers start with DS0 or choose DS1 if your jumpers start with DS1. These are actually the same jumpers, just numbered differently by the drive manufacturer. What you need in a single drive MFM/RLL installation is the first available drive-select jumper.

If you are installing a second MFM or RLL drive in your system with a twisted cable, choose DS1 if your jumpers start with DS0 or choose DS2 if your jumpers start with DS1. What you really want in this case is the second drive select jumper.

SCSI drive jumpering is an altogether different story. SCSI drives usually use three jumpers for addressing. The eight possible on/off configurations of these jumpers represent eight SCSI addresses. Normally these jumpers follow a straight-forward binary sequence with the lowest numbered jumper being the LSB. Check your drive manual to be sure before jumpering your SCSI drive.

Table B - MFM and RLL Drive Jumpering

If your drives have:	And you are installing:	
	1 Drive with a flat cable	2 drives with a twisted cable
Select pins numbered DS0 to DS3	Set C: to DS0	Set C: to DS1 Set D: to DS1
Select pins numbered DS1 to DS4	Set C: to DS1	Set C: to DS2 Set D: to DS2

Always connect drive C: to the last connector (after the twist). Connect D: to the middle connector (before the twist).

IDE Drive Jumpering

Most IDE drives have one or more of the following jumpers:
HOST SLV/ACT, C/D, DSP, and ACT.

HSP, when jumpered, grounds the HOST/SLAVE/ACTIVE signal on the IDE interface. This signals to the system that a slave drive is present in a two drive system.

C/D is also sometimes labeled DS and is the drive select jumper. This jumper is set on the master (i.e. C:) drive and removed on the slave (i.e. D:) drive.

DSP should only be jumpered on the first drive (ie. C:) if two IDE drives are installed in the same system. This jumper tells the master (i.e. C:) drive that there is another drive present on the IDE cable.

The ACT jumper connects the -ACTIVE signal to the -HOST SLV/ACT signal on the interface. This signal is often used to drive an external LED which indicates drive activity.

Drive Cabling

Twisted Cables

Why do many drive installations use twisted cables? Simply because IBM used them in the first PC's. In an effort to simplify installation, IBM decided to jumper all of their hard and floppy drives on the second drive select. This eliminated the need for technicians to jumper the drives. The first floppy drive (A:) was connected to the end of the cable (after the twist). The second floppy drive (B:) was connected before the twist. The twist in the cable simply flipped the first and second drive select lines so that all drives could be jumpered identically.

The floppy and hard drive cables in a standard AT look suspiciously similar. Be careful not to interchange them. A significant number of installation problems are a result of interchanged hard and floppy cables. Each cable has a different twist, and they are often not marked. If you are using twisted cables, make sure the floppy drive cable has seven conductors twisted. A twisted cable used with MFM or RLL hard drives must have only five conductors in the twist.

Single Drives (MFM, RLL or ESDI)

Cabling a single drive MFM, RLL, or ESDI system is easy. Use standard 20-pin flat data cable and a 34-pin control cable with no twist. A word of caution: watch out for pin one. Pin one is identified by a red stripe on one side of the cable. This side of the cable must be connected closest to pin one of both the drive and controller. Check the controller card for a small number 1 or a square dot on the silk screen near one edge of the connector. Pin 1 on the drive is nearest a notch in the edge connector. Reversing the data cable can cause damage to the drive, controller, or both. The differential line drivers on the drive and controller are easily damaged by reversed cables. If you are not sure which is pin 1, check the manual, don't try to guess!

Multi Drive MFM and RLL Cabling

Three cables are required when installing two MFM or RLL drives using one controller. Two flat 20-pin data cables and one twisted 34-pin cable will be necessary. The 34-pin control cable should have only the drive select and ground pins twisted (5 conductors twisted). Set both drives to the second drive select position (This position is marked DS1 or DS2 as described earlier in this section). Terminate the control cable on the last drive only.

Multi Drive ESDI Cabling

Three cables are required when installing two ESDI drives using one controller. Two flat 20-pin data cables and one flat 34-pin cable with two drive connectors are necessary. Set the first ESDI drive jumpers to drive select 0. Set the second drive to drive select 1. Terminate the control cable on the last drive only.

Although most ESDI controllers support only two drives, the ESDI interface provides the ability to daisy-chain up to 8 drives. If you are installing more than two ESDI drives, use a flat 34-pin cable and set the select jumpers sequentially. A separate 20-pin data cable is required for each drive.

IDE Drive Cabling

IDE (Imbedded Drive Electronics) interface disk drives use a 40-pin interface cable. This cable connects the drive logic (with imbedded controller) to a bus adapter card. This adapter is usually called a "paddle board". The paddle board buffers (amplifies) the signals from the drive and provides enough power to drive the PC bus.

Cabling an IDE drive is simple. Connect a 40-pin flat cable from the drive to the controller, being careful to observe pin 1 orientation. If the drive supports it, a second IDE drive can usually be connected to the same cable. To do so, jumper the boot drive in "master" mode, and jumper the second drive as a "slave". Since the IDE interface transfers data and control signals at full bus speed, IDE cable lengths are critical. As a rule of thumb, try to avoid using a cable longer than 18" in any IDE drive installation.

SCSI Drive Cabling

Internal SCSI drives are connected to the controller with a 50-pin ribbon cable. Be extremely careful to observe the pin 1 location when connecting cables to SCSI drives. Reversing SCSI cables on drives often causes a loss of termination power which can result in marginal data transfer or no transfer at all. Some external SCSI drives are connected to the controller with a 25-pin D-type connector, others use a 50-pin Amphenol connector.

The SCSI bus must have a total of 2 terminators - no more and no less. If you are using the controller with one internal hard disk, for example, termination will be installed on the internal hard drive and on the controller card. If you are installing one internal and one external drive, the terminators must be removed from the controller card and installed on the internal and external drives. Check the manual included with your SCSI drives and controllers for terminator installation and removal.

Low-Level Formatting

Unlike floppy disks which are low-level formatted at the same time as they are high-level formatted, a hard disk must be low-level formatted separately because of the various types and styles of controller cards, the encoding format and the interleave that can be used with a hard drive.

If you decide to use a different controller card, or to use a different interleave on the hard disk, it will have to be low-level formatted again. Once the low-level format is completed properly, it will not have to be done again unless the controller card is replaced, the interleave is changed, or there is a hard disk failure. Low-level formatting destroys all the data written on the hard disk. Be sure to back-up all data before a hard disk is low-level or high-level formatted.

What is DEBUG?

DEBUG is a program provided on the DOS disks (DEBUG.COM) that is primarily used by programmers, service technicians or computer hackers. The operation of DEBUG is described in detail in the DOS manual. In order to use DEBUG for low-level formatting, only two commands are generally necessary, the G (GO) command, and the Q (QUIT) command. In the following paragraphs, commands such as G=C800:5 will be used to start the ROM based low-level formatting program stored on the hard drive controller.

To start the program, insert a disk containing the DEBUG.COM program into the floppy drive and type DEBUG at the DOS prompt. When the DEBUG prompt (-) is displayed type G= followed by the starting address of the ROM based program (G=C800:5) for example. This means go to ROM address C800:5 and run the program contained in the ROM. After the program is finished, it will usually return you to the DOS prompt (>). If the program returns you to the DEBUG prompt (-) type Q to quit DEBUG and return to the DOS prompt.

What is CSCFMT?

CSCFMT is a low-level format utility supplied on the enclosed diskette. CSCFMT works with all MFM and most RLL, ESDI, and IDE drives. Low level formatting is the only way of changing the interleave of a hard drive. CSCFMT is useful if you are installing a hard drive for the first time, or if you need to change the interleave of an installed drive to optimize its performance. For most common DOS installations, CSCFMT is the only program you'll need in addition to DOS FDISK and FORMAT.

> **Warning:** As with any low-level format, CSCFMT will destroy all existing data. Don't use CSCFMT unless you have a verified backup of all data.

To low-level format, just type CSCFMT at the DOS prompt. CSCFMT will ask for the interleave you wish to use. Check the interleave information on page 25 for the optimum value for your system configuration.

Choosing a Drive Type

Many of the older AT's only provided 14 (MFM only) or so drive types to choose from in the CMOS. The middle-aged AT's usually have up to 46 (still usually only MFM) types. Some newer AT's have up to 60 or more which begin to include direct support for the popular RLL and ESDI drives. If you have this newer kind of BIOS then by all means pick the one that matches the drive and DISABLE the controller BIOS. (Note: This may also disable the controller's caching feature). Likewise, most new machines have a "User Definable" or "Custom" drive type that can be created and saved in the CMOS, thus providing a standard drive type. "User Definable" drive types will not work with all non-MS/PC-DOS applications.

MFM Drive Types

If the internal drive type table lists the exact geometry, great. If not, then check to see if a "Custom" or "User Definable" CMOS option is available. Otherwise, a drive type match that is close but not exceeding either the cylinder or head values is the only choice left. An exact match in the head count is definitely preferred when getting a "close" match. When there is no direct match in the internal drive type tables, a partitioning program may be needed to provide a software driven translation solution in order to achieve full capacity. Keep in mind that the drive will only format out to the capacity of the chosen drive type when not using third-party driver software. Also, some AT 16-bit MFM controllers provide an onboard BIOS which will allow the unique geometry of the drive to be dynamically configured.

RLL and ESDI Drive Types

RLL and ESDI drives are usually not represented at all in the internal drive tables and consequently the controllers for these drives have onboard a ROM BIOS which either contains its own internal list of choices for the interface or else provides the ability to dynamically configure (define) the controller to the specific geometry of the drive. In the case of the ESDI interface, the controller gets parameters directly from the drive with the equivalent of a SCSI "Mode Sense" command. Most RLL and ESDI controllers require that CMOS be set to "Type 1". This setting is then overwritten by the controller BIOS after power-up.

A special note on ESDI and other drives that have more than 1024 cylinders. Since DOS cannot access cylinders above this limit, a translation scheme may be elected in the controller's BIOS. As the total number of Logical Blocks Available (LBA's) is defined as CYLINDERS*HEADS*SECTORS PER TRACK, translations that equal the same number of logical blocks with the cylinder count below the 1024 limit will be devised. The controller BIOS will need to be ENABLED in order to utilize translation schemes.

IDE Drive Types

This idea of translation schemes bring us to the AT or IDE (Imbedded Drive Electronics) interface. These drives are intelligent in that they will "mimic" other drive geometries that equal or are very close to the same number of logical blocks. If a "custom" drive type option is not available for an AT drive, simply pick one from the list of available choices that has the same number of megabytes. Note: Translate LBA's are always less than or equal to Native LBA's. (Warning! All IDE drives are already low-level formatted at the factory.) Low-level formatting an IDE drive may erase the factory recorded defect tables.

SCSI Drive Types

Almost all SCSI drives use DRIVE TYPE 0 or NONE, as the host adapter BIOS and the drive communicate together to establish the drive geometry. The SCSI controller "Rings" the SCSI bus shortly after power-up and installs BIOS support for any attached SCSI devices.

Formatting MFM Drives

The first step in a low-level format of an MFM drive is correct CMOS setup. Check the drive geometry list for the heads and cylinders configuration of your drive. Then check your motherboard manual (or ROM based setup program) for a CMOS drive type that matches your drive geometry. If you find an exact match, set the CMOS to that drive type number and skip the next paragraph.

Table Overrides

If your drive geometry does not match a CMOS drive type, you will need to perform a CMOS type table override. Use Speedstor or Disk Manager software to do this. These programs add a software device driver to the drive that overrides the CMOS drive type settings on power-up, enabling you to use a drive not listed in your setup program.

Check the Tune-Up section for the correct default interleave for your system, then low-level format the drive. If you have a late AMI BIOS, you may have low-level formatting routines built in ROM. If not, use either the setup disk that came with your computer, CSCFMT, IBM Diagnostics, Speedstor, or Disk Manager to low level format.

Once the drive is low-level formatted, proceed to the partitioning and high level formatting instructions in the following sections.

Formatting RLL Drives

Most 16-bit and all of the 8-bit RLL controllers we have found have low level formatting routines in ROM firmware on the board. The default address segment for XT controller boards is C800 hex. To find the starting address, enter DEBUG and type

U C800:3. The jump instruction is usually found at C800:5 or C800:6. The first two bytes of the ROM are a 55 and AA hex which identify the BIOS ROM. The third byte represents the length of the BIOS ROM in 512 byte blocks.

To format the drive, first select the correct CMOS setup. Consult the manual that came with your RLL controller for the correct setup value.

After setting CMOS, proceed to the low level format. If you have a ROM based low level formatting routine available, use it. Otherwise, use CSCFMT, Speedstor, or Disk Manager. Be sure to use the /SECS:26 option if you are using Speedstor.

When formatting lower capacity (i.e. 30MB) RLL drives, be sure to enter the write precompensation cylinder correctly. Write precomp is important to these drives, since RLL encoding leaves less margin for error. Write precomp is handled automatically on almost all newer drives.

Once the drive is low-level formatted, proceed to the partitioning and high-level formatting procedures described in the following sections.

Formatting ESDI Drives

All of the PC-bus ESDI controllers we have come across have low-level formatting routines in ROM firmware. The formatting procedures for these drives vary from controller to controller, so the best advice we can give you here is follow the instructions that came with the card.

In addition to the interleave, you may be asked if you want to use sector sparing when you format. Sector sparing reduces the number of available sectors per track from 36 to 35 or from 54 to 53. This will reduce the available formatted capacity of your drive. Choose sector sparing only if your drive has a large defect map. Sector sparing will allow the controller to remap defective sectors to the spare sector on each track. This means that your application will "see" less defects. Sparing will reduce the capacity of your drive by 1/36th. If your drive has a small error map, sector sparing won't gain you much. If you are running an application that requires a "Defect Free" drive, enable sector sparing to "Hide" the drive's defects.

Many ESDI controllers may also ask you for head and track sector skewing values. These values offset the position of sectors relative to the index so that as the drive steps from track to track and changes from head to head, the next sequential sector is immediately available. To calculate the optimum track skewing value, divide the track-to-track seek time of your drive by 16.6ms. Then multiply this number by the number of sectors per track (rounding up). This will give you the optimum track skewing value. Select 0 when asked for head skew.

You may notice that your large capacity ESDI drive contains a large number of factory defects. Not to worry. These defects are mapped by a factory analog tester that is extremely sensitive compared to your controller. Most of these defects could never be detected using your controller. They are usually just small analog spikes or dropouts that are corrected by the ECC on your controller. The factory maps these defects because they are the most likely areas to cause problems as the drive wears over time.

Once your ESDI drive is low-level formatted, proceed to the partitioning and high-level formatting procedures in the following sections.

Formatting SCSI Drives

Most SCSI controllers require that the CMOS setup on 286, 386, and 486 machines be set for "no drive installed". On power up, the SCSI BIOS on the adapter card scans the SCSI bus to detect attached devices. Once detected, these devices are added to the list of available drives. Most SCSI controllers support up to seven SCSI devices. More than two drives usually require third party device driver for use with DOS.

Almost every SCSI controller includes a low-level format program that is specific to that particular board. The low level format routines in programs like Speedstor and Disk Manager don't usually work with SCSI drives, so you'll most likely need to use the low-level format program that came with the card.

Once the low-level format is completed, FDISK, Speedstor, or Disk Manager can be used for partitioning and high-level formatting.

NOTE: Many SCSI drives including some made by Quantum will return almost immediately from a SCSI low level FORMAT command. These drives report that they have successfully completed a low level format but don't actually format the disk. There is now way of erasing these disks with a SCSI FORMAT command. In this case, data written to the disk is not erased until it is overwritten with a SCSI WRITE command.

Formatting IDE Drives

Most IDE drives operate in two modes, "native" and "translation". To use an IDE drive in native mode, set CMOS to the actual number of heads and cylinders on the drive, then proceed to partitioning and high-level format.

If the IDE drive you are using has physical characteristics (ie. heads, cylinders, and sectors/track) which are not listed in your ROM BIOS, and you do not have a BIOS which offers a user defined drive type, you will need to use translation mode. Translation mode remaps the drive's physical characteristics into characteristics that match a common drive type. For example, most 40MB IDE drives offer a translation mode that matches the physical characteristics of the popular Seagate 251. Since this type is included in almost all ROM BIOS drive type tables, compatibility is improved.

Some IDE drives automatically enable translation mode based on CMOS settings; others require a jumper. Like SCSI drives, all IDE drives are low-level formatted at the factory. Unless you need to change interleaves, we don't recommend reformatting your

IDE drive. The imbedded factory defect maps may be accidentally erased by low level formatting.

Once CMOS and translation mode is set correctly, FDISK, Speedstor, or Disk Manager may be used for partitioning and high-level formatting.

DOS Partitioning

DOS partitioning and high-level formatting can be tricky. This may be done using DOS FORMAT and FDISK or using a third party program such as Speedstor or Disk Manager. Although these menu driven programs are convenient, DOS is usually all you need. It is important to understand the following DOS partition constraints before beginning.

Old DOS Limitations

Versions of MS DOS and PC DOS before 3.30 have a 32MB storage limitation. There is no way to access over 32MB per physical drive without a device driver, if you are using an old version of DOS. If you are stuck with DOS 3.2 or earlier, you will need SpeedStor or Disk Manager to fully utilize a drive larger than 32MB. The best solution is to upgrade to 3.30 or later version.

The 32MB Barrier

Versions of MS DOS and PC DOS after 3.30 but before 4.0 have a 32MB per partition barrier. Using these DOS versions, you cannot access more than 32MB per logical partition without using a third-party device driver. Both Speedstor and Disk Manager provide a device driver which can be installed in your CONFIG.SYS to bypass this limitation. We recommend use of DOS 4.01 or later if you desire more than 32MB per partition.

The 1024 Cylinder Barrier

All versions of DOS have a 1024 cylinder limitation. This is becoming more and more of a problem as larger capacity drives are introduced with more cylinders. To access more than 1024 cylinders, you will need a device driver or a controller card that offers a "translate mode". Some ESDI and most SCSI controllers (like the CSC FastCache32) offer translation mode.

Controllers which feature a translation mode will logically remap a drive's physical parameters so that the system "sees" less cylinders and more heads or sectors per track. For example, and ESDI drive with 1224 cylinders, 15 heads, and 36 sectors per track might be mapped into a configuration of 612 cylinders, 30 heads, and 36 sectors per track. The physical configuration of the drive will remain the same, but the controller card will remap the drive so that DOS will recognize the entire disk.

Translation mode is usually enabled during the low-level format procedure. If your controller does not support translation mode, the only way to bypass the 1024 cylinder limitation is with a device driver.

Once you have decided how you want to partition the drive, use either Speedstor, Disk Manager, or FDISK to do the work for you. Divide the disk into as many partitions as you desire. After you have set the partitions, you will have to reboot the system before any partition changes are recognized. Be sure to mark the partition you want to boot from as the ACTIVE partition. Then proceed to the high-level format procedure described in this section.

Partition Compatiblity

All versions of DOS 5.0 and later have the ability to access partitions created under older versions of DOS. Most, but not all, older versions of DOS will access partitions created under newer DOS versions. For example, a system booted under DOS 3.3 will recognize a hard drive partition created under DOS 3.2, but not an extended partition created under DOS 4.0. If you're partitioning a drive with a later versions of DOS and using partitions larger than 32MB in size, be aware that you are limiting your compatibility with earlier versions of DOS. If you plan to reformat a drive originally formatted with a late version of DOS, you must use the later version of DOS FDISK to erase the existing partition.

DOS Format

DOS format (or high-level format) is simple. Use the DOS format program with the /S option or use FORMAT and SYS C: to initialize your bootable partition. If you are using a device driver, install it next and reboot the system before formatting any remaining partitions.

You may also use Speedstor or Disk Manager for high-level formatting. Be sure to copy COMMAND.COM and invoke SYS C: to copy the DOS system to the active partition after using these programs.

Congratulations! You are now ready to run! Proceed to the tune-up section for tips on optimizing your software setup.

Novell Compsurf

Novell's COMPSURF program is a tricky beast. It is one of the most rigorous and intensive test programs available. It's also a necessary prerequisite to installing Novell Netware on a hard drive. Compsurf was first written in 1984 when large capacity drives were not as reliable as they are today. It uses and intensive random and sequential read/write test to certify the drive. Compsurf takes around one hour per 20MB of disk space to run. After testing, Compsurf partitions the drive for use with Novell, and writes a defect table to the drive.

Before running COMPSURF, make sure you have all the necessary software drivers. ELS level I or level II Netware is designed to support MFM drives only. ELS Compsurf will only work with MFM, RLL, or ESDI controllers that bear a close resemblance to the original IBM-AT MFM controller. If you are running Advanced 286, SFT 286, or Netware 386, you have more options. Drivers for SCSI, ESDI, and SMD controllers are available for these versions of Netware. To use a Netware driver, you must follow the Netware installation instructions to the letter, and link the device driver with Compsurf. This will create a custom formatting and testing program that will operate with your controller.

If you are running a SCSI drive with Compsurf, be sure to answer NO when Compsurf asks if you wish to format the drive. Use the low-level formatting program provided with the controller card instead. Compsurf can't format SCSI drives because the SCSI interface only supports a "format drive" command, and not a "format track" like ST506-MFM or RLL drives.

NOTE: When running Compsurf on SCSI drives, be sure to low-level format the drive first, then answer NO to the following prompts:

FORMAT THE DRIVE? **NO** (ENTER)
MAINTAIN DEFECT LIST? **NO** (ENTER)

Many newer controllers offer a "watered down" version of Compsurf in ROM BIOS. We have yet to find a controller card BIOS that tests as well as the real Compsurf. Our feelings are that the reliability demands of most network users justify the time it takes to run the real Compsurf.

To save time and effort, it's a good idea to ask your drive dealer if he can Compsurf your drive for you. If he's reputable and confident in his product, this service should be available at no extra charge.

Choosing a Hard Drive and Controller

With so many different drives and controllers on the market, where do you start? Begin with your software requirements. Narrow down your choices by eliminating drive interfaces or controllers which are not compatible with your software application. For example, a SCSI drive and controller may not work with your network software, or Xenix drivers may not be available for the RLL controller you are considering. In general, MFM, IDE, and ESDI controllers are the most compatible.

Consider expandability and upgradability. SCSI controllers offer the most flexibility and expandability in the long run. With a SCSI controller, you can daisy-chain up to 7 devices, including SCSI hard drives, CD ROMS, WORM drives, and SCSI tape drives from the same controller. If you are considering an ESDI controller, make sure that it supports 15-20Mbit/sec drives that you may upgrade to in the future.

Next, investigate hardware compatibility. Make sure that the controller board you have in mind is compatible with your motherboard. If you have an older 386 board that might not correctly support 16-bit memory transfers, ESDI cards generally offer better hardware compatibility than SCSI.

Of course, watch your budget. (Although it is generally more expensive to buy a disk system that will last you for a few years than it is to upgrade down the road, everyone has a budget). If you are upgrading an existing MFM system, it may be cheaper to add an additional MFM drive and use your existing MFM controller. If you are interested in a small capacity drive and controller, and RLL drive and controller kit, or a small IDE drive will offer the most for the money.

Be sure not to underestimate your speed and storage requirements. For Network server applications, go with the fastest voice coil drive you can afford. For word processing or light database applications, you can probably get away with a stepper motor drive. In portable PC applications, insist on a voice coil drive with an automatic park and lock mechanism.

In summary, for most low capacity applications, we recommend a small RLL drive with a fast 1:1 interleave controller or an IDE drive with an imbedded controller. For maximum software compatibility and speed in a medium size drive, ESDI is the best interface. If you are interested in high speed with upward compatibility and the ability to daisy-chain additional peripherals, go with a SCSI drive and controller.

Fine Tuning

This section contains a few hints on how to get the most out of your hard disk subsystem. There are several ways of measuring disk performance. In the PC world, the most common utility program for comparing hard disks is CORETEST from Core International. Running CORETEST on your drive yields a performance rating based on the average seek time and data transfer rate of the drive.

If you do not specify any command line options when running CORETEST, the program defaults to a block size of 64KB. The performance rating you get based on a 64K block size is only part of the picture. Many common operating systems (including DOS) often transfer data in blocks smaller than 64KB. To get an idea of how your system performs with these smaller block sizes, use the command CORETEST/B:xx where xx is the size of the block you would like to test. Making a graph of the performance ratings you get for different block sizes gives a more complete picture.

CSCTEST

Due to the limitations in programs like CoreTest, CSC decided to release its own performance test program. This program, called CSCTEST is supplied on the enclosed diskette. Since this program is larger than will fit on the disk in uncompressed format, it is supplied in a self extracting compressed archive format. To uncompress it, first change to the directory on your hard drive where you would like to install the test program. Once you are in that directory, type A:CSCTEST, and the program will automatically unpack and transfer itself to your hard disk. To view the results, you will need an EGA, VGA, or Hercules compatible monitor.

CSCTEST gives a more realistic evaluation of system performance by accurately evaluating the number of seeks per second and 512 byte blocks transferred per second. These ratings are combined to give an overall performance rating. This rating can then be compared with the rankings of other popular systems.

There are several ways of increasing your system performance by optimizing software setups and not changing hardware.

The two most important steps to a tuneup are optimizing interleave and defragmenting files. The optimum interleave for your hard disk system is a function of both the hardware and software in your system. Contrary to popular opinion, 1:1 is not the optimum interleave for ALL applications. If the controller you are using does not feature a full track read-ahead cache (most MFM, RLL, and imbedded controllers don't), selecting the optimum interleave will make a significant difference in data transfer rate.

Corporate Systems Center (408) 737-7312

After extensive testing, we have come up with the following rules-of-thumb regarding interleaves for MFM and RLL controllers:

Use 4:1 Interleave With:

All 4.77MHz XT class machines.

Use 3:1 Interleave With:

All XT class machines with DOS applications
All 6MHz and 8MHz AT class machines running DOS.

Use 2:1 Interleave With:

All 10MHz to 16MHz 286/386 Machines running DOS.

Use 1:1 Interleave With:

All 10MHz or faster 286/386 machines running Netware
All 20MHz or faster 286/386 machines running DOS
All 486 machines.

It's interesting to note that a 16MHz 386 machine running DOS often operates faster with a 2:1 interleave controller than a 1:1. This is because many DOS applications can't operate fast enough to take advantage of the 1:1 interleave. By the time the DOS application requests the next sequential sector of disk data, the 1:1 formatted disk has already spun past that sector, and DOS must wait for the disk to spin another revolution. Fortunately, if you are building up a new system with a clock speed of 20MHz or faster, the choice is clear. Most modern clone boards with 8MHz I/O channels and fast CPU's work best with 1:1 interleave. If you are tuning up an older system with a clock speed of 16MHz or less, 2:1 interleave may be the optimum choice.

There is really only one way of exactly determining the actual optimum interleave for your system. Test it. Popular programs like OPTUNE or SPINRITE let you determine the optimum interleave based on hardware considerations only. Unfortunately, these programs do not take into account the software overhead that DOS and other operating systems create. Format the drive with an interleave value one sector larger than suggested by SPINRITE or OPTUNE. Then load your applications and make your own performance tests. Record the results and then reformat with the interleave recommended by the test program. If performance increases, you have chosen the optimum interleave. If not, the software overhead of your applications is causing the system to operate better at the higher interleave.

Defragmenting files is the next step in increasing system performance. As a disk is used over time, files become fragmented. The simplest way to defragment files is with a program like Central Point Software's COMPRESS. Alternately, the files can be copied to another drive and then restored. Defragmenting files will significantly increase your system performance.

Buffers and FASTOPEN

Appropriate use of the DOS BUFFERS and FASTOPEN commands will also improve system throughput.

The DOS buffers command allocates a fixed amount of memory which DOS uses to cache data while reading and writing. As many buffers as possible should be installed in your CONFIG.SYS file. Each buffer will take a total of 548 bytes of memory (512 bytes for data and 36 for pointers). If you have extended memory available, use the /X option to store buffers in extended RAM and keep your base 640k free and clear. If you are using a caching controller, set the DOS buffers command as low as possible for best performance.

The DOS FASTOPEN program tracks the locations of files on a disk for fast access. Access to files in a complex directory structure can be time consuming. If you run applications that use several files (such as dBASE, Paradox, or other database programs), FASTOPEN records the name and physical location on the drive. When the file is reopened, access time is significantly reduced. If you are using disk intensive programs without FASTOPEN, your disk performance is suffering.

One of the nicest features of FASTOPEN is its ability to use extended memory. For example adding the line FASTOPEN C:100,10/X to your AUTOEXEC.BAT file would automatically make FASTOPEN load using extended memory to track up to 100 files with a 10 entry extent cache. Unfortunately, once FASTOPEN is loaded, its setup cannot be changed. To change FASTOPEN settings, reboot the computer.

Cache Programs

Caching programs such as DOS SMARTDRV.SYS dramatically improve disk system performance. Another benefit of using a good caching program is extended drive life. Drive life is based not only on the number of power on hours (POH), but also on the number of seek operations. Adding even a small RAM cache will prolong drive life significantly by reducing the number of seeks necessary.

If you are using DOS 4.0 or later, we recommend you try the SMARTDRV.SYS program included with DOS. It offers good performance, particularly with expanded memory. You can improve drive performance dramatically without buying extra software by adding SMARTDRV to your CONFIG.SYS file.

For a few dollars more, many excellent third-party caching programs are available which offer improved performance over SMARTDRV. Two of the best cache programs we have found are PC-Cache from Central Point Software and Speed Cache from Storage Dimensions. Both of these programs enable disk caching using extended or expanded system memory. PC-Cache has an adjustable read-ahead feature which improves sequential access on large files.

If you are running Unix, Database programs, or other extremely disk intensive programs, the ultimate solution (if you can afford it) is a caching controller card. A caching controller can provide reduced data access times, improved throughputs, and improve your hard drive's life span. For DOS and Microsoft Windows users, a caching controller frees Extended and EMS memory for applications. Due to the large number of requests for an inexpensive, high performance caching SCSI controller, CSC has designed the FastCache 32. A number of other caching controllers are available, and if disk I/O is a bottleneck, they are all worth considering.

To sum up the fine tuning of your hard drive, perform the following five steps for better disk performance:

1. Find the optimum interleave (Reformat if necessary)
2. Compress and defragment
3. Set buffers correctly
4. Install FASTOPEN
5. Use SMARTDRV or another cache program if you do not have a caching controller.

Hardware Compatibility Problems

Unfortunately, not all controller cards are compatible with all computers and not all disk drives work with all controller cards.

Some of the major hardware compatibility problems we have come across are listed below.

SCSI Arbitration on Bus Scan

On power-up, a SCSI controller communicates with the attached devices to determine if the device is operating in synchronous or asynchronous mode. Many SCSI controllers do not perform this arbitration process correctly. This failure usually causes the system to hang. The solution is an upgraded controller BIOS or a new controller.

SCSI Command Set

SCSI command set problems occur because SCSI commands differ among device manufacturers. These problems can usually be resolved with a firmware upgrade on the SCSI device or controller. Be sure to check for command set compatibility before purchasing any SCSI devices.

I/O Channel Ready Timing

Slow devices connected to the AT bus must assert a signal called I/O CHANNEL READY to force the motherboard to wait for data. Many faster motherboards do not conform to the original IBM AT bus timing specs. Because they don't, a controller card requesting a wait state delay using this line may not operate correctly. If you have a Chips & Technology based motherboard, this can be corrected by adding a bus wait state using extended setup. Otherwise the only solution is a new controller card.

16-Bit Memory Transfers

This problem often occurs in older motherboards that use discrete chip sets. On the AT bus, a signal called MEM16 must be asserted by the bus devices in order to initiate a 16-bit data transfer. This signal must be available almost immediately, or the system may default to 8-bit transfer. Many of the cheaper clone motherboards do not provide valid address signals in time to decode this signal. If the address signals are not presented in time, it is impossible to perform a 16-bit transfer. This causes problems with many 16-bit cards that use memory mapped I/O, such as the WD7000 and DTC3280 SCSI controllers. Older DTK motherboards are notorious in this regard. The solution is to switch to an 8-bit card and suffer a slight loss of performance. If this is not acceptable, the only solution is upgrading to a higher quality motherboard.

ESDI Defect Tables

Many older style controller cards have problems reading the defect tables from some ESDI drives. This is due to the way the defect table is recorded on the drive. The solution is upgrading to a newer style card or rewriting the defect table using a factory analog type drive tester.

Common Installation Problems

Handle Hard Drives Like Eggs

Hard drives are extremely fragile. Dropping, bumping, or jarring a hard drive can cause permanent damage. Always use a manufacturer approved shipping carton if you need to transport the drive outside of the system. Rough handling accounts for more drive failures than all other factors combined.

Reversed Cables!

Reversed cables account for a large number of hard drive electronic failures. The balanced line drivers on either the controller, drive, or both can easily be damaged if the 20-pin data cable is reversed. Refer to the Drive Cabling section on page 13 to ensure the proper twisted cable is used when installing multiple MFM or RLL drives.

Reversing a SCSI cable will cause the terminator power line to be grounded. This usually blows a fuse or fusable link on either the drive or controller. Without terminator power, SCSI data transfer will be unreliable. Make certain all cables are oriented correctly before applying power.

Shadow RAM Problems

Shadow RAM problems are not really a hardware problem, just a common setup error. Cards that use memory mapped I/O (i.e., most popular SCSI controllers) can't be shadowed. Use your extended setup to shut off shadow RAM in the controller's address space.

CMOS Setup

Most ESDI drives use an IBM standard type 1 CMOS setup. This corresponds to a standard 10MB drive. Upon power-up, the BIOS on the ESDI card overrides this drive type. Most SCSI controllers operate with CMOS set to 0 (no drive installed). Double check your controller manual for the correct CMOS setup value. Programs that use drive table overrides for MFM and RLL drives normally use the closest match in the ROM type table with an identical number of heads.

Hardware Conflicts

Hardware conflicts can occur if the controller card used conflicts with the interrupt, DMA, I/O address or ROM address of other cards in the system. These conflicts are often difficult to debug. To be sure, check the manuals for ALL of the other boards installed in the system before jumpering the controller card.

Defect Locking

It's important to enter and lock the defect table on all MFM, RLL, and IDE drives. If these defects are not entered, long term reliability will suffer.

Extended Setup

Be sure to set the following extended setup parameters per your controller card manufacturer's recommendation:

BUS CLOCK SPEED	-	Usually 8 MHz.
16-BIT BUS WAIT STATES	-	Usually 1 or 2 wait states.
AT CLOCK STRETCH	-	Usually enabled.

Improper extended setup settings may cause erratic controller operation.

SCSI Parity Jumpers

Most SCSI drives are shipped from the factory with parity enabled. PC applications generally require that parity be disabled by moving a jumper.

SCSI ID and Termination

95% or the problems we have seen with SCSI installations are due to improper ID settings and termination errors. Please read the section on SCSI cabling instructions on page 14 and the termination and ID warnings on page 32 before installing your SCSI peripherals.

Troubleshooting

Introduction

The following information is for general reference. It is not intended to be a complete reference to computer or hard disk drive service information. If you need assistance or further information, please contact your dealer.

Installation Troubleshooting

CAUTION: *BE CERTAIN THAT ANY DRIVE CONTAINING DATA IS FULLY BACKED UP BEFORE YOU BEGIN TROUBLESHOOTING. THESE PROCEDURES MAY RESULT IN LOSS OF DATA. Do not touch any board components or connectors without observing static-discharge precautions. Use a grounded wrist strap or ground yourself frequently by touching the metal chassis of your system before handling any components. Before removing the system cover to perform troubleshooting procedures, turn off the system and disconnect the power from the computer.*

The following procedures may require opening your system and removing or installing components. If you are not comfortable doing these things, you may want to consult a qualified PC technician.

ST412/506 Interface Drives

If your drive is installed and formatted properly and it still does not work, the following is a list of possible problem areas to check:

Make sure all cables are securely attached and not stressed or pinched by other devices in the system. Check that the stripe down one side of each cable is lined up with pin 1 on the controller card. Make sure that no pins are bent or sticking out of the cables.

Make sure that the drive is powered up with a power cable from the power supply. Can you hear the drive power up when you turn the system on? See page 35 for information on power problems.

Check that the controller card is fitted securely into the slot on the motherboard. You may want to try another slot in the computer.

17XX Error Messages

If you are getting a 1700 error message on power-up, it may be due to one of the following errors:

1790 is an error on disk 1, your C: drive. This error is nothing to worry about in a new installation, it simply means that your drive needs to be formatted. 1791 is the same message referring to your second hard drive.

1780 errors usually refer to your cabling and drive select - check these again! This error refers to your first drive. 1781 is the same message referring to your second hard drive.

1701 and 1780/1781 errors can mean many things. Basically, they mean that the system was unable to initialize your hard drive. These errors are commonly caused by a mistake in installation. Make sure the drive select jumper is installed in the correct position on your drive or try your controller in another slot. Check that the cables are correctly attached and that the drive is getting the proper power from your system power supply. Also check your CMOS setup, extended setup, and drive and controller jumpering

SCSI Interface Drives

If your drive is installed and formatted properly and it still does not work, the following is a list of possible problem areas to check:

Make sure the CMOS is set for "No Drive Installed"

If your SCSI drive is in an AT system and you are getting a 1700 or "Hard Drive Controller Failure" error message upon booting the system, remove the drive from the CMOS setup in your AT. No drive type is required for SCSI drives.

Make sure the 50-pin cable is securely attached and not stressed or pinched by other devices in the system. Check that the stripe down one side of the cable is lined up with pin 1 on the host adapter. Make sure that no pins are bent or sticking out of the cable.

If you are using a caching SCSI controller and get a cache memory failure error message, check your motherboard bus speed and extended setup.

Make sure that the drive is powered up with a power cable from the power supply. Can you hear the drive power up when you turn the system on? See page 35 for information on power problems.

Check that the host adapter is fitted securely into the slot on the motherboard. You may want to try another slot in the computer.

Check BIOS shadow RAM settings and ensure that shadow RAM is disabled in the memory address space used by the controller.

SCSI Error Messages

If you are getting error messages such as "No SCSI device found" or "0 hard drives present" upon booting the system, check your installation by consulting your installation manuals or your dealer.

If you verified that the installation is correct, try individually swapping the 50-pin SCSI cable, the host adapter, or the drive, to verify which component is faulty.

Your Drive Does Not Power Up

If your drive is malfunctioning or you do not hear the drive power-up when you turn on your system, you should check the following conditions:

Make sure you are getting adequate power to the drive, as described below. You must be able to supply the drive with the maximum power required at power on. See drive specifications for your drive power requirements.

You can verify that the drive is getting power by measuring the voltage on the drive PC board with a voltmeter. The power connector from the power supply to your hard disc has four wire connections. The two inside connections are grounds and are black in color. One of the outside wires is red in color and provides the +5 volt source. This voltage should be between 4.8 and 5.2 VDC. The other outside wire is usually yellow in color and provides the +12 volt source. This voltage should be between 11.5 and 12.6 VDC. You can also check the drive by plugging it into another system with a known good power supply to verify that it functions.

If your drive is receiving the proper power, it should then power-on. If the drive is not working, contact your dealer for repair and warranty information.

Format Troubleshooting

Errors Encountered in Low-level Format

2-Digit Error Codes

The following is a brief explanation of the more common 2-digit error codes:

80 is a time-out error.
40 is a seek failure.
20 is an invalid command or a controller failure.

All of these errors usually indicate an installation or format problem.

Check your drive installation, make sure that the cables are correctly and securely attached, the drive select jumper is installed in the proper position, and that the controller is correctly installed. Also make sure that you used the correct parameters in the low-level format. Check that the drive is getting the proper power.

Formatting Takes An Unreasonably Long Time

A format that takes too long or never concludes can result when the drive parameters are incorrectly entered during the debug procedure.

If these parameters were entered correctly and the problem persists, check your drive installation. Make sure the cables are properly attached and that the jumpers are correctly installed.

System Hangs When You Enter The DEBUG Address

The system will hang when you enter the DEBUG command if the wrong address is entered or if the controller's address is conflicting with the memory location of another card in the system. Check the address jumpers on the controller card.

Drive Fails Recal or Test Drive Ready Error in Disk Manager, SpeedStor, or Diags

The drive fails "recal" or "test drive ready" error is commonly caused by a mistake in installation. Make sure the drive select jumper is installed in the correct position. Check that the cables are correctly attached and that the drive is getting the proper power.

If, after verifying that the installation is correct, you still get this error, you may have a faulty component. To isolate the problem to a specific component, try individually swapping the cables, controller, and drive. You may also try your drive in another system to determine which component is faulty. If you need more help isolating the problem, please contact your dealer.

I/O Errors in Disk Manager, SpeedStor, or Diags

If you encounter an occasional "Uncorrectable ECC - I/O error" message during the initialization while using Disk Manager, don't worry. This simply means that the program has found and mapped out an error on the disk surface.

You will receive a "No record found - I/O error" message if you try to verify a drive that has not yet been initialized.

If you receive an "Unrecoverable I/O error" message or other I/O error message on every cylinder and head, there are several possible causes. If you are formatting a drive in an XT or are using an 8-bit controller in an AT, you should low-level format the drive through debug using the controller's BIOS format routine. See your controller or host adapter documentation for further information on formatting through debug.

In an AT system using a 16-bit controller, I/O errors may occur if the drive type entered in your system setup is not the correct type for your hard drive. Run Disk Manager in "manual mode" or use your system's setup routine to change the drive type.

If you ran Disk Manager in "manual mode" and were unsuccessful, you should verify that your installation is correct. Make sure your cables are installed correctly.

If you still receive I/O errors, you may have a faulty component. To isolate the problem to a specific component, try individually swapping the cables, controller, and drive.

Errors Encountered in FDISK or Partitioning

FDISK is a DOS partitioning program found on your DOS diskette. FDISK will partition your drive into one DOS partition and one extended DOS partition depending on your version of DOS. Please note that DOS 3.2 or lower does not create extended DOS partitions and cannot partition drives over 32 MB. If you have a drive which is greater than 32 MB and do not have DOS 3.3 or higher, you will need to partition the drive with Disk Manager, Speedstor or other partitioning software.

Note: You may need to reboot the system after low-level formatting, before using FDISK.

If you encounter an error in FDISK such as "Error reading fixed disk" or "No fixed disk present" or the system hangs in FDISK, check the following:

Check your installation - make sure the cables are installed properly, the drive select jumper is in the correct position, and the controller or host adapter is correctly installed. Verify that the low-level format was successful and that the correct parameters were used.

If, after verifying that your installation is correct and the low-level format was performed correctly, you still have trouble in FDISK, you may have a faulty component. To isolate the problem to a specific component, try individually swapping the cables, controller, and drive. You may also try your drive in another system to determine which component is faulty.

Errors Encountered In High-level Format

"Invalid drive specification" error message

To verify that the drive partitioning was performed successfully, run FDISK and display your partitions. If you receive a message such as "No partitions defined," you need to create your partition table with FDISK, Disk Manager, Speedstor, or other partitioning software. Consult your DOS manual for further FDISK information.

If you have already defined your partitions and receive the "Invalid drive specification" error message, recreate your partition table, then power the system down before attempting a high-level format.

If you still receive an "Invalid drive specification" error, you may have a faulty component. To isolate the problem to a specific component, try individually swapping the cables, controller, and drive.

"Track 0 bad, disk unusable" error message

If you are using DOS version 3.1 and receive the error message "Track 0 bad, disk unusable" at the end of the high-level format, don't worry. You will need to edit the buffers statement in your CONFIG.SYS file to read BUFFERS=99. Then you may reboot the system and your high-level format will complete successfully.

If the low-level format was performed properly and you still have trouble, you may have a faulty component. To isolate the problem to a specific component, try individually swapping the cables, controller, and drive.

"Insert Diskette For Drive C:" in an XT system

If you receive the message "Insert diskette for drive C:" at the beginning of the high-level format, the jumper settings on the motherboard of your XT are probably incorrect. Consult your computer system manual or your dealer for more information.

Trouble Getting The Full Capacity Of The Drive

If you are formatting your drive in an XT system or in an AT with an 8-bit controller and are not getting the full capacity of your drive, you may need to do the low-level format through the controller's DEBUG format routine. You must enter the correct parameters for your drive.

If you are using Disk Manager to format your drive in an AT and your drive is a non-standard drive, (one that does not have a corresponding entry in your machine's system setup), Disk Manager will compensate by allowing partitions to utilize the drive's full capacity. These partitions will be handled by the Disk Manager device driver, DMDRVR.BIN. The DOS partition on a non-standard disk can use only the part of the disk depicted by the BIOS ROM for the particular drive type you have chosen.

Therefore, if you have a drive which does not have a drive type entry with the correct number of heads, the DOS partition will waste disk space. If the head count mismatch is severe, only a very small DOS partition would be possible without wasting a significant portion of the capacity. This limitation does not apply to partitions handled by the Disk Manager device driver, such as a Write/Read partition. In other words, if you have a head/cylinder count mismatch, you should create a small DOS partition. You can then use all of the remaining cylinders of the disk for any other partitions. You must invoke Disk Manager in the "manual mode" with DM /M to control these choices.

If you are not using Disk Manager and are having trouble getting the full capacity of your drive, check that you are using the correct drive type in your system setup. If there is no drive type which exactly matches your drive parameters, you need to use Disk

Manager or other partitioning software or upgrade your system BIOS to reach the full capacity. See the section on DOS Partitioning if you are using a drive with over 1024 cylinders.

"Disk boot failure" error message when booting from the hard drive

If you cannot boot from the hard drive, but you can boot from the floppy and then access the hard drive, this means your operating system was not correctly installed on your hard drive.

Follow these steps to solve this problem:

Place your DOS boot disk in the A: drive. At the A> prompt, type "SYS C:" and press <enter>. After a few seconds, a message should appear saying "System transferred." At the A> prompt, type "COPY COMMAND.COM C:" and press <enter>. These procedures will copy the files necessary to make your drive bootable. If you are still unable to boot from the hard drive and you used DOS to format and partition your drive, enter FDISK and make sure the C: partition is active.

If you used Disk Manager to format and partition your drive, insert the Disk Manager disk in the A: drive, and at the A> prompt, type "DM /M," choose "P" for Partitioning and make sure that your first partition say "DOS" under Type and "Y" under Boot and that the partition has been prepared.

WARNING: *BE SURE TO BACK UP ANY DATA STORED ON YOUR HARD DRIVE BEFORE FORMATTING YOUR DRIVE. FORMATTING AT ANY LEVEL IS ALMOST CERTAIN TO RESULT IN PARTIAL OR COMPLETE LOSS OF DATA.*

If your system still will not boot, insert your DOS disk in the A: drive, and at the A> prompt type "FORMAT C: /S" and press <enter>. If you used Disk Manager to format your drive, you will need to install the device driver on your C: drive in order to access additional partitions. When formatting has completed, insert your Disk Manager disk in the A: drive and at the A> prompt type "COPY CONFIG.SYS C:" and press <enter>. Then type, at the A> prompt, "COPY DMDRVR.BIN C:." You will now have a copy of the Disk Manager device driver in your C: drive root directory and an entry in your CONFIG.SYS file which reads "DEVICE=DMDRVR.BIN." Now boot the system from the hard disk. Directory commands directed at all partitions should operate correctly and CHKDSK should display the correct information as well.

Unable to access any partition beyond the C: partition

The reason you cannot access other partitions is that either the program failed to correctly copy the CONFIG.SYS file to your C: drive root directory or you accidentally copied over your old CONFIG.SYS file when you restored your backed up files.

In either case, if you are using Disk Manager, place the disk in the A: drive and type, at the A> prompt, "DMCFIG" and press <enter>. This program will check that you have fulfilled the two requirements for accessing the secondary partitions on boot-up:

(1) Your CONFIG.SYS file must contain an entry which reads "DEVICE=DMDRVR.BIN;" (or SSTOR.SYS if you are using SpeedStor).

(2) The DMDRVR.BIN file must be copied to the root directory of your C: drive.

You should now be able to access all other partitions after booting to the C: drive. If you are using another partitioning software, you will need to contact the manufacturer or your dealer for further information.

If you have checked and these two conditions have been met and you still cannot access the D: drive, be certain that you have completed the preparation part of the Disk Manager program. At the A> prompt, type "DM /M" and select "P" for Partitioning to check the partition table.

If you used DOS to create the partitions, make certain that you formatted each of the partitions that you created. Consult your DOS manual for further information.

Unable to access the second physical drive

If you cannot access your second physical hard drive and your first drive was NOT formatted with Disk Manager, the following extra steps are required to enable your system to recognize the second drive:

Disk Manager's device driver, DMDRVR.BIN, must reside in the root directory of you boot drive. This file must be copied from the Disk Manager diskette by typing, at the A> prompt, "COPY DMDRVR.BIN C:" and pressing <enter>. If your boot drive does not have a CONFIG.SYS file, you may also copy this file from the Disk Manager diskette. At the A> prompt, type "COPY CONFIG.SYS C:" and press <enter>. If your boot drive already has a CONFIG.SYS file, you will need to edit this file and add a line which reads "DEVICE=DMDRVR.BIN."

Bad sectors reported in CHKDSK

If you run CHKDSK on your hard disk and you notice that it reports a certain number of bytes in bad sectors, don't worry. CHKDSK is simply reporting the amount of capacity taken by the errors which were mapped out during the low-level format. The number of bytes in bad sectors may seem high to you, because 8.5 to 32 kilobytes are spared out for each error. This is normal. For example, 1000 kilobytes in bad sectors only equals approximately 30 hard errors.

Macintosh Drive Installation

No hard drive technical manual would be complete without instructions for drive installation on the Apple Macintosh. Internal and external SCSI drives are relatively easy to connect to the Mac, provided you pay proper attention to cabling, termination, SCSI ID, and driver installation.

As described in earlier chapters, the SCSI bus uses "daisy chain" cabling with dual ended termination. This means that each device must be connected in series using a continuous ribbon cable or a series of "daisy chained" external SCSI cables.

The Macintosh uses a DB-25 connector as its external SCSI port. Most computer stores offer cables which connect the Macintosh to Centronics 50-pin and other industry standard connectors. If you are unable to locate the cable you need locally, CSC can supply you with good quality cables at a reasonable price. Avoid using "T" type cables for SCSI connections. These cables cause noise and ringing which can result in unreliable operation.

Correct termination is critical for any SCSI installation. Every SCSI installation must use a total of two terminating resistors, no more and no less. A Macintosh with one internal hard drive usually has two internal terminators. To add an external SCSI drive or other SCSI device, first remove one internal terminator from the Macintosh and then add a terminator to the last device installed at the end of the external SCSI cable. If several devices are installed, connect the terminator to the last device of the chain only. Remember not to use more than two terminators total (internal and external).

Always power up all SCSI peripherals before switching the Macintosh on. Allow a few seconds for the attached drives to spin-up before turning on the Macintosh. SCSI devices which are attached but switched off can hang the SCSI bus and prevent drive operation or cause unreliable data transfer.

To maintain compatibility with your installed software, it is important that you drag YOUR version of the Macintosh system and finder to any new hard drives. Chances are that the preformatted Macintosh drive you received will have a system and finder version which will not match the version you are using. Using two different versions of system and finder software can cause erratic software crashes and "system bombs".

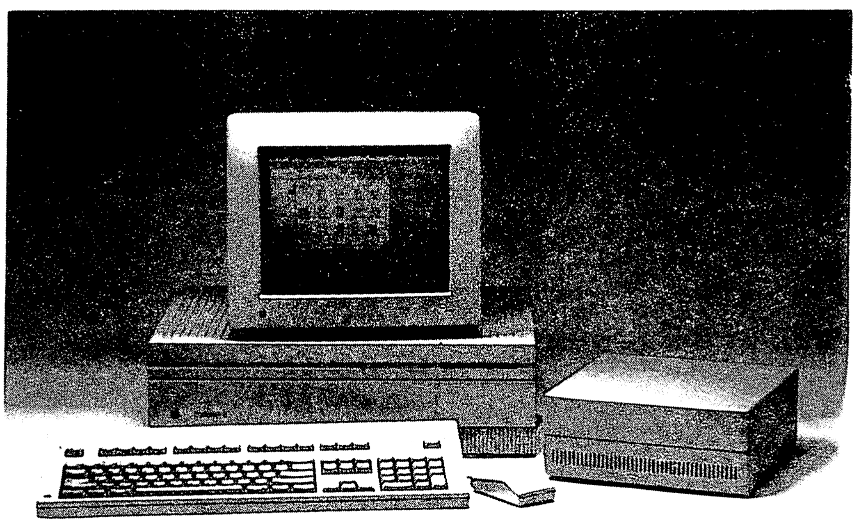
When reformatting your external hard drive, we recommend an interleave of 1:1 for Macintosh II or faster computers and 2:1 for 68000 based computers like the Macintosh Plus, Macintosh SE and Macintosh Classic.

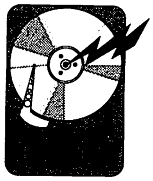
The Apple HFS (Hierarchial File System) can easily loose data if files are not properly closed. For this reason, it is important to back up all files as often as possible. Shut off the system power only after using the Finder "Shut-Down" option. If files are accidentally damaged due to a power failure or accidental shut down, the desktop file on your hard drive may need to be rebuilt. To repair it, shut off power to the Macintosh. Then restart the system holding down both the Command and Option keys while you turn on the hard drive and then the Macintosh. The message "Are you sure you want the desktop rebuilt?" will appear. Rebuilding an undamaged desktop will cause no harm, so click "OK" and the desktop will be rebuilt on all hard drives connected to the Macintosh.

Most software problems with Macintosh drives are caused by driver conflicts or corrupted system and finder files.

If your Macintosh hard drive was working correctly but suddenly refuses to boot, restart from a floppy and check the system folder. The most likely cause of this problem is that a different version of the system or finder may have been inadvertently copied into the system folder. Several desk accessories may interfere with the software driver that provides access to the hard drive. Recopy the system and finder files and then remove any potentially troublesome desk accessories to correct this problem.

If your multiple hard drive Macintosh suddenly reports "Disk is unreadable, would you like to initialize ?", the problem is most likely a software driver conflict. This message commonly occurs in systems with two or more hard drives that use different drivers. Verify that the drivers you are using for both your hard drives are identical. If the drivers are not identical, one hard drive will need to be reformatted with the same driver that the other hard drive uses.





Hard Drive List

Listed on the following pages are many common hard drives and their parameters. The capacities listed are in formatted megabytes (1,000,000 bytes), with 512 bytes per sector. Formatted capacities may vary slightly depending on how the drive is formatted (i.e., using sector sparing or 35/36 sectors per track). As you would expect, all MFM drives have 17 sectors per track, and all RLL drives which use the ST-506 interface have 26 sectors per track. ESDI drives have 35, 36, 48, or 63 sectors per track.

Access times listed are those published by the manufacturer. These advertised access times are often slightly lower than the average tested times. Drive information unavailable at the time of printing is entered as zeros.

Landing Zone

The landing zone, or "park cylinder" of a hard drive is a location to which the drive head carriage should be moved before the drive is transported. Older hard drives which use stepper motor actuators had to be manually parked before they were transported. This parking procedure moved the heads away from the data area of the disk and reduced the chance of data loss if the drive was bumped or jarred with the power off.

All newer hard disk drives with voice coil actuators incorporate automatic parking mechanisms. These mechanisms are as simple as a spring and a small latch which move and lock the heads away from the data areas of the disk when power is removed. Because the manual landing zone is no longer used in modern drives, we have omitted it from the tables. If you have an older stepper motor type drive which does require manual parking, step the heads to the maximum cylinder + 1 before removing power from the drive. For example, if you have a ST-225 which has 615 cylinders, step to the 616th cylinder before power down if you intend to transport the drive.

Write Precomp

Write precompensation is a technique which alters the timing of data written to a hard drive on particular cylinders. Since the track length of cylinders which are close to the center of the disk is shorter than the outer cylinders, the timing of data read changes.

To compensate for the difference in read data timing between inner and outer tracks, several drives use "write precompensation" which alters the timing of data written to inner cylinders on the drive. Newer drives generate "write precompensation" using internal logic which senses the position of the head and adjusts the timing of write data accordingly. Older drives depend on the controller card to generate write precompensation.

Since write precompensation is either handled internally or not used at all on newer hard drives the starting write precompensation cylinder is not as important as it once was. We have omitted write precomp information in the hard drive list to keep things simple. The correct write precompensation start cylinder for most drives can be calculated by dividing the maximum cylinder number by two.

CDC, Imprimis or Seagate?

Control Data Corporation (CDC) was one of the first manufacturers of high performance 5.25" hard disk drives. CDC has over the years developed an excellent reputation for reliability. In 1987, Control Data Corporation named its disk drive division Imprimis. Recently, the CDC's Imprimis division was purchased by Seagate. Hopefully, Seagate will maintain CDC's reputation for quality.

If you are trying to locate an Imprimis drive, please check both the Seagate and CDC sections.

Miniscribe or Maxtor Colorado?

Miniscribes management caused financial problems which eventually led to Maxtor Corporations acquisition in 1990. Miniscribe is now called Maxtor Colorado. Maxtor's management and expertise in high capacity drives has helped improve the Miniscribe product.

If you are trying to locate a Maxtor Colorado drive, also check in the Miniscribe section.

Hard Drive Parameters

ALPS

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
DRND-10A	10	2	615	60	MFM	17	3.50 HH
DRND-20A	20	4	615	60	MFM	17	3.50 HH
DRPO-20D	20	2	615	60	RLL	26	3.50 HH
RPO-20A	20	2	615	60	RLL	26	3.50 HH

AMPEX

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
PYXIS-7	5	2	320	90	MFM	17	5.25 FH
PYXIS-13	10	4	320	90	MFM	17	5.25 FH
PYXIS-20	15	6	320	90	MFM	17	5.25 FH
PYXIS-27	20	8	320	90	MFM	17	5.25 FH

AREAL

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
MD-2060	61	2	1024	28	AT-IDE	60	2.50 4H
MD-2100	100	0	0	0	AT-IDE	0	2.50 4H

ATASI

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
AT-676	765	15	1632	16	ESDI	54	5.25 FH
AT-3020	17	3	645	38	MFM	17	5.25 FH
AT-3033	28	5	645	33	MFM	17	5.25 FH
AT-3046	39	7	645	33	MFM	17	5.25 FH
AT-3051	43	7	704	33	MFM	17	5.25 FH
AT-3051+	44	7	733	33	MFM	17	5.25 FH
AT-3053	44	7	733	33	MFM	17	5.25 FH
AT-3075	67	8	1024	33	MFM	17	5.25 FH
AT-3085	71	8	1024	28	RLL	26	5.25 FH
AT-3128	109	8	1024	28	RLL	26	5.25 FH
AT-6120	1051	15	1925	14	ESDI	71	5.25 FH

BASF

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
6185	23	6	440	99	MFM	17	5.25 FH
6186	15	4	440	70	MFM	17	5.25 FH
6187	8	2	440	70	MFM	17	5.25 FH
6188-R1	10	2	612	70	MFM	17	5.25 FH
6188-R3	21	4	612	70	MFM	17	5.25 FH

BRAND TECHNOLOGY

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
BT 8085	71	8	0	0	MFM	17	-
BT 8128	109	8	0	0	RLL	26	-
BT 8170	142	8	0	0	ESDI	34	-

BULL

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
D-530	26	3	987	65	MFM	17	5.25 FH
D-550	43	5	987	65	MFM	17	5.25 FH
D-570	60	7	987	65	MFM	17	5.25 FH
D-585	71	7	1166	65	RLL	17	5.25 FH

C. ITOH (also see Ye-Data)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
YD-3042	44	4	788	26	RLL	26	5.25 FH
YD-3082	87	8	788	26	RLL	26	5.25 FH
YD-3530	32	5	731	26	MFM	17	5.25 HH
YD-3540	45	7	731	26	MFM	17	5.25 HH

CARDIFF

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
F-3053	44	5	1024	20	MFM	17	3.50 HH
F-3080E	68	5	1024	20	ESDI	26	3.50 HH
F-3080S	68	5	1024	20	SCSI	26	3.50 HH
F-3127E	109	5	1024	20	ESDI	35	3.50 HH
F-3127S	109	5	1024	20	SCSI	35	3.50 HH

CDC (also see Seagate)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
24221-125M Wren V	110	3	1024	18	SCSI	36	5.25 HH
24221-209M Wren V	183	5	1024	18	SCSI	36	5.25 HH
94155-19	18	3	697	28	MFM	17	5.25 FH
94155-21	21	3	697	28	MFM	17	5.25 FH
94155-25 Wren I	24	4	697	28	MFM	17	5.25 FH
94155-28	24	4	697	28	MFM	17	5.25 FH
94155-036 Wren I	36	5	697	28	MFM	17	5.25 FH
94155-038	31	5	733	28	MFM	17	5.25 FH
94155-48 Wren II	40	5	925	28	MFM	17	5.25 FH
94155-51 Wren II	43	5	989	28	MFM	17	5.25 FH
94155-57 Wren II	48	6	925	28	MFM	17	5.25 FH
94155-67 Wren II	56	7	925	28	MFM	17	5.25 FH
94155-77 Wren II	64	8	925	28	MFM	17	5.25 FH
94155-85 Wren II	71	8	1024	28	MFM	17	5.25 FH
94155-85P Wren II	71	8	1024	28	MFM	17	5.25 FH
94155-86 Wren II	72	9	925	28	MFM	17	5.25 FH
94155-96 Wren II	80	9	1024	28	MFM	17	5.25 FH
94155-96P Wren II	80	9	1024	28	MFM	17	5.25 FH
94155-120 Wren II	102	8	960	28	RLL	26	5.25 FH
94155-120P Wren II	102	8	960	28	RLL	26	5.25 FH
94155-135 Wren II	115	9	960	28	RLL	26	5.25 FH
94155-135P Wren II	115	9	960	28	RLL	26	5.25 FH
94156-48 Wren II	40	5	925	28	ESDI	17	5.25 FH
94156-67 Wren II	56	7	925	28	ESDI	17	5.25 FH
94156-86 Wren II	72	9	925	28	ESDI	17	5.25 FH
94161-86 Wren III	86	0	969	17	SCSI	26	5.25 FH
94161-101 Wren III	86	5	969	16	SCSI	26	5.25 FH
94161-121 Wren III	121	7	969	16	SCSI	26	5.25 FH
94161-141 Wren III	121	7	969	16	SCSI	26	5.25 FH
94161-155	155	9	967	18	SCSI	36	5.25 FH
94161-182 Wren III	160	9	969	18	SCSI	26	5.25 FH
94166-101 Wren III	84	5	969	18	ESDI	34	5.25 FH
94166-141 Wren III	118	7	969	18	ESDI	34	5.25 FH

<u>CDC</u> (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
94166-182 Wren III	151	9	969	18	ESDI	34	5.25 FH
94171-300	288	9	1365	18	SCSI	36	5.25 FH
94171-344	335	9	1549	18	SCSI	36	5.25 FH
94171-350 Wren IV	307	9	1412	17	SCSI	36	5.25 FH
94171-375 Wren V	375	9	1549	16	SCSI	35	5.25 FH
94171-376 Wren IV	330	9	1549	18	SCSI	36	5.25 FH
94171-376D	330	9	1549	18	SCSI	36	5.25 FH
94181-385D	337	15	791	11	SCSI	36	5.25 FH
94181-385H Runner	337	15	791	11	SCSI	36	5.25 FH
94181-574 Wren V	574	15	1549	16	SCSI	36	5.25 FH
94181-702D Wren V	428	15	1549	17	SCSI	36	5.25 FH
94181-702M Wren V	428	15	1549	17	SCSI	36	5.25 FH
94186-265 Wren V	221	9	1412	18	ESDI	34	5.25 FH
94186-324 Wren V	270	11	1412	18	ESDI	34	5.25 FH
94186-383 Wren V	338	13	1412	18	ESDI	36	5.25 FH
94186-383H Wren V	338	15	1224	15	ESDI	36	5.25 FH
94186-383S Wren V	338	13	1412	19	ESDI	36	5.25 FH
94186-442 Wren V	368	15	1412	16	ESDI	34	5.25 FH
94186-442H	368	15	1412	0	ESDI	34	5.25 FH
94191-766 Wren VI	676	15	1632	16	SCSI	54	5.25 FH
94191-766M Wren VI	676	15	1632	16	SCSI	54	5.25 FH
94196-383 Wren VI	338	13	1412	16	ESDI	34	5.25 FH
94196-766 Wren VI	676	15	1632	16	ESDI	54	5.25 FH
94204-65	65	8	941	28	MFM	17	5.25 FH
94204-71	71	8	1024	28	MFM	17	5.25 FH
94204-74 Wren II	65	5	948	28	AT-IDE	17	5.25 HH
94204-74C Wren II	65	5	948	28	AT-IDE	17	5.25 HH
94204-81 Wren II	71	5	1032	28	AT-IDE	17	5.25 HH
94205-30 Wren II	25	3	989	28	RLL	26	5.25 HH
94205-41 Wren II	38	3	989	28	RLL	26	5.25 HH
94205-51 Wren II	43	5	989	28	RLL	26	5.25 HH
94205-77 Wren II	65	5	989	28	RLL	26	5.25 HH
94208-75 Wren II	60	5	989	30	AT-IDE	26	5.25 HH

CDC (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
94211-91 Wren III	91	5	969	16	SCSI	36	5.25 FH
94211-106 Wren III	91	5	1024	18	SCSI	36	5.25 FH
94211-209 Wren V	142	5	1547	18	SCSI	36	5.25 FH
94216-106 Wren III	89	5	1024	16	ESDI	34	5.25 HH
94221-125 Wren V	110	3	1544	18	SCSI	36	5.25 HH
94221-190 Wren V	190	5	1547	18	SCSI	36	5.25 HH
94221-209 Wren V	183	5	1544	18	SCSI	36	5.25 HH
94241-383 Wren VI	338	7	1261	14	SCSI	36	5.25 HH
94241-502 Wren VI	440	7	1755	16	SCSI	36	5.25 HH
94244-219	191	4	1747	16	AT-IDE	54	5.25 HH
94244-274 Wren VI	193	4	1453	16	AT-IDE	54	5.25 HH
94244-383 Wren VI	338	7	1747	16	AT-IDE	54	5.25 HH
94246-182 Wren VI	160	4	1453	15	ESDI	54	5.25 HH
94246-383 Wren VI	331	7	1747	15	ESDI	53	5.25 HH
94295-051	43	5	989	28	MFM	17	5.25 FH
94311-136S Swift SL	120	5	1068	15	SCSI-2	36	3.50 3H
94314-136 Swift SL	120	5	1068	15	AT-BUS	36	3.50 3H
94316-111 Swift	98	5	1072	23	ESDI	36	3.50 HH
94316-136 Swift SL	120	5	1268	15	ESDI	36	3.50 3H
94316-155 Swift	138	7	1072	15	ESDI	36	3.50 HH
94316-200 Swift	177	9	1072	15	ESDI	36	3.50 HH
94335-055	46	5	1268	25	MFM	17	3.50 HH
94335-100	83	9	1268	25	MFM	17	3.50 HH
94335-150	128	9	1268	25	RLL	26	3.50 HH
94351-111 Swift	98	5	1068	15	SCSI	36	3.50 HH
94351-126 Swift	111	7	1068	15	SCSI	36	3.50 HH
94351-128	111	7	1068	0	SCSI	36	3.50 HH
94351-133 Swift	134	7	1268	15	SCSI	36	3.50 HH
94351-133S Swift	116	5	1268	15	SCSI-2	36	3.50 HH
94351-134	117	7	1068	15	SCSI	36	3.50 HH
94351-155 Swift	138	7	1068	15	SCSI	36	3.50 HH
94351-155S Swift	138	7	1068	15	SCSI-2	36	3.50 HH
94351-160 Swift	142	9	1068	15	SCSI	36	3.50 HH

CDC (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
94351-172	150	9	1068	15	SCSI	36	3.50 HH
94351-186S Swift	163	7	1268	15	SCSI-2	36	3.50 HH
94351-200 Swift	177	9	1068	15	SCSI	36	3.50 HH
94351-200S Swift	177	9	1068	15	SCSI-2	36	3.50 HH
94351-230 Swift	210	9	1272	15	SCSI	36	3.50 HH
94351-230S Swift	210	9	1268	15	SCSI-2	36	3.50 HH
94354-111 Swift	98	5	1072	15	AT-IDE	36	3.50 HH
94354-126 Swift	111	7	1072	15	AT-IDE	36	3.50 HH
94354-133 Swift	117	5	1272	15	AT-IDE	36	3.50 HH
94354-135	143	9	1072	15	AT-IDE	29	3.50 HH
94354-155 Swift	138	7	1072	15	AT-IDE	36	3.50 HH
94354-160 Swift	143	9	1072	15	AT-IDE	36	3.50 HH
94354-172	177	9	1072	0	AT-IDE	36	3.50 HH
94354-186 Swift	164	7	1272	15	AT-IDE	36	3.50 HH
94354-200 Swift	177	9	1072	15	AT-IDE	36	3.50 HH
94354-230 Swift	211	9	1272	15	AT-IDE	36	3.50 HH
94355-055 Swift	46	5	1072	16	MFM	17	3.50 HH
94355-100 Swift	83	9	1072	15	MFM	17	3.50 HH
94355-150 Swift	128	9	1072	15	RLL	26	3.50 HH
94356-111 Swift	98	5	1072	15	ESDI	36	3.50 HH
94356-155 Swift	138	7	1072	15	ESDI	36	3.50 HH
94356-200 Swift	172	9	1072	15	ESDI	36	3.50 HH
94601-12G Wren VII	1050	15	1931	15	SCSI	var	5.25 FH
94601-12GM Wren VII	1050	15	0	15	SCSI	var	5.25 FH
94601-767M	676	15	1508	12	SCSI	54	5.25 FH
97155-036	30	0	0	0	MFM	17	8.00 FH
9720-1123 SABRE	964	19	0	15	SMD	var	8.00 FH
9720-1230 SABRE	1236	15	1635	15	SMD/SCSI	var	8.00 FH
9720-2270 SABRE	1948	19	0	12	SMD	var	8.00 FH
9720-2500 SABRE	2145	19	0	12	SMD/SCSI	var	8.00 FH
9720-368 SABRE	368	10	1635	18	SMD/SCSI	var	8.00 FH
9720-500 SABRE	500	10	1217	18	SMD/SCSI	var	8.00 FH
9720-736 SABRE	741	15	1217	15	SMD/SCSI	var	8.00 FH

CDC (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
9720-850 Sabre	851	15	1635	15	SMD/SCSI	var	8.00 FH
97229-1150	990	19	1784	15	IPI-2	var	8.00 FH
97500-12G	1050	17	0	15	IPI-2	var	5.25 FH
97500-15G Elite	1285	17	0	16	SCSI-2	var	5.25 FH
BJ7D5A 77731608	29	5	670	28	MFM	17	5.25 FH
BJ7D5A 77731613	33	5	733	28	MFM	17	5.25 FH
BJ7D5A 77731614	23	4	670	28	MFM	17	5.25 FH

CENTURY DATA

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
CAST-10203E	55	3	1050	28	ESDI	35	5.25 FH
CAST-10203S	55	3	1050	28	SCSI	35	5.25 FH
CAST-10304E	75	4	1050	28	ESDI	35	5.25 FH
CAST-10304S	75	4	1050	28	SCSI	35	5.25 FH
CAST-10305E	94	5	1050	28	ESDI	35	5.25 FH
CAST-10305S	94	5	1050	28	SCSI	35	5.25 FH
CAST-14404E	114	4	1590	25	ESDI	35	5.25 HH
CAST-14404S	114	4	1590	25	SCSI	35	5.25 HH
CAST-14405E	140	5	1590	25	ESDI	35	5.25 HH
CAST-14405S	140	5	1590	25	SCSI	35	5.25 HH
CAST-14406E	170	6	1590	25	ESDI	35	5.25 HH
CAST-14406S	170	6	1590	25	SCSI	35	5.25 HH
CAST-24509E	258	9	1599	18	ESDI	35	5.25 FH
CAST-24509S	258	9	1599	18	SCSI	35	5.25 FH
CAST-24611E	315	11	1599	18	ESDI	35	5.25 FH
CAST-24611S	315	11	1599	18	SCSI	35	5.25 FH
CAST-24713E	372	13	1599	18	ESDI	35	5.25 FH
CAST-24713S	372	13	1599	18	SCSI	35	5.25 FH

CMI

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
CM 3206	10	4	306	99	MFM	17	5.25 FH
CM 3426	20	4	615	85	MFM	17	5.25 FH
CM 5018H	15	0	0	85	MFM	17	5.25 FH
CM 5205	4	2	256	105	MFM	17	5.25 FH
CM 5206	5	2	306	99	MFM	17	5.25 FH
CM 5410	8	4	256	105	MFM	17	5.25 FH
CM 5412	10	4	306	99	MFM	17	5.25 FH
CM 5616	13	6	256	105	MFM	17	5.25 FH
CM 5619	15	6	306	105	MFM	17	5.25 FH
CM 5826	21	8	306	99	MFM	17	5.25 FH
CM 6213	11	2	640	105	MFM	17	5.25 FH
CM 6426	21	4	615	40	MFM	17	5.25 FH
CM 6426S	22	4	640	40	MFM	17	5.25 FH
CM 6640	33	6	640	40	MFM	17	5.25 FH
CM 7660	50	6	960	40	MFM	17	5.25 FH
CM 7880	67	8	960	40	MFM	17	5.25 FH

CMS ENHANCEMENTS

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
F115ESDI-T	114	0	0	30	ESDI	36	5.25 FH
F150AT-CA	150	0	0	17	ESDI	36	5.25 FH
F150AT-WCA	150	0	0	17	ESDI	36	5.25 FH
F150EQ-WCA	150	0	0	17	0	0	5.25 FH
F320AT-CA	320	15	1224	15	ESDI	36	5.25 FH
F70ESDI-T	73	0	0	30	ESDI	36	5.25 FH
H330E1 PS Expr.	330	7	1780	14	ESDI	54	5.25 FH
H340E1	340	7	1780	14	ESDI	54	5.25 FH
PS Express 150	150	0	0	17	ESDI	36	5.25 FH
PS Express 320	320	15	1224	15	ESDI	36	5.25 FH

COGITO

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
CG-906	5	2	306	85	MFM	17	5.25 FH
CG-912	11	4	306	65	MFM	17	5.25 FH
CG-925	21	4	612	65	MFM	17	5.25 FH
PT-912	11	2	612	40	MFM	17	3.50 HH
PT-925	21	4	612	40	MFM	17	3.50 HH

CONNER

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
CP-340	42	4	788	29	SCSI	26	3.50 HH
CP-342	40	4	805	29	AT-IDE	26	3.50 HH
CP-344	43	4	788	29	AT-IDE	26	3.50 HH
CP-2024 KATO	21	2	653	40	AT/XT-IDE	32	2.50 4H
CP-2034 PANCHO	32	0	0	19	AT-IDE	0	2.50 4H
CP-2044 PANCHO	42	0	0	19	AT-IDE	0	2.50 4H
CP-2064 PANCHO	64	0	0	19	AT-IDE	0	2.50 4H
CP-2304	209	8	1348	19	AT-IDE	39	3.50 HH
CP-3020	21	2	636	27	SCSI	33	3.50 HH
CP-3022	21	2	622	27	AT-IDE	33	3.50 HH
CP-3024	22	2	636	27	AT-IDE	33	3.50 HH
CP-3040	42	2	1026	25	SCSI	40	3.50 HH
CP-3044	43	2	1047	25	AT-IDE	40	3.50 HH
CP-3100	105	8	776	25	SCSI	33	3.50 HH
CP-3102	104	8	776	25	AT-IDE	33	3.50 HH
CP-3104	105	8	776	25	AT-IDE	33	3.50 HH
CP-3180	84	6	832	25	SCSI	33	3.50 HH
CP-3184	84	6	832	25	AT-IDE	33	3.50 HH
CP-3200	209	8	1348	19	SCSI	39	3.50 HH
CP-3200F	213	8	1366	16	SCSI	38	3.50 HH
CP-3204	209	8	1348	19	AT-IDE	39	3.50 HH
CP-3204F	213	8	1366	16	AT-IDE	38	3.50 HH
CP-3209F	213	8	1366	16	MCA	38	3.50 HH
CP-3500	510	0	0	0	SCSI	0	3.50 HH
CP-3504	510	0	0	0	AT-IDE	0	3.50 HH

CONNER (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
CP-4024 STUBBY	22	2	627	29	AT/XT	34	3.50 HH
CP-4044 STUBBY	43	2	1104	50	AT/XT	38	3.50 HH
CP-30080	84	0	0	0	SCSI	0	3.50 HH
CP-30100 HOPI	120	4	1522	19	SCSI	39	3.50 HH
CP-30104 HOPI	120	4	1522	19	AT-IDE	39	3.50 HH
CP-30109 HOPI	120	4	1522	19	MCA	39	3.50 HH

CORE INTERNATIONAL

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
AT 30	31	5	733	26	MFM	17	5.25 FH
AT 30R	48	5	733	26	RLL	26	5.25 FH
AT 32	31	5	733	21	MFM	17	5.25 HH
AT 32R	48	5	733	21	RLL	26	5.25 HH
AT 40	40	5	924	26	MFM	17	5.25 FH
AT 40R	61	5	924	26	RLL	26	5.25 FH
AT 63	42	5	988	26	MFM	17	5.25 FH
AT 63R	65	5	988	26	RLL	26	5.25 FH
AT 72	72	9	924	26	MFM	17	5.25 FH
AT 72R	107	9	924	26	RLL	26	5.25 FH
AT-150	156	0	0	16	ESDI	0	5.25 FH
HC 40	40	4	564	10	RLL	35	5.25 FH
HC 90	91	5	969	16	RLL	35	5.25 HH
HC 100F	101	0	0	9	ESDI	0	5.25 FH
HC 150	156	9	969	16	RLL	35	5.25 FH
HC 175	177	9	0	16	ESDI	0	5.25 FH
HC 200	200	8	0	16	AT-IDE	0	5.25 FH
HC 260	260	12	1212	25	RLL	35	5.25 FH
HC 310	311	12	1582	16	RLL	35	5.25 FH
HC 315	340	8	1447	16	ESDI	57	5.25 FH
HC 380	383	0	0	16	ESDI	0	5.25 FH
HC 650	658	15	1661	16	ESDI	53	5.25 FH
HC 650S	663	14	0	18	SCSI	0	5.25 FH
HC 655	680	16	1447	16	ESDI	57	5.25 FH

CORE INTERNATIONAL (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
HC 1000S	1200	0	0	18	SCSI	0	5.25 FH
OPTIMA 30	31	5	733	21	MFM	17	5.25 HH
OPTIMA 30R	48	5	733	21	RLL	26	5.25 HH
OPTIMA 40	41	5	963	26	MFM	17	5.25 HH
OPTIMA 40R	64	5	963	26	RLL	26	5.25 HH
OPTIMA 70	71	9	918	26	MFM	17	5.25 FH
OPTIMA 70R	109	9	918	26	RLL	26	5.25 FH

CSC

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
McHuge	334	20	1020	18	SCSI	36	External
McHuge II	641	15	1224	16	SCSI	48	External

DATA TECH MEMORIES

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
DTM-553	44	5	1024	0	MFM	17	5.25 FH
DTM-853	44	8	640	0	MFM	17	5.25 FH
DTM-885	71	8	1024	0	MFM	17	5.25 FH

DISCTRON (also see Otari)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
D-503	3	2	153	85	MFM	17	5.25 FH
D-504	4	2	215	85	MFM	17	5.25 FH
D-506	5	4	153	85	MFM	17	5.25 FH
D-507	5	2	306	85	MFM	17	5.25 FH
D-509	8	4	215	85	MFM	17	5.25 FH
D-512	11	8	153	85	MFM	17	5.25 FH
D-513	11	6	215	85	MFM	17	5.25 FH
D-514	11	4	306	85	MFM	17	5.25 FH
D-518	15	8	215	85	MFM	17	5.25 FH
D-519	16	6	306	85	MFM	17	5.25 FH
D-526	21	8	306	85	MFM	17	5.25 FH

DISK TECHNOLOGIES

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
DISCTEC RHD-20	20	0	0	23	AT-IDE	17	2.50 4H

DMA

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
306	11	2	612	85	MFM	17	5.25 FH

ELCOH

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
DISCACHE 10	10	4	320	65	MFM	17	5.25 FH
DISCACHE 20	20	8	320	65	MFM	17	5.25 FH

EMULEX

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
EMS/760	663	0	0	18	ESDI	0	5.25
ER2E/760	663	0	0	17	ESDI	0	5.25
ES36/760-1	663	0	0	17	ESDI	0	5.25

EPSON

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
HD 850	11	4	306	99	MFM	17	5.25 HH
HD 860	21	4	612	99	MFM	17	5.25 HH

ESPERT

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
EP-340A	42	4	0	25	AT-IDE	0	3.50 HH

FUJI

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
FK301-13	10	4	306	65	MFM	17	3.50 HH
FK302-13	10	2	612	65	MFM	17	3.50 HH
FK302-26	21	4	612	65	MFM	17	3.50 HH
FK302-39	32	6	612	65	MFM	17	3.50 HH
FK303-52	40	8	615	65	MFM	17	3.50 HH
FK305-26	21	4	615	65	MFM	17	3.50 HH
FK305-39	32	6	615	65	MFM	17	3.50 HH
FK305-39R	32	4	615	65	RLL	26	3.50 HH
FK305-58R	49	6	615	65	RLL	26	3.50 HH
FK308S-39R	31	4	615	65	SCSI	26	3.50 HH
FK308S-58R	45	6	615	65	SCSI	26	3.50 HH
FK309-26	20	4	615	65	MFM	17	3.50 HH
FK309-39	32	6	615	65	MFM	17	3.50 HH
FK309-39R	30	4	615	65	RLL	26	3.50 HH
FK309S-50R	41	4	615	47	RLL	26	3.50 HH

FUJITSU

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
M 2225D	21	4	615	35	MFM	17	3.50 HH
M 2225DR	32	4	615	35	RLL	26	3.50 HH
M 2226D2	30	6	615	35	MFM	17	3.50 HH
M 2226DR	49	6	615	35	RLL	26	3.50 HH
M 2227D	40	8	615	35	MFM	17	3.50 HH
M 2227DR	65	8	615	35	RLL	26	3.50 HH
M 2230AS	5	2	320	0	MFM	17	5.25 FH
M 2230AT	5	2	320	0	MFM	17	5.25 FH
M 2231	5	2	306	0	MFM	17	5.25 FH
M 2233AS	11	4	320	80	MFM	17	5.25 FH
M 2233AT	11	4	320	80	MFM	17	5.25 FH
M 2234AS	16	6	320	80	MFM	17	5.25 FH
M 2235AS	22	8	320	80	MFM	17	5.25 FH
M 2241AS	19	4	754	35	MFM	17	5.25 FH

FUJITSU (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
M 2242AS	45	7	754	35	MFM	17	5.25 FH
M 2242AS2	43	7	754	30	MFM	17	5.25 FH
M 2243AS	72	11	754	35	MFM	17	5.25 FH
M 2243AS2	67	11	754	30	MFM	17	5.25 FH
M 2243R	110	7	1186	25	RLL	26	5.25 HH
M 2243T	68	7	1186	25	MFM	17	5.25 HH
M 2245SA	120	7	823	25	SCSI	35	5.25 HH
M 2246E	172	10	823	25	ESDI	35	5.25 FH
M 2246SA	171	10	823	25	SCSI	35	5.25 FH
M 2247E	160	7	1243	18	ESDI	36	5.25 FH
M 2248E	252	11	1243	18	ESDI	36	5.25 FH
M 2249	389	15	1243	18	ESDI/SCSI	36	5.25 FH
M 2249E	336	15	1243	18	ESDI	36	5.25 FH
M 2249S	336	15	1224	18	SCSI	36	5.25 FH
M 2261E	326	8	1658	16	ESDI	48	5.25 FH
M 2262E	448	11	1658	16	ESDI	48	5.25 FH
M 2263	778	15	1658	16	ESDI	48	5.25 FH
M 2263E	611	15	1658	16	ESDI	48	5.25 FH
M 2263S	611	15	1658	16	SCSI	48	5.25 FH
M 2266SA	1266	0	0	15	SCSI	0	5.25 FH
M 2344KS	690	27	624	16	SCSI	var	8.00
M 2611S	45	2	1334	25	SCSI	36	3.50 HH
M 2611T	45	2	1334	25	AT-IDE	36	3.50 HH
M 2612S	90	4	1334	25	SCSI	36	3.50 HH
M 2612T	90	4	1334	25	AT-IDE	36	3.50 HH
M 2613S	136	6	1334	25	SCSI	36	3.50 HH
M 2613T	135	6	1334	25	AT-IDE	36	3.50 HH
M 2614S	182	8	1334	25	SCSI	36	3.50 HH
M 2614T	180	8	1334	25	AT-IDE	36	3.50 HH
M 262xSA	520	0	0	12	SCSI	0	3.50 HH
M 262xST	520	0	0	12	AT-IDE	0	3.50 HH

HEWLETT-PACKARD

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
HP-97500-85600	20	0	0	0	SCSI	0	3.50 HH
HP-97500-85620	20	0	0	0	SCSI	0	3.50 HH
HP-97530E	136	4	0	18	ESDI	0	5.25 FH
HP-97530S	204	6	0	18	SCSI	0	5.25 FH
HP-97532E	103	0	0	17	ESDI	0	5.25 FH
HP-97533E	155	0	0	17	ESDI	0	5.25 FH
HP-97536E	311	0	0	17	ESDI	0	5.25 FH
HP-97544E	340	8	0	17	ESDI	0	5.25 FH
HP-97544S/D	331	8	0	17	SCSI	0	5.25 FH
HP-97544T/P	331	8	0	17	SCSI-2	0	5.25 FH
HP-97548E	680	16	0	17	ESDI	56	5.25 FH
HP-97548S/D	663	16	0	17	SCSI	0	5.25 FH
HP-97548T/P	663	16	0	17	SCSI-2	0	5.25 FH
HP-97549T/P	1000	16	0	18	SCSI-2	0	5.25 FH
HP-97556E	681	11	0	14	ESDI	0	5.25 FH
HP-97556T/P	677	11	0	14	SCSI-2	0	5.25 FH
HP-97558E	1084	15	0	14	ESDI	0	5.25 FH
HP-97558T/P	1070	15	0	14	SCSI-2	0	5.25 FH
HP-97560E	1374	19	0	14	ESDI	0	5.25 FH
HP-97560T/P	1360	19	0	14	SCSI-2	0	5.25 FH
HP-C2233S	234	5	1511	13	SCSI	49	3.50 HH
HP-C2234S	328	7	1511	13	SCSI-2	64	3.50 HH
HP-C2235S	422	9	1511	13	SCSI-2	72	3.50 HH
HP-D1660A	333	8	1457	16	ESDI	57	5.25 FH
HP-D1661A	667	16	1457	16	ESDI	57	5.25 FH

HITACHI

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
DK 301-1	10	4	306	85	MFM	17	3.50 HH
DK 301-2	15	6	306	85	MFM	17	3.50 HH
DK 312C-20	209	10	0	16	SCSI	0	3.50 HH
DK 312C-25	251	12	0	16	SCSI	0	3.50 HH
DK 314C-41	419	14	0	17	SCSI	0	3.50 HH

HITACHI (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
DK 502-2	21	4	615	85	MFM	17	5.25 HH
DK 511-3	30	5	699	30	MFM	17	5.25 FH
DK 511-5	42	7	699	30	MFM	17	5.25 FH
DK 511-8	67	10	823	23	MFM	17	5.25 FH
DK 512-8	67	5	823	23	ESDI	34	5.25 FH
DK 512C-8	67	5	823	23	SCSI	34	5.25 FH
DK 512-12	94	7	823	23	ESDI	34	5.25 FH
DK 512C-12	94	7	823	23	SCSI	34	5.25 FH
DK 512-17	134	10	823	23	ESDI	34	5.25 FH
DK 512C-17	134	10	819	23	SCSI	34	5.25 FH
DK 514-38	330	14	903	16	ESDI	51	5.25 FH
DK 514C-38	321	14	903	16	SCSI	51	5.25 FH
DK 514S-38	330	14	903	14	SMD	51	5.25 FH
DK 515-12	1229	15	0	14	ESDI	69	5.25 FH
DK 515-78	673	14	1361	16	ESDI	69	5.25 FH
DK 515C-78	661	14	1261	16	SCSI	69	5.25 FH
DK 516-12	1230	0	0	14	ESDI	0	5.25 FH
DK 516C-16	1500	0	0	14	SCSI-2	0	5.25 FH
DK 521-5	42	6	823	25	MFM	17	5.25 HH
DK 522-10	103	6	823	25	ESDI	36	5.25 HH
DK 522C-10	88	6	819	25	SCSI	35	5.25 HH

IBM

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
20MB(2)	21	4	615	40	MFM	17	5.25 FH
20MB(13)	21	8	306	40	MFM	17	5.25 FH
30MB(22)	31	5	733	40	MFM	17	5.25 FH
0661	371	14	0	12	SCSI-2	0	3.50 HH
0671E	387	15	0	20	ESDI	0	5.25 HH
0671S	387	15	0	20	SCSI	0	5.25 HH
0681	1054	20	0	0	SCSI-2	0	5.25 HH
WD-3168	157	8	0	23	PS/2	0	3.50 HH
WDA-3160	206	8	0	16	0	0	3.50 HH
WDS-3160	206	8	0	16	0	0	3.50 HH

IMI

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
5006	5	2	306	85	MFM	17	5.25 FH
5007	5	2	312	85	MFM	17	5.25 FH
5012	10	4	306	85	MFM	17	5.25 FH
5018	15	6	306	85	MFM	17	5.25 FH
5021H	15	4	306	85	MFM	17	5.25 FH
7720	21	4	310	85	MFM	17	8.00 FH
7740	43	8	315	85	MFM	17	8.00 FH

JCT

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
100	5	0	0	110	MFM	17	5.25 HH
105	7	0	0	110	MFM	17	5.25 HH
110	14	0	0	130	MFM	17	5.25 HH
120	20	0	0	100	MFM	17	5.25 HH
1000	5	0	0	0	MFM	17	5.25 HH
1005	7	0	0	0	MFM	17	5.25 HH
1010	14	0	0	0	MFM	17	5.25 HH

KALOK

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
KL320 Octagon I	21	4	615	48	MFM	17	3.50 HH
KL330 Octagon I	32	4	616	48	RLL	26	3.50 HH
KL332 Octagon	40	4	615	48	PS/2	26	3.50 HH
KL340 Octagon II	43	6	820	25	-	26	3.50 HH
KL341 Octagon I	40	4	644	25	SCSI	26	3.50 HH
KL342 Octagon I	43	4	676	30	PS/2	26	3.50 HH
KL343 Octagon I	40	4	644	25	AT-IDE	26	3.50 HH
KL360 Octagon II	66	6	820	25	RLL	26	3.50 HH
KL381 Octagpm II	85	6	815	25	SCSI	26	3.50 HH
KL383 Octagon II	85	6	815	25	AT-IDE	26	3.50 HH
KL3100 Octagon II	105	0	0	0	AT-IDE	0	3.50 HH

LANSTOR

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
LAN-64	71	8	1024	0	MFM	17	5.25 FH
LAN-115	119	15	918	0	MFM	17	5.25 FH
LAN-140	142	8	1024	0	ESDI	34	5.25 FH
LAN-180	109	8	1024	0	RLL	26	5.25 FH

LAPINE

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
3522	10	4	306	65	MFM	17	3.50 HH
LT 10	10	2	615	65	MFM	17	3.50 HH
LT 20	20	4	615	65	MFM	17	3.50 HH
LT 200	20	4	614	65	MFM	17	3.50 HH
LT 300	32	4	614	65	RLL	26	3.50 HH
LT 2000	20	4	614	65	MFM	17	3.50 HH
TITAN 20	21	4	615	65	MFM	17	3.50 HH
TITAN 30	33	4	615	65	RLL	26	3.50 HH
TITAN 3532	32	4	615	65	RLL	26	3.50 HH

MAXTOR

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
LXT-50	48	4	733	25	SCSI	32	3.50 HH
LXT-100	96	8	733	27	SCSI	32	3.50 HH
LXT-200A	207	7	1320	15	AT-IDE	33	3.50 HH
LXT-200S	207	7	1320	15	SCSI	33	3.50 HH
LXT-213A	213	7	1320	15	AT-IDE	55	3.50 HH
LXT-213S	213	7	1320	15	SCSI	55	3.50 HH
LXT-340A	340	7	1560	15	AT-IDE	0	3.50 HH
LXT-340S	340	7	1560	15	SCSI	0	3.50 HH
LXT-437S	437	0	0	13	SCSI	0	3.50 HH
LXT-535A	535	0	0	13	AT-IDE	0	3.50 HH
LXT-535S	535	0	0	13	SCSI	0	3.50 HH
P0-12S Panther	1027	15	1632	13	SCSI	72	5.25 FH
P1-08E Panther	696	9	1778	12	ESDI	72	5.25 FH

MAXTOR (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
P1-08S Panther	696	9	1778	12	SCSI	72	5.25 FH
P1-12E Panther	1051	15	1778	13	ESDI	72	5.25 FH
P1-12S Panther	1005	19	1216	10	SCSI	72	5.25 FH
P1-13E Panther	1160	15	1778	13	ESDI	72	5.25 FH
P1-16E Panther	1331	19	1778	13	ESDI	72	5.25 FH
P1-17E Panther	1470	19	1778	13	ESDI	72	5.25 FH
P1-17S Panther	1470	19	1778	13	SCSI	72	5.25 FH
RXT-800HS(WORM)	786	2	108	0	SCSI	0	5.25 FH
TAHITI (WORM)	650	2	35	0	SCSI	0	5.25 FH
XT 1050	50	5	917	50	MFM	17	5.25 FH
XT 1065	56	7	918	28	MFM	17	5.25 FH
XT 1085	71	8	1024	28	MFM	17	5.25 FH
XT 1105	87	11	918	27	MFM	17	5.25 FH
XT 1120R	104	8	1024	27	RLL	25	5.25 FH
XT 1140	119	15	918	27	MFM	17	5.25 FH
XT 1140E	140	15	1141	28	MFM	17	5.25 FH
XT 1240R	196	15	1024	27	RLL	25	5.25 FH
XT 2085	74	7	1224	30	MFM	17	5.25 FH
XT 2140	117	11	1224	30	MFM	17	5.25 FH
XT 2190	150	15	1224	30	MFM	17	5.25 FH
XT 3170	146	9	1224	30	SCSI	48	5.25 FH
XT 3280	227	15	1224	30	SCSI	26	5.25 FH
XT 3380	335	15	1224	27	SCSI	36	5.25 FH
XT 4170E	157	7	1224	16	ESDI	35	5.25 FH
XT 4170S	157	7	1224	16	SCSI	36	5.25 FH
XT 4175	150	7	1224	27	ESDI	35	5.25 FH
XT 4179E	158	7	1224	14	ESDI	36	5.25 FH
XT 4230E	203	9	1224	16	ESDI	35	5.25 FH
XT 4280E	241	11	1224	18	ESDI	35	5.25 FH
XT 4280S	338	11	1224	27	SCSI	36	5.25 FH
XT 4380	338	15	1224	16	MFM	17	5.25 FH
XT 4380E	338	15	1224	16	ESDI	35	5.25 FH
XT 4380S	338	15	1224	18	SCSI	36	5.25 FH

MAXTOR (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
XT 8380E	360	8	1632	16	ESDI	54	5.25 FH
XT 8380S	360	8	1632	16	SCSI	54	5.25 FH
XT 8610E	541	12	1632	16	ESDI	54	5.25 FH
XT 8702S	616	15	1551	16	SCSI	54	5.25 FH
XT 8760E	676	15	1632	18	ESDI	54	5.25 FH
XT 8760S	675	15	1632	18	SCSI	54	5.25 FH
XT 8800E	694	15	1274	15	ESDI	54	5.25 FH
XT 81000E	889	15	1632	16	ESDI	54	5.25 FH

MAXTOR COLORADO (also see Miniscribe)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
7040A Cheyene	41	2	1170	17	AT-IDE	36	3.50 HH
7040S Cheyene	40	2	1155	17	SCSI	36	3.50 HH
7060A Cheyene	65	0	0	15	AT-IDE	0	3.50 1"
70S0S Cheyene	65	0	0	15	SCSI	0	3.50 1"
7080A Cheyene	81	4	1170	17	AT-IDE	36	3.50 1"
7080S Cheyene	81	4	1155	17	SCSI	36	3.50 1"
7120A Cheyene	130	0	0	15	AT-IDE	0	3.50 1"
7120S Cheyene	130	0	0	15	SCSI	0	3.50 1"
8051A	43	4	745	28	AT-IDE	28	3.50 HH

MEGADRIVE

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
P-42	42	0	834	19	SCSI	0	3.50 HH
P-84	84	0	834	19	SCSI	0	3.50 HH
P-105	105	0	1019	19	SCSI	0	3.50 HH
P-120	120	0	1123	14	SCSI	0	3.50 HH
P-170	170	0	1123	14	SCSI	0	3.50 HH
P-210	210	0	1156	14	SCSI	0	3.50 HH
P-425	425	0	0	9	SCSI	0	3.50 HH

MEMOREX

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
310	2	2	118	90	MFM	17	5.25 FH
321	5	2	320	90	MFM	17	5.25 FH
322	10	4	320	90	MFM	17	5.25 FH
323	15	6	320	90	MFM	17	5.25 FH
324	20	8	320	90	MFM	17	5.25 FH
450	10	2	612	90	MFM	17	5.25 FH
512	25	3	961	90	MFM	17	5.25 FH
513	41	5	961	90	MFM	17	5.25 FH
514	58	7	961	90	MFM	17	5.25 FH

MICROPOLIS

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
1202	45	0	0	0	MFM	17	8.00 FH
1223	45	0	0	0	MFM	17	8.00 FH
1302	21	3	830	28	MFM	17	5.25 FH
1303	36	5	830	28	MFM	17	5.25 FH
1304	43	6	830	28	MFM	17	5.25 FH
1323	35	4	1024	28	MFM	17	5.25 FH
1323A	44	5	1024	28	MFM	17	5.25 FH
1324	53	6	1024	28	MFM	17	5.25 FH
1324A	62	7	1024	28	MFM	17	5.25 FH
1325	71	8	1024	28	MFM	17	5.25 FH
1333	35	4	1024	28	MFM	17	5.25 FH
1333A	44	5	1024	28	MFM	17	5.25 FH
1334	53	6	1024	28	MFM	17	5.25 FH
1334A	62	7	1024	28	MFM	17	5.25 FH
1335	71	8	1024	28	MFM	17	5.25 FH
1352	0	2	1024	23	ESDI	36	5.25 FH
1352A	41	3	1024	23	ESDI	36	5.25 FH
1353	79	4	1024	23	ESDI	~~35~~ 36	5.25 FH
1353A	99	5	1024	23	ESDI	35	5.25 FH
1354	119	6	1024	23	ESDI	35	5.25 FH
1354A	139	7	1024	23	ESDI	35	5.25 FH
1355	158	8	1024	23	ESDI	35	5.25 FH

MICROPOLIS (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
1373	76	4	1024	23	SCSI	36	5.25 FH
1373A	95	5	1024	23	SCSI	36	5.25 FH
1374	115	6	1024	23	SCSI	36	5.25 FH
1374A	134	7	1024	23	SCSI	36	5.25 FH
1375	158	8	1024	23	SCSI	36	5.25 FH
1488-15	675	15	1628	16	SCSI	54	5.25 FH
1516-10S	678	10	1840	13	ESDI	72	5.25 FH
1517-13	922	13	1925	14	ESDI	72	5.25 FH
1518-14	993	14	1925	14	ESDI	72	5.25 FH
1518-15	1064	15	1925	14	ESDI	72	5.25 FH
1538-15	872	15	1925	15	ESDI	71	5.25 FH
1551	149	7	1224	18	ESDI	34	5.25 FH
1554-7	158	7	1224	18	ESDI	36	5.25 FH
1554-11	234	11	1224	18	ESDI	34	5.25 FH
1555-8	180	8	1224	18	ESDI	36	5.25 FH
1555-9	203	9	1224	18	ESDI	36	5.25 FH
1555-12	255	12	1224	18	ESDI	34	5.25 FH
1556-10	226	10	1224	18	ESDI	36	5.25 FH
1556-11	248	11	1224	18	ESDI	36	5.25 FH
1556-13	276	13	1224	18	ESDI	34	5.25 FH
1557-12	270	12	1224	18	ESDI	36	5.25 FH
1557-13	293	13	1224	18	ESDI	36	5.25 FH
1557-14	315	14	1224	18	ESDI	36	5.25 FH
1557-15	338	15	1224	18	ESDI	36	5.25 FH
1558-14	315	14	1224	18	ESDI	36	5.25 FH
1558-15	338	15	1224	18	ESDI	36	5.25 FH
1566-11	496	11	1632	16	ESDI	54	5.25 FH
1567-12	541	12	1632	16	ESDI	54	5.25 FH
1567-13	586	13	1632	16	ESDI	54	5.25 FH
1568-14	631	14	1632	16	ESDI	54	5.25 FH
1568-15	676	15	1632	16	ESDI	54	5.25 FH
1576-11	243	11	1224	18	SCSI	36	5.25 FH

MICROPOLIS (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
1577-12	266	12	1224	18	SCSI	36	5.25 FH
1577-13	287	13	1224	18	SCSI	36	5.25 FH
1578-14	310	14	1224	18	SCSI	36	5.25 FH
1578-15	332	15	1224	16	SCSI	36	5.25 FH
1586-11	490	11	1632	16	SCSI	54	5.25 FH
1587-12	535	12	1632	16	SCSI	54	5.25 FH
1587-13	579	13	1632	16	SCSI	54	5.25 FH
1588-14	624	14	1632	16	SCSI	54	5.25 FH
1588-15	668	15	1632	16	SCSI	54	5.25 FH
1596-10S	668	10	1834	35	SCSI	72	5.25 FH
1597-13	909	13	1919	14	SCSI	72	5.25 FH
1598-14	979	14	1919	14	SCSI	72	5.25 FH
1598-15	1049	15	1919	14	SCSI	72	5.25 FH
1653-4	92	4	1249	16	ESDI	36	5.25 HH
1653-5	115	5	1249	16	ESDI	36	5.25 HH
1654-6	138	6	1249	16	ESDI	36	5.25 HH
1654-7	161	7	1249	16	ESDI	36	5.25 HH
1663-4	197	4	1780	14	ESDI	36	5.25 HH
1663-5	246	5	1780	14	ESDI	36	5.25 HH
1664-6	295	6	1780	14	ESDI	54	5.25 HH
1664-7	345	7	1780	14	ESDI	54	5.25 HH
1673-4	90	4	1249	16	SCSI	36	5.25 HH
1673-5	112	5	1249	16	SCSI	36	5.25 HH
1674-6	135	6	1249	16	SCSI	36	5.25 HH
1674-7	158	7	1249	16	SCSI	36	5.25 HH
1683-4	193	4	1776	14	SCSI	54	5.25 HH
1683-5	242	5	1776	14	SCSI	54	5.25 HH
1684-6	291	6	1776	14	SCSI	54	5.25 HH
1684-7	340	7	1776	14	SCSI	54	5.25 HH
1743-5	112	5	1140	15	AT-IDE	28	3.50 HH
1744-6	135	6	1140	15	AT-IDE	28	3.50 HH
1744-7	157	7	1140	15	AT-IDE	28	3.50 HH
1745-8	180	8	1140	15	AT-IDE	28	3.50 HH

MICROPOLIS (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
1745-9	202	9	1140	15	AT-IDE	28	3.50 HH
1773-5	112	5	1140	15	SCSI	28	3.50 HH
1774-6	135	6	1140	15	SCSI	28	3.50 HH
1774-7	157	7	1140	15	SCSI	28	3.50 HH
1775-8	180	8	1140	15	SCSI	28	3.50 HH
1775-9	202	9	1140	15	SCSI	28	3.50 HH

MICROSCIENCE

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
4050	45	5	1024	18	MFM	17	3.50 HH
4060	67	5	1024	18	RLL	26	3.50 HH
4070	62	7	1024	18	RLL	26	3.50 HH
4090	93	7	1024	18	RLL	26	3.50 HH
5100	110	7	855	18	ESDI	36	3.50 HH
6100	110	7	855	18	SCSI	36	3.50 HH
7040	47	3	855	18	AT-IDE	36	3.50 HH
7100	110	7	855	18	AT-IDE	36	3.50 HH
FH 2777E	777	0	0	14	ESDI	0	5.25 FH
FH 2777S	777	0	0	14	SCSI	0	5.25 FH
FH 3777E	1200	0	0	14	ESDI	0	5.25 FH
FH 3777S	1200	0	0	14	SCSI	0	5.25 FH
HH 312	10	4	306	65	MFM	17	5.25 HH
HH 315	10	4	306	65	MFM	17	5.25 HH
HH 325	21	4	615	65	MFM	17	5.25 HH
HH 330	32	4	612	65	RLL	26	5.25 HH
HH 612	11	4	306	99	MFM	17	5.25 HH
HH 625	21	4	612	65	MFM	17	5.25 HH
HH 712	10	2	612	105	MFM	17	5.25 HH
HH 712A	10	2	612	75	MFM	17	5.25 HH
HH 725	21	4	615	105	MFM	17	5.25 HH
HH 738	32	4	612	105	RLL	26	5.25 HH
HH 825	21	4	615	65	MFM	17	5.25 HH
HH 830	32	4	615	65	RLL	26	5.25 HH

MICROSCIENCE (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
HH 1050	45	5	1024	28	MFM	17	5.25 HH
HH 1060	66	5	1024	28	RLL	26	5.25 HH
HH 1075	62	7	1024	28	MFM	17	5.25 HH
HH 1080	67	7	1024	28	SCSI	26	5.25 HH
HH 1090	80	7	1314	28	MFM	17	5.25 HH
HH 1095	95	7	1024	28	RLL	26	5.25 HH
HH 1120	122	7	1314	28	RLL	26	5.25 HH
HH 2012	10	4	306	80	MFM	17	5.25 HH
HH 2085	72	5	1024	28	ESDI	36	5.25 HH
HH 2120	121	7	1024	28	ESDI	35	5.25 HH
HH 2160	160	7	1276	28	ESDI	34	5.25 HH
HH 3120	122	7	1314	28	SCSI	26	5.25 HH
HH 3160	170	7	1314	28	SCSI	36	5.25 HH

MINISCRIBE (also see Maxtor Colorado)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
1006	5	2	306	179	MFM	17	5.25 FH
1012	10	4	306	179	MFM	17	5.25 FH
2006	5	2	306	93	MFM	17	5.25 FH
2012	11	4	306	85	MFM	17	5.25 HH
3006	5	2	306	0	MFM	17	5.25 HH
3012	10	2	612	155	MFM	17	5.25 HH
3053	44	5	1024	25	MFM	17	5.25 HH
3085	71	7	1170	22	MFM	17	5.25 HH
3085E	72	3	1270	17	ESDI	36	5.25 HH
3085S	72	3	1255	17	SCSI	36	5.25 HH
3130E	112	5	1250	17	ESDI	36	5.25 HH
3130S	115	5	1255	17	SCSI	36	5.25 HH
3180E	157	7	1250	17	ESDI	36	5.25 HH
3180S	153	7	1255	17	SCSI	36	5.25 HH
3180SM	160	7	1250	17	SCSI-MAC	36	5.25 HH
3212	11	2	612	85	MFM	17	5.25 HH
3212 PLUS	11	2	612	53	MFM	17	5.25 HH

MINISCRIBE (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
3412	21	4	615	60	MFM	17	5.25 HH
3425	21	4	615	85	MFM	17	5.25 HH
3425 PLUS	21	4	612	53	MFM	17	5.25 HH
3438	32	4	615	85	RLL	26	5.25 HH
3438 PLUS	32	4	612	53	RLL	26	5.25 HH
3650	42	6	809	61	MFM	17	5.25 HH
3650F	42	6	809	46	MFM	17	5.25 HH
3675	63	6	809	61	RLL	26	5.25 HH
4010	8	2	480	133	MFM	17	5.25 FH
4020	17	4	480	133	MFM	17	5.25 FH
5330	25	6	480	0	MFM	17	5.25 FH
5338	32	6	612	0	MFM	17	5.25 FH
5440	32	8	480	0	MFM	17	5.25 FH
5451	43	8	612	0	MFM	17	5.25 FH
6032	26	3	1024	28	MFM	17	5.25 FH
6053	44	5	1024	28	MFM	17	5.25 FH
6053 II	44	5	1024	28	MFM	17	5.25 FH
6074	62	7	1024	28	MFM	17	5.25 FH
6079	68	5	1024	28	RLL	26	5.25 FH
6085	71	8	1024	28	MFM	17	5.25 FH
6128	110	8	1024	28	RLL	26	5.25 FH
6170E	130	8	1024	28	ESDI	36	5.25 FH
6212	10	2	612	90	MFM	17	5.25 FH
7040A	40	4	980	19	AT-IDE	36	3.50 3H
7040S	40	2	1156	19	SCSI	0	3.50 3H
7080A	80	4	980	19	AT-IDE	36	3.50 3H
7080S	81	4	1155	19	SCSI	36	3.50 3H
7426	21	4	612	65	MFM	17	3.50 HH
8048	40	0	0	0	SCSI	0	3.50 HH
8051A	43	4	745	28	AT-IDE	28	3.50 HH
8051AT	42	4	745	28	AT-IDE	0	3.50 HH
8051S	45	4	793	28	SCSI	28	3.50 HH
8212	11	2	612	68	MFM	17	3.50 HH

MINISCRIBE (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
8225	20	2	771	68	RLL	26	3.50 HH
8225AT	21	2	745	28	AT-IDE	28	3.50 HH
8225-C	21	2	798	68	RLL	26	3.50 HH
8225S	21	2	804	68	SCSI	26	3.50 HH
8225XT	21	2	805	68	XT-IDE	26	3.50 HH
8412	10	4	306	50	MFM	17	3.50 HH
8425	21	4	615	68	MFM	17	3.50 HH
8425F	21	4	615	40	MFM	17	3.50 HH
8425S	21	4	612	68	MFM	17	3.50 HH
8425XT	21	4	615	68	MFM	17	3.50 HH
8434F	32	4	615	40	RLL	26	3.50 HH
8438	32	4	615	68	RLL	26	3.50 HH
8438F	32	4	615	40	RLL	26	3.50 HH
8438XT	31	4	615	68	XT-IDE	26	3.50 HH
8450	40	4	771	45	RLL	26	3.50 HH
8450AT	42	4	745	40	AT-IDE	28	3.50 HH
8450-C	42	4	748	45	RLL	26	3.50 HH
8450XT	42	4	805	45	XT-IDE	26	3.50 HH
9000E	338	15	1224	16	ESDI	36	5.25 FH
9000S	347	15	1220	16	SCSI	36	5.25 FH
9230	203	9	1224	36	ESDI/SCSI	36	5.25 FH
9380E	338	15	1224	16	ESDI	36	5.25 FH
9380S	347	15	1224	16	SCSI	36	5.25 FH
9380SM	319	15	1218	16	SCSI-MAC	36	5.25 FH
9424E	360	8	1661	17	ESDI	54	5.25 FH
9424S	355	8	1661	17	SCSI	54	5.25 FH
9780E	676	15	1661	17	ESDI	54	5.25 FH
9780S	668	15	1661	17	SCSI	54	5.25 FH

MITSUBISHI

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
M2860-1	21	0	0	0	MFM	17	8.00 FH
M2860-2	50	0	0	0	MFM	17	8.00 FH
M2860-3	85	0	0	0	MFM	17	8.00 FH
MR 521	10	2	612	85	MFM	17	5.25 HH
MR 522	20	4	612	85	MFM	17	5.25 HH
MR 533	25	3	971	0	MFM	17	5.25 HH
MR 535	42	5	977	28	MFM	17	5.25 HH
MR 535R	65	5	977	28	RLL	26	5.25 HH
MR 535S	50	5	977	28	SCSI	26	5.25 HH
MR 537S	76	5	977	28	SCSI	26	5.25 HH
MR 5310E	101	5	977	28	ESDI	26	5.25 HH
MW-5C1 (WORM)	300	0	0	85	SCSI	0	5.25 FH
MW-5D1 (WORM)	300	0	0	80	ESDI	0	5.25 FH

MMI

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
M 106	5	2	306	75	MFM	17	3.50 HH
M 112	10	4	306	75	MFM	17	3.50 HH
M 125	20	8	306	75	MFM	17	3.50 HH
M 212	10	4	306	75	MFM	17	5.25 HH
M 225	20	8	306	75	MFM	17	5.25 HH
M 306	5	2	306	75	MFM	17	3.50 HH
M 312	10	4	306	75	MFM	17	5.25 HH
M 325	20	8	306	75	MFM	17	5.25 HH
M 5012	10	4	306	75	MFM	17	3.50 HH

NCR

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
6091-5101	323	9	0	27	SCSI	0	5.25
6091-5301	675	15	0	25	SCSI	0	5.25

NEC

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
2247	87	6	841	80	SMD	var	8.00 FH
D 3126	20	4	615	85	MFM	17	3.50 HH
D 3142	42	8	642	28	MFM	32	3.50 HH
D 3146H	40	8	615	35	MFM	32	3.50 HH
D 3661	118	7	915	0	ESDI	36	3.50 HH
D 3735	56	2	1084	20	AT-IDE	41	3.50 1"
D 3755	105	4	1250	20	AT-IDE	41	3.50 1"
D 3761	114	7	915	20	AT-IDE	35	3.50 HH
D 3835	45	2	1084	20	SCSI	41	3.50 1"
D 3855	105	4	1250	20	SCSI	41	3.50 1"
D 3861	114	7	915	20	SCSI	35	3.50 HH
D 3881	520	0	0	15	SCSI	0	3.50 HH
D 5114	5	2	306	0	MFM	17	5.25
D 5124	10	4	309	85	MFM	17	5.25 HH
D 5126	20	4	612	85	MFM	17	5.25 HH
D 5126H	20	4	612	40	MFM	17	5.25 HH
D 5127H	32	4	615	0	RLL	26	-
D 5146	40	8	615	85	MFM	17	5.25 HH
D 5146H	40	8	615	40	MFM	17	5.25 HH
D 5147H	65	8	615	0	RLL	26	-
D 5392	1322	0	0	14	IPI-2	0	5.25 FH
D 5452	71	10	823	0	MFM	17	-
D 5652	143	10	823	23	ESDI	0	5.25 HH
D 5655	153	7	1224	18	ESDI	35	5.25 HH
D 5662	319	15	1224	16	ESDI	34	5.25 FH
D 5682	664	15	1633	16	ESDI	53	5.25 FH
D 5862	385	8	0	18	SCSI	0	5.25 FH
D 5882	665	15	1633	16	SCSI	53	5.25 FH
D 5892	1404	19	1678	14	SCSI	86	5.25 FH

NEI

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
RD 3127	10	2	612	0	MFM	17	5.25
RD 3255	21	4	612	0	MFM	17	5.25
RD 4127	10	4	306	0	MFM	17	5.25
RD 4255	21	8	306	0	MFM	17	5.25

NEWBURY DATA

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
NDR 320	21	4	615	0	MFM	17	5.25
NDR 340	42	8	615	0	MFM	17	3.50 HH
NDR 360	65	8	615	0	RLL	26	-
NDR 1065	55	7	918	25	MFM	17	5.25 FH
NDR 1085	71	8	1025	26	MFM	17	5.25 FH
NDR 1105	87	11	918	25	MFM	17	5.25 FH
NDR 1140	119	15	918	25	MFM	17	5.25 FH
NDR 2085	74	7	1224	28	MFM	17	5.25 FH
NDR 2140	117	11	1224	28	MFM	17	5.25 FH
NDR 2190	191	15	918	28	MFM	17	5.25 FH
NDR 3170S	146	9	1224	28	SCSI	26	5.25 FH
NDR 3280S	244	15	1224	28	SCSI	26	5.25 FH
NDR 4170	149	7	1224	28	ESDI	34	5.25 FH
NDR 4175	179	7	1224	28	ESDI	36	5.25 FH
NDR 4380	384	15	1224	28	ESDI	36	5.25 FH
NDR 4380S	319	15	1224	28	SCSI	34	5.25 FH
PENNY 340	42	8	615	28	MFM	17	5.25

NPL

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
4064	5	0	0	0	MFM	17	5.25 FH
4127	10	0	0	0	MFM	17	5.25 FH
4191S	15	0	0	0	MFM	17	5.25 FH
4255	20	0	0	0	MFM	17	5.25 FH
NP 02-26S	22	4	640	0	MFM	17	5.25
NP 03-13	10	4	306	0	MFM	17	5.25
NP 03-6	5	2	306	0	MFM	17	5.25

OKIDATA

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
OD 526	31	4	612	0	RLL	26	3.50 HH
OD 540	47	6	612	0	RLL	26	3.50 HH

OLIVETTI

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
HD662/11	10	2	612	65	MFM	17	5.25 HH
HD662/12	20	4	612	65	MFM	17	5.25 HH
XM 5210	10	4	612	65	MFM	17	5.25 HH
XM 5220/2	20	0	0	85	MFM	17	5.25 FH

OPTIMA

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
Minipak 100	104	4	0	25	SCSI	0	3.50 HH
Minipak 200	209	8	0	20	SCSI	0	3.50 HH
Minipak 300	320	0	0	13	SCSI	0	3.50 HH
Concorde 635	640	14	0	16	SCSI	0	5.25 HH
Concorde 1050	1050	15	0	15	SCSI	0	5.25 HH
Diskovery 420	416	8	0	16	SCSI	0	5.25 HH

ORCA TECHNOLOGY

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
320A	370	9	0	12	AT-IDE	0	3.50 HH
320S	370	9	0	12	SCSI	0	3.50 HH
400A	470	9	0	12	AT-IDE	0	3.50 HH
400S	470	9	0	12	SCSI	0	3.50 HH
760E	760	15	0	14	ESDI	0	5.25 HH
760S	760	15	0	14	SCSI	0	5.25 HH

OTARI (also see Disctron)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
C 214	10	4	306	0	MFM	17	5.25 FH
C 507	5	2	306	79	MFM	17	5.25 FH
C 514	10	4	306	79	MFM	17	5.25 FH
C 519	15	6	306	79	MFM	17	5.25 FH
C 526	21	8	306	0	MFM	17	5.25 FH

PACIFIC MAGTRON

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
MT-4115E	115	0	0	16	ESDI	0	5.25 HH
MT-4115S	115	0	0	16	SCSI	0	5.25 HH
MT-4140E	140	0	0	16	ESDI	0	5.25 HH
MT-4140S	140	0	0	16	SCSI	0	5.25 HH
MT-4170E	170	0	0	16	ESDI	0	5.25 HH
MT-4170S	170	0	0	16	SCSI	0	5.25 HH

PANASONIC

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
JU-116	20	4	615	85	MFM	17	3.50 HH
JU-128	42	7	733	35	MFM	17	3.50 HH

PRAIRIETEK

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
Prairie 120	21	2	615	23	AT-IDE	34	2.50 .6"
Prairie 140	40	2	0	0	AT-IDE	0	2.50 .6"
Prairie 220A	20	4	612	28	AT-IDE	0	2.50 1"
Prairie 220B	20	4	612	28	SCSI	0	2.50 1"
Prairie 240	43	4	615	28	AT-IDE	34	2.50 1"
Prairie 242A	41	4	0	0	XT/AT-IDE	0	2.50 1"
Prairie 242S	41	4	0	0	SCSI	0	2.50 1"
Prairie 282S	82	4	0	0	SCSI	0	2.50 1"
Prairie 282A	82	4	0	0	AT-IDE	0	2.50 1"

PRIAM (also see Vertex)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
502	46	7	755	0	MFM	17	5.25 FH
504	46	7	755	0	MFM	17	5.25 FH
514	117	11	1224	22	MFM	17	5.25 FH
519	160	15	1224	22	MFM	17	5.25 FH
617	153	7	1225	20	ESDI	36	5.25 FH
623	196	15	752	0	ESDI	34	5.25 FH
628	241	11	1225	20	ESDI	36	5.25 FH
630	319	15	1224	15	ESDI	34	5.25 FH

PRIAM (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
638	329	15	1225	20	ESDI	36	5.25 FH
717	153	7	1225	20	SCSI	17	5.25 FH
728	241	11	1225	20	SCSI	26	5.25 FH
738	329	15	1225	20	SCSI	36	5.25 FH
3504	44	0	0	0	RLL	26	3.50 HH
ID20	26	3	987	23	MFM	17	5.25 FH
ID45H	44	5	1024	23	MFM	17	5.25 FH
ID330	338	15	1225	18	ESDI	36	5.25 FH
ID/ED40	43	5	987	23	MFM	17	5.25 FH
ID/ED45	44	5	1166	23	MFM	17	5.25 FH
ID/ED60	59	7	1018	30	MFM	17	5.25 FH
ID/ED62	62	7	1166	23	MFM	17	5.25 FH
ID/ED75	73	5	1166	23	RLL	25	5.25 FH
ID/ED100	103	7	1166	15	RLL	25	5.25 FH
ID/ED120	121	7	1024	28	ESDI	33	5.25 HH
ID/ED130	132	15	1224	13	MFM	17	5.25 FH
ID/ED150	159	7	1276	28	ESDI	35	5.25 HH
ID/ED160	158	7	1225	18	ESDI	36	5.25 FH
ID160E-PS2	152	7	1195	18	PS/2	36	5.25 FH
ID200L-I	200	0	0	15	AT-IDE	0	5.25 FH
ID/ED230	233	15	1224	11	RLL	25	5.25 FH
ID/ED250	248	11	1225	18	ESDI	36	5.25 FH
ID330E	336	15	1218	18	ESDI	36	5.25 FH
ID330E-PS/2	330	15	1195	18	PS/2	36	5.25 FH
ID330S	338	15	1218	18	SCSI	36	5.25 FH
ID340H-U	340	7	0	14	ESDI	0	5.25 FH
ID660-U	660	15	0	16	ESDI	0	5.25 FH
ID700E	701	0	0	0	ESDI	0	5.25 FH
ID700S	668	0	0	0	SCSI	0	5.25 FH
V 130R	39	3	987	28	RLL	26	5.25 FH
V 150	42	5	987	28	MFM	17	5.25 FH
V 160	50	5	1166	28	MFM	17	5.25 FH
V 170	60	7	987	28	MFM	17	5.25 FH

PRIAM (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
V 170R	91	7	987	0	RLL	26	5.25 FH
V 185	71	7	1166	28	MFM	17	5.25 FH
V 519	159	15	1224	0	MFM	17	5.25 FH
V 519-	62	7	1024	0	MFM	17	5.25 FH

PROCOM

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
Propaq 185-15	189	5	0	15	AT-IDE	0	3.50 HH
HiPer 380	388	8	0	17	ESDI	0	5.25
Si 200/PS3	209	4	0	18	SCSI	0	3.50 HH
Si 585/S5	601	8	0	17	SCSI	0	5.25
Si 1000/S5	1037	8	0	15	SCSI	0	5.25

PTI

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
PT-225	21	4	615	35	MFM	17	3.50 HH
PT-234	28	4	820	35	MFM	17	3.50 HH
PT-238A	32	4	615	35	AT-IDE	26	3.50 HH
PT-238R	32	4	615	35	RLL	26	3.50 HH
PT-238S	32	4	615	35	SCSI	26	3.50 HH
PT-251A	43	4	820	35	AT-IDE	26	3.50 HH
PT-251R	43	4	820	35	RLL	26	3.50 HH
PT-251S	43	4	820	35	SCSI	26	3.50 HH
PT-325R	21	4	615	65	RLL	26	3.50 HH
PT-338	32	6	615	35	MFM	17	3.50 HH
PT-338R	32	4	615	65	RLL	26	3.50 HH
PT-351	42	6	820	35	MFM	17	3.50 HH
PT-351R	60	0	0	0	RLL	26	3.50 HH
PT-357A	49	6	615	35	AT-IDE	26	3.50 HH
PT-357R	49	6	615	35	RLL	26	3.50 HH
PT-357S	49	6	615	35	SCSI	26	3.50 HH
PT-376A	65	6	820	35	AT-IDE	26	3.50 HH
PT-376R	65	6	820	35	RLL	26	3.50 HH

PTI (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
PT-376S	65	6	820	35	SCSI	26	3.50 HH
PT-468	57	8	820	35	MFM	17	3.50 HH
PT-4102A	87	8	820	35	AT-IDE	26	3.50 HH
PT-4102R	87	8	820	28	RLL	26	3.50 HH

QUANTUM

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
2010	10	0	0	0	MFM	17	8.00 FH
2020	20	0	0	0	MFM	17	8.00 FH
2030	30	0	0	0	MFM	17	8.00 FH
2040	40	0	0	0	MFM	17	8.00 FH
2080	80	0	0	0	MFM	17	8.00 FH
ProDrive 40AT	42	3	0	19	AT-IDE	0	3.50 HH
ProDrive 40S	42	3	834	19	SCSI	0	3.50 HH
ProDrive 80AT	84	6	834	19	AT-IDE	0	3.50 HH
ProDrive 80S	84	6	834	19	SCSI	0	3.50 HH
ProDrive 100E	103	6	1019	19	ESDI	0	3.50 HH
ProDrive 105S	105	6	1019	19	SCSI	0	3.50 HH
ProDrive 120AT	120	5	1123	19	AT-IDE	0	3.50 HH
ProDrive 120S	120	5	1123	15	SCSI	0	3.50 HH
ProDrive 145E	145	0	0	19	ESDI	0	3.50 HH
ProDrive 170AT	168	0	0	19	AT-IDE	0	3.50 HH
ProDrive 170S	168	7	1123	15	SCSI	0	3.50 HH
ProDrive 210AT	210	7	1156	15	AT-IDE	0	3.50 HH
ProDrive 210S	210	7	1156	15	SCSI	0	3.50 HH
ProDrive 330AT	330	0	0	14	AT-IDE	0	3.50 HH
ProDrive 330S	330	0	0	14	SCSI	0	3.50 HH
ProDrive 425AT	425	0	0	14	AT-IDE	0	3.50 HH
ProDrive 425S	425	0	0	14	SCSI	0	3.50 HH
ProDrive GEM 80A	84	0	0	19	AT-IDE	0	3.50 HH
ProDrive GEM 80S	84	0	0	19	SCSI	0	3.50 HH
ProDrive GEM 160A	168	0	0	19	AT-IDE	0	3.50 HH
ProDrive GEM 160S	168	0	0	19	SCSI	0	3.50 HH

QUANTUM (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
ProDrive LPS 52AT	52	2	1219	17	AT-IDE	0	3.50 3H
ProDrive LPS 52S	52	2	1219	17	SCSI	0	3.50 3H
ProDrive LPS 105AT	105	4	1219	17	AT-IDE	0	3.50 3H
ProDrive LPS 105S	105	4	1219	17	SCSI	0	3.50 3H
Q-160	200	12	971	16	SCSI	36	5.25 HH
Q-250	53	4	823	28	SCSI	36	5.25 HH
Q-280	80	6	823	28	SCSI	36	5.25 HH
Q-510	8	2	512	0	MFM	17	5.25 HH
Q-520	18	4	512	0	MFM	17	5.25 HH
Q-530	27	6	512	47	MFM	17	5.25 FH
Q-540	36	8	512	40	MFM	17	5.25 FH

QUME

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
R 200	0	0	0	0	MFM	17	5.25
R 300	0	0	0	0	MFM	17	5.25

RICOH

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
RH-5130	10	2	612	85	MFM	17	-
RH-5260	10	2	615	85	MFM	17	-
RH-5261	10	2	612	85	SCSI	0	-
RH-5500	50	2	1285	25	SCSI	76	5.25 HH
RS-9150AR	49	2	1285	25	SCSI	76	5.25 HH

RMS

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
RMS 506	5	4	153	130	MFM	17	5.25
RMS 509	7.5	6	153	130	MFM	17	5.25
RMS 512	10	8	153	130	MFM	17	5.25

RODIME

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
Cobra 40at	40	0	0	20	ESDI	0	3.50 HH
Cobra 80at	80	0	0	20	ESDI	0	3.50 HH
Cobra 110at	110	4	0	20	ESDI	0	3.50 HH
Cobra 110e	105	4	0	18	SCSI	0	3.50 HH
Cobra 210at	210	5	0	20	ESDI	0	3.50 HH
Cobra 210e	210	5	0	18	SCSI	0	3.50 HH
Cobra 650e	650	15	0	17	SCSI	0	5.25
RO 101	6	2	192	0	MFM	17	5.25 FH
RO 102	12	4	192	0	MFM	17	5.25 FH
RO 103	18	6	192	55	MFM	17	5.25 FH
RO 104	24	8	192	0	MFM	17	5.25 FH
RO 200	11	4	320	0	MFM	17	5.25 FH
RO 201	5	2	321	85	MFM	17	5.25 FH
RO 201E	11	2	640	55	MFM	17	5.25 FH
RO 202	10	4	321	85	MFM	17	5.25 HH
RO 202E	21	4	640	55	MFM	17	5.25 FH
RO 203	15	6	321	85	MFM	17	5.25 HH
RO 203E	32	6	640	55	MFM	17	5.25 FH
RO 204	21	8	320	85	MFM	17	5.25 FH
RO 204E	43	8	640	55	MFM	17	5.25 FH
RO 251	5	2	306	85	MFM	17	5.25 HH
RO 252	11	4	306	85	MFM	17	5.25 HH
RO 351	5	2	306	85	MFM	17	3.50 HH
RO 352	11	4	306	85	MFM	17	3.50 HH
RO 365	21	4	612	0	MFM	17	3.50 HH
RO 652A	20	0	0	85	SCSI	0	3.50 HH
RO 652B	20	4	306	85	SCSI	0	3.50 HH
RO 752A	25	0	0	85	SCSI	0	5.25 HH
RO 3000	43	5	625	0	ESDI	27	3.50 HH
RO 3045	37	5	872	28	MFM	17	3.50 HH
RO 3055	45	6	872	28	MFM	17	3.50 HH
RO 3057S	45	5	680	28	SCSI	0	3.50 HH

RODIME (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
RO 3058A	45	3	868	18	AT-IDE	0	3.50 HH
RO 3058T	45	3	868	18	SCSI	0	3.50 HH
RO 3059A	59	2	1216	18	AT-IDE	0	3.50 HH
RO 3059T	47	2	1216	18	SCSI	0	3.50 HH
RO 3060R	49	5	750	28	RLL	26	3.50 HH
RO 3065	53	7	872	28	MFM	17	3.50 HH
RO 3070S	71	0	0	28	SCSI	0	3.50 HH
RO 3075R	59	6	750	28	RLL	26	3.50 HH
RO 3085R	69	7	750	28	RLL	26	3.50 HH
RO 3085S	85	7	750	28	SCSI	0	3.50 HH
RO 3088A	76	5	868	18	AT-IDE	0	3.50 HH
RO 3088T	76	5	868	18	SCSI	0	3.50 HH
RO 3089A	70	3	1216	18	AT-IDE	0	3.50 HH
RO 3089T	70	3	1216	18	SCSI	0	3.50 HH
RO 3095A	80	0	0	18	AT-IDE	0	3.50 HH
RO 3128A	105	7	868	18	AT-IDE	0	3.50 HH
RO 3128T	105	7	868	18	SCSI	0	3.50 HH
RO 3129A	106	5	1091	18	AT-IDE	0	3.50 HH
RO 3129T	106	5	1091	18	SCSI	0	3.50 HH
RO 3130S	106	7	1047	22	SCSI	30	5.25 HH
RO 3135A	112	7	923	19	AT-IDE	0	3.50 HH
RO 3139A	112	5	1168	18	AT-IDE	0	3.50 HH
RO 3151A	122	0	0	0	AT-IDE	0	3.50 HH
RO 3259A	210	0	0	0	AT-IDE	0	3.50 HH
RO 3259T	210	0	0	0	SCSI	0	3.50 HH
RO 5040	38	3	1224	28	MFM	17	-
RO 5065	63	5	1224	28	MFM	17	5.25 HH
RO 5075S	76	0	0	28	SCSI	0	5.25 HH
RO 5090	89	7	1224	28	MFM	17	5.25 HH
RO 5125E	127	6	1224	0	ESDI	34	-
RO 5125S	127	5	1219	28	SCSI	0	5.25 HH
RO 5130R	114	7	1224	0	RLL	26	-
RO 5178S	144	7	1219	19	SCSI	0	5.25 HH

RODIME (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
RO 5130R	114	7	1224	0	RLL	26	-
RO 5178S	144	7	1219	19	SCSI	0	5.25 HH

SEAGATE

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
ST 124	21	4	615	40	MFM	17	3.50 HH
ST 125	21	4	615	40	MFM	17	3.50 HH
ST 125-1	21	4	615	28	MFM	17	3.50 HH
ST 125A	21	4	404	40	AT-IDE	26	3.50 HH
ST 125A-1	21	4	404	28	AT-IDE	26	3.50 HH
ST 125N	21	4	407	40	SCSI	26	3.50 HH
ST 125N-1	21	4	407	28	SCSI	26	3.50 HH
ST 137R	33	4	615	40	RLL	26	3.50 HH
ST 138	32	6	615	40	MFM	17	3.50 HH
ST 138-1	32	6	615	28	MFM	17	3.50 HH
ST 138A	32	4	604	40	AT-IDE	26	3.50 HH
ST 138A-1	32	4	604	28	AT-IDE	26	3.50 HH
ST 138N	32	4	615	40	SCSI	26	3.50 HH
ST 138N-1	32	4	615	28	SCSI	26	3.50 HH
ST 138R	33	4	615	40	RLL	26	3.50 HH
ST 138R-1	32	4	615	28	RLL	26	3.50 HH
ST 151	43	5	977	24	MFM	17	3.50 HH
ST 157A	45	6	560	40	AT-IDE	26	3.50 HH
ST 157A-1	44	6	560	28	AT-IDE	26	3.50 HH
ST 157N	49	6	615	40	SCSI	26	3.50 HH
ST 157N-1	48	6	615	28	SCSI	26	3.50 HH
ST 157R	49	6	615	40	RLL	26	3.50 HH
ST 157R-1	49	6	615	28	RLL	26	3.50 HH
ST 177N	61	5	921	24	SCSI	26	3.50 HH
ST 206	5	2	306	0	MFM	17	5.25 HH
ST 212	10	4	306	0	MFM	17	5.25 HH
ST 213	10	2	615	65	MFM	17	5.25 FH

SEAGATE (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
ST 224N	21	2	615	70	MFM	17	5.25 HH
ST 225	21	4	615	65	MFM	17	5.25 HH
ST 225N	21	4	615	65	SCSI	17	5.25 HH
ST 225R	21	2	667	70	RLL	31	5.25 HH
ST 238R	32	4	615	65	RLL	26	5.25 HH
ST 250N	43	4	615	70	SCSI	26	5.25 HH
ST 250R	42	4	667	70	RLL	31	5.25 HH
ST 251	43	6	820	40	MFM	17	5.25 HH
ST 251-1	43	6	820	28	MFM	17	5.25 HH
ST 251N	43	4	820	40	SCSI	26	5.25 HH
ST 251N-1	43	4	630	28	SCSI	34	5.25 HH
ST 251R	43	4	820	40	RLL	26	5.25 HH
ST 252	43	6	820	40	MFM	17	3.50 HH
ST 253	43	5	989	28	MFM	17	5.25 HH
ST 274A	65	5	948	28	AT-IDE	26	5.25 HH
ST 277N	65	6	820	40	SCSI	26	5.25 HH
ST 277N-1	65	6	628	28	SCSI	34	5.25 HH
ST 277R	66	6	820	40	RLL	26	5.25 HH
ST 277R-1	66	6	820	28	RLL	26	5.25 HH
ST 278R	66	6	820	40	RLL	26	5.25 HH
ST 279R	65	5	989	28	RLL	26	5.25 HH
ST 280A	71	5	1032	28	AT-IDE	26	5.25 HH
ST 296N	85	6	820	28	SCSI	34	5.25 HH
ST 325A	21	2	697	45	AT-IDE	30	3.50 HH
ST 325N	21	2	697	45	SCSI	30	3.50 HH
ST 325X	21	2	697	45	XT-IDE	30	3.50 HH
ST 351A/X	43	2	820	28	XT/AT-IDE	17	3.50 HH
ST 406	5	2	306	85	MFM	17	5.25 FH
ST 412	10	4	306	85	MFM	17	5.25 FH
ST 419	15	6	306	85	MFM	17	5.25 FH
ST 425	21	8	306	65	MFM	17	5.25 FH
ST 506	5	4	153	85	MFM	17	5.25 FH
ST 706	5	2	306	0	MFM	17	5.25 FH

SEAGATE (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
ST 1057A	49	3	940	18	AT-IDE	34	3.50 HH
ST 1057N	49	3	940	20	SCSI-2	34	3.50 HH
ST 1090A	79	5	1072	15	AT-IDE	29	3.50 HH
ST 1090N	79	5	1068	15	SCSI	29	3.50 HH
ST 1096N	84	7	906	24	SCSI	26	3.50 HH
ST 1100	88	9	1072	15	MFM	17	3.50 HH
ST 1102A	89	5	1024	18	AT-IDE	34	3.50 HH
ST 1102N	84	5	965	20	SCSI-2	34	3.50 HH
ST 1106R	91	7	977	24	RLL	26	3.50 HH
ST 1111A	98	5	1072	15	AT-IDE	36	3.50 HH
ST 1111E	98	5	1072	15	ESDI	36	3.50 HH
ST 1111N	98	5	1068	15	SCSI	36	3.50 HH
ST 1126A	111	7	1072	15	AT-IDE	29	3.50 HH
ST 1126N	111	7	1068	15	SCSI	29	3.50 HH
ST 1133A	117	5	1272	15	AT-IDE	36	3.50 HH
ST 1133NS	116	5	1268	15	SCSI-2	36	3.50 HH
ST 1144A	126	7	1024	18	AT-IDE	36	3.50 HH
ST 1144N	126	7	0	20	SCSI-2	32	3.50 HH
ST 1150R	128	9	1072	15	RLL	26	3.50 HH
ST 1156A	138	7	1072	15	AT-IDE	36	3.50 HH
ST 1156E	138	7	1072	15	ESDI	36	3.50 HH
ST 1156N	138	7	1068	15	SCSI	36	3.50 HH
ST 1156NS	138	7	1068	15	SCSI-2	36	3.50 HH
ST 1162A	143	9	1072	15	AT-IDE	29	3.50 HH
ST 1162N	142	9	1068	15	SCSI	29	3.50 HH
ST 1186A	164	7	1272	15	AT-IDE	36	3.50 HH
ST 1186NS	163	7	1268	15	SCSI-2	36	3.50 HH
ST 1201A	177	9	1072	15	AT-IDE	36	3.50 HH
ST 1201E	177	9	1072	15	ESDI	36	3.50 HH
ST 1201N	177	9	1068	15	SCSI	36	3.50 HH
ST 1201NS	177	9	1068	15	SCSI-2	36	3.50 HH
ST 1239A	211	9	1272	15	AT-IDE	36	3.50 HH
ST 1239NS	210	9	1268	15	SCSI-2	36	3.50 HH

SEAGATE (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
ST 1274A	230	0	0	18	AT-IDE	0	3.50 HH
ST 1400A	331	0	0	14	AT-IDE	0	3.50 HH
ST 1400N	331	7	1476	14	SCSI-2	0	3.50 HH
ST 1401N	338	9	1100	12	SCSI-2	0	3.50 HH
ST 1410A	340	0	0	14	AT-IDE	0	3.50 HH
ST 1410N	340	0	0	14	SCSI	0	3.50 HH
ST 1480A	426	9	1474	14	AT-IDE	62	3.50 HH
ST 1480N/ND	426	9	1476	14	SCSI-2	0	3.50 HH
ST 2106E	94	5	1024	18	ESDI	34	5.25 HH
ST 2106N/NM	91	5	1024	18	SCSI	34	5.25 HH
ST 2125N/NM/NV	107	3	1544	18	SCSI	36	5.25 HH
ST 2182E	160	4	1453	16	ESDI	54	5.25 HH
ST 2209N/NM/NV	179	5	1544	18	SCSI	36	5.25 HH
ST 2274A	241	5	1747	16	AT-IDE	54	5.25 HH
ST 2383A	338	7	1747	16	AT-IDE	0	5.25 HH
ST 2383E	337	7	1747	15	ESDI	54	5.25 HH
ST 2383N	332	7	1261	14	SCSI	0	5.25 HH
ST 2384A	330	0	0	18	AT-IDE	0	5.25 HH
ST 2502N	435	7	1755	16	SCSI	36	5.25 HH
ST 3025A	21	1	1616	20	AT-IDE	26	3.50 3H
ST 3025N	21	1	1616	20	SCSI-2	26	3.50 3H
ST 3057A	49	3	940	20	AT-IDE	34	3.50 3H
ST 3057N	49	6	940	20	SCSI	34	3.50 3H
ST 3096A	84	3	610	20	AT-IDE	35	3.50 3H
ST 3096N	84	3	610	20	SCSI	35	3.50 3H
ST 3120A	107	3	1024	20	AT-IDE	17	3.50 3H
ST 3144A	130	3	1001	20	AT-IDE	17	3.50 3H
ST 3144N	126	3	0	20	SCSI-2	0	3.50 3H
ST 4026	21	4	615	40	MFM	17	5.25 FH
ST 4038	31	5	733	40	MFM	17	5.25 FH
ST 4051	42	5	977	40	MFM	17	5.25 FH
ST 4053	45	5	1024	28	MFM	17	5.25 FH
ST 4077N	67	5	1024	28	SCSI	26	5.25 FH

SEAGATE (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
ST 4077R	65	5	1024	28	RLL	26	5.25 FH
ST 4085	71	8	1024	28	MFM	17	5.25 FH
ST 4086	72	9	925	28	MFM	17	5.25 FH
ST 4096	80	9	1024	28	MFM	17	5.25 FH
ST 4096N	84	9	1024	28	SCSI	17	5.25 FH
ST 4097	80	9	1024	28	MFM	17	5.25 FH
ST 4128E	151	9	969	17	ESDI	34	5.25 FH
ST 4128N	155	9	969	17	SCSI	34	5.25 FH
ST 4135R	115	9	960	28	RLL	26	5.25 FH
ST 4144N	122	9	1024	28	SCSI	26	5.25 FH
ST 4144R	123	9	1024	28	RLL	26	5.25 FH
ST 4144RN	80	9	1024	28	MFM	17	5.25 FH
ST 4182E	160	9	969	16	ESDI	0	5.25 FH
ST 4182N/NM	155	9	969	16	SCSI	0	5.25 FH
ST 4192E	169	8	1147	17	ESDI	36	5.25 FH
ST 4192N	168	8	1147	17	SCSI	36	5.25 FH
ST 4350N/NM	307	9	1412	17	SCSI	36	5.25 FH
ST 4376N/NM/NV	330	9	1546	18	SCSI	36	5.25 FH
ST 4383E	319	13	1412	18	ESDI	34	5.25 FH
ST 4384E	329	15	1224	15	ESDI	34	5.25 FH
ST 4385N	357	15	791	11	SCSI	36	5.25 F H
ST 4442E	368	15	1412	16	ESDI	34	5.25 FH
ST 4702N	613	15	1549	16	SCSI	54	5.25 FH
ST 4766E	676	15	1632	16	ESDI	53	5.25 FH
ST 4766N/NM/NV	676	15	1632	16	SCSI	54	5.25 FH
ST 4767E	676	15	1399	12	ESDI	54	5.25 FH
ST 4767N/NM/NV	676	15	1356	12	SCSI-2	54	5.25 FH
ST 4769E	691	15	1552	13	ESDI	0	5.25 FH
ST 6344J	344	24	711	18	SMD	0	9.00
ST 6515J/K	516	24	711	18	SMD/IPI	0	9.00
ST 8851J/K/N	727	15	1381	15	SMD/IPI/SCSI	0	8.00 FH
ST 9025A	21	2	1024	20	AT-IDE	63	2.50 .8"
ST 9051A	43	4	1024	20	AT-IDE	63	2.50 .8"

SEAGATE (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
ST 41097J	1097	17	2101	12	SMD-01E	0	5.25 FH
ST 41200N/NM/NV	1037	15	1931	15	SCSI	64	5.25 FH
ST 41201J/K	1200	17	2101	12	SMD/IPI	0	5.25 FH
ST 41520N	1352	17	2101	12	SCSI-2	var	5.25 FH
ST 41600N	1352	17	2101	12	SCSI-2	var	5.25 FH
ST 41650N/ND	1420	15	2107	15	SCSI-2	var	5.25 FH
ST 41651N/ND	1420	15	2107	15	SCSI-2	var	5.25 FH
ST 41800K	1800	18	2653	11	IPI-2	0	5.25 FH
ST 42100N/ND	1830	15	2574	13	SCSI-2	0	5.25 FH
ST 42400N	2100	19	2653	11	SCSI-2	0	5.25 FH
ST 81123J	1123	15	1635	15	SMD-01E	0	8.00
ST 81154K	1154	14	1635	15	IPI-2	0	8.00
ST 82030J/K	2030	19	2120	11	SMD/IPI	0	8.00
ST 82038J	2038	19	2611	12	SMD-E	0	8.00
ST 82105K	2105	16	2611	12	IPI-2	0	8.00
ST 82272J	2272	19	2611	12	SMD-E	0	8.00
ST 82368K	2368	18	2611	12	IPI-2	0	8.00
ST 82500J/K/N	2140	19	2611	12	SMD/IPI/SCSI	0	8.00
ST 83050K	3050	18	2655	12	IPI-2	0	8.00
ST 83220K	3220	19	2655	12	IPI-2	0	8.00

SHUGART

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
SA 604	5	4	160	0	MFM	17	-
SA 606	7	6	160	0	MFM	17	-
SA 607	5	2	306	0	MFM	17	5.25
SA 612	11	4	306	0	MFM	17	5.25 FH
SA 706	6	2	320	0	MFM	17	5.25 FH
SA 712	11	4	320	0	MFM	17	5.25 HH
SA 724	0	0	0	0	MFM	17	5.25
SA 1002	5	0	0	0	MFM	17	8.00 FH
SA 1004	10	0	0	0	MFM	17	8.00 FH

SHUGART (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
SA 1106	30	0	0	0	MFM	17	8.00 FH
SA 4004	14	0	0	0	MFM	17	14.00 FH
SA 4008	29	0	0	0	MFM	17	14.00 FH
SA 4100	56	0	0	0	MFM	17	14.00 FH

SIEMENS

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
1200	174	8	1216	25	ESDI	36	5.25 FH
1300	261	12	1216	25	ESDI	36	5.25 FH
2200	174	8	1216	25	ESDI	36	5.25 FH
2300	261	12	1216	25	ESDI	36	5.25 FH
4410	334	11	1100	16	ESDI	54	5.25 FH
4420	334	11	1100	16	SCSI	54	5.25 FH
5710	655	15	1224	16	ESDI	48	5.25 FH
5720	655	15	1224	16	SCSI	48	5.25 FH
5810	777	16	0	18	ESDI	0	5.25 FH
5820	777	16	0	18	SCSI	0	5.25 FH
6200	1200	0	0	14	SCSI	0	5.25 FH
7520	655	15	0	16	SCSI	0	5.25 FH

STORAGE DIMENSIONS

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
AT-40	44	5	1024	0	MFM	17	-
AT-70	71	8	1024	0	MFM	17	-
AT-100R	109	8	1024	0	RLL	26	-
AT-100S	105	3	0	19	SCSI	0	3.50 HH
AT-120	119	15	918	27	MFM	17	5.25 FH
AT-133	133	15	1024	0	MFM	17	-
AT-140	142	8	1024	0	ESDI	34	-
AT-155E	157	7	1224	14	ESDI	52	5.25 FH
AT-155S	156	9	1224	14	SCSI	36	5.25 FH
AT-160	159	15	1224	28	MFM	17	5.25 FH
AT-200	204	15	1024	0	RLL	26	-

STORAGE DIMENSIONS (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
AT-200S	204	7	0	15	SCSI	0	3.50 HH
AT-320E	329	15	1224	16	ESDI	35	5.25 FH
AT-320S	320	15	1224	16	SCSI	36	5.25 FH
AT-335E	338	15	1224	16	ESDI	36	5.25 FH
AT-650E	651	15	1632	0	ESDI	52	5.25 FH
AT-650S	651	15	1632	0	SCSI	54	5.25 FH
AT-1000S	1000	15	0	15	SCSI	0	5.25
MAC-195	195	7	0	15	SCSI	0	3.50 HH
PS-155E	156	9	1224	14	ESDI	36	5.25 FH
PS-155S	156	9	1224	14	SCSI	36	5.25 FH
PS-320S	320	15	1224	16	SCSI	36	5.25 FH
PS-335E	338	15	1224	16	ESDI	36	5.25 FH
PS-650S	651	15	1632	16	SCSI	54	5.25 FH
XT-40	44	5	1024	0	MFM	17	-
XT-70	71	8	1024	0	MFM	17	-
XT-100	109	8	1024	0	RLL	26	-
XT-120	119	15	918	0	MFM	17	-
XT-200R	204	15	1024	0	RLL	26	-

SYQUEST

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
SQ 225F	20	4	615	85	MFM	17	5.25 HH
SQ 306F	5	4	306	85	MFM	17	5.25 HH
SQ 306R	5	2	306	85	MFM	17	5.25 HH
SQ 306RD	5	2	306	85	MFM	17	5.25 HH
SQ 312	10	2	615	85	MFM	17	4.00 HH
SQ 312RD	10	2	615	85	MFM	17	4.00 HH
SQ 315F	21	4	612	65	MFM	17	4.00 HH
SQ 319	10	2	612	85	MFM	17	4.00 HH
SQ 325	21	4	612	85	MFM	17	4.00 HH
SQ 325F	20	4	615	65	MFM	17	4.00 HH
SQ 338F	30	6	615	65	MFM	17	4.00 HH
SQ 340AF	38	6	640	0	MFM	17	4.00 HH

TANDON

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
TM 244	41	4	782	37	RLL	26	5.25 HH
TM 246	62	6	782	37	RLL	26	5.25 HH
TM 251	5	2	306	0	MFM	17	5.25 HH
TM 252	10	4	306	85	MFM	17	5.25 HH
TM 261	10	2	615	0	MFM	17	3.50 HH
TM 262	21	4	615	65	MFM	17	3.50 HH
TM 262R	20	2	782	85	RLL	26	3.50 HH
TM 264	41	4	782	85	RLL	26	3.50 HH
TM 344	41	4	782	37	RLL	26	3.50 HH
TM 346	62	6	782	37	RLL	26	3.50 HH
TM 361	10	2	615	65	MFM	17	3.50 HH
TM 362	21	4	615	65	MFM	17	3.50 HH
TM 362R	20	2	782	85	RLL	26	3.50 HH
TM 364	41	4	782	85	RLL	26	3.50 HH
TM 501	5	2	306	85	MFM	17	5.25 FH
TM 502	10	4	306	85	MFM	17	5.25 FH
TM 503	15	6	306	85	MFM	17	5.25 FH
TM 602S	5	4	153	85	MFM	17	5.25 FH
TM 603S	10	6	153	0	MFM	17	5.25 FH
TM 603SE	21	6	230	0	MFM	17	5.25 FH
TM 702	20	4	615	40	RLL	26	5.25 FH
TM 702AT	8	4	615	35	MFM	17	5.25 FH
TM 703	10	5	733	40	MFM	17	5.25 FH
TM 703-C	25	0	0	40	MFM	17	5.25 FH
TM 703AT	31	5	733	35	MFM	17	5.25 FH
TM 705	41	5	962	40	MFM	17	5.25 FH
TM 755	43	5	981	33	MFM	17	5.25 HH
TM 2085	74	9	1004	25	SCSI	36	-
TM 2128	115	9	1004	25	SCSI	36	5.25
TM 2170	154	9	1344	25	SCSI	36	5.25
TM 3085	71	8	1024	37	MFM	17	3.50 HH
TM 3085-R	104	8	1024	37	RLL	26	3.50 HH

TANDY

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
25-1045	21	0	0	0	XT-IDE	0	5.25 HH
25-1046	43	4	782	28	XT-IDE	27	5.25 HH
25-4130	100		0	17	AT-IDE	0	3.50 HH

TEAC

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
SD 150	10	4	306	0	MFM	17	5.25
SD 340-A	43	2	1050	23	AT-IDE	40	3.50 3H
SD 340-S	43	2	1050	23	SCSI	40	3.50 3H
SD 380	86	4	1050	20	AT-IDE	0	3.50 3H
SD 380-S	86	4	1050	20	SCSI	0	3.50 3H
SD 510	10	4	306	0	MFM	17	5.25 FH
SD 520	20	4	615	0	MFM	17	5.25 FH
SD 540	0	0	0	0	MFM	17	5.25 FH
SD 3105H	105	0	0	0	0	0	3.50 1"

TEXAS INSTRUMENTS

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
TI-5	5	4	153	0	MFM	17	5.25 FH

TOKICO

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
DK 503-2	10	4	306	0	MFM	17	5.25

TOSHIBA

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
MK 53F	36	5	830	0	MFM	17	5.25 FH
MK 53FA(M)	43	5	830	30	MFM	26	5.25 FH
MK 53FA(R)	64	5	830	30	RLL	26	5.25 FH
MK 53FB(M)	43	5	830	25	MFM	17	5.25 FH
MK 53FB(R)	64	5	830	25	RLL	26	5.25 FH
MK 54F	50	7	830	0	MFM	17	5.25 FH
MK 54FA(M)	60	7	830	30	MFM	17	5.25 FH
MK 54FA(R)	90	7	830	25	RLL	26	5.25 FH

TOSHIBA (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
MK 54FB(M)	60	7	830	25	MFM	17	5.25 FH
MK 54FB(R)	90	7	830	25	RLL	26	5.25 FH
MK 56F	72	10	830	0	MFM	17	5.25 FH
MK 56FA(M)	86	10	830	30	MFM	17	5.25 FH
MK 56FA(R)	129	10	830	30	RLL	26	5.25 FH
MK 56FB(M)	86	10	830	25	MFM	17	5.25 FH
MK 56FB(R)	130	10	830	25	RLL	26	5.25 FH
MK 72	72	0	0	25	MFM	17	3.50 HH
MK 72PCR	109	0	0	25	RLL	26	3.50 HH
MK 130	53	0	0	25	MFM	17	3.50 HH
MK 134FA(M)	44	7	733	25	MFM	17	3.50 HH
MK 134FA(R)	65	7	733	23	RLL	26	3.50 HH
MK 153FA	74	5	830	23	ESDI	35	5.25 FH
MK 153FB	74	5	830	23	SCSI	35	5.25 FH
MK 154FA	104	7	830	23	ESDI	35	5.25 FH
MK 154FB	104	7	830	23	SCSI	35	5.25 FH
MK 156FA	148	10	830	23	ESDI	35	5.25 FH
MK 156FB	148	10	830	23	SCSI	35	5.25 FH
MK 232FB	45	3	845	25	SCSI	35	3.50 HH
MK 233FB	76	5	845	25	SCSI	35	3.50 HH
MK 234FB	106	7	845	25	SCSI	35	3.50 HH
MK 234FC	106	7	845	25	AT-IDE	35	3.50 HH
MK 250FA	382	10	1224	18	ESDI	35	5.25 FH
MK 250FB	382	10	1224	18	SCSI	35	5.25 FH
MK 353A	72	0	0	28	0	0	5.25 FH
MK 355FA	459	9	1632	16	ESDI	53	5.25 FH
MK 355FB	459	9	1632	16	SCSI	53	5.25 FH
MK 358FA	765	15	1632	16	ESDI	53	5.25 FH
MK 358FB	765	15	1632	16	SCSI	53	5.25 FH
MK 556FA	152	10	830	23	ESDI	0	5.25 FH
MK 1034FC	106	0	0	0	AT-IDE	0	3.50 1"

TULIN

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
TL 213	10	2	640	0	MFM	17	5.25 HH
TL 226	22	4	640	0	MFM	17	5.25 HH
TL 238	22	4	640	0	MFM	17	5.25 HH
TL 240	33	6	640	0	MFM	17	5.25 HH
TL 258	33	6	640	0	MFM	17	5.25 HH
TL 326	22	4	640	0	MFM	17	5.25 HH
TL 340	33	6	640	0	MFM	17	5.25 HH

VERTEX (also see Priam)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
V130	26	3	987	40	MFM	17	5.25 FH
V150	43	5	987	40	MFM	17	5.25 FH
V170	60	7	987	28	MFM	17	5.25 FH

WESTERN DIGITAL

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
WD 262	20	4	615	80	MFM	17	3.50 HH
WD 344R	40	4	782	40	RLL	26	3.50 HH
WD 362	20	4	615	80	MFM	17	3.50 HH
WD 382R	20	2	782	85	RLL	26	3.50 HH
WD 383R	30	4	615	85	RLL	26	3.50 HH
WD 384R	40	4	782	85	RLL	26	3.50 HH
WD 544R	40	4	782	40	RLL	26	3.50 HH
WD 582R	20	2	782	85	RLL	26	3.50 HH
WD 583R	30	4	615	85	RLL	26	3.50 HH
WD 584R	40	4	782	85	RLL	26	3.50 HH
WD 93024-A	22	2	782	28	AT-IDE	27	3.50 HH
WD 93024-X	21	2	782	39	XT-IDE	27	3.50 HH
WD 93028-A	20	2	782	80	AT-IDE	0	3.50 HH
WD 93028-AD	22	2	782	69	AT-IDE	27	3.50 HH
WD 93028-X	22	2	782	70	XT-IDE	0	3.50 HH
WD 93034-X	32	3	782	39	XT-IDE	27	3.50 HH
WD 93038-X	32	3	782	70	XT-IDE	0	3.50 HH

WESTERN DIGITAL (Continued)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
WD 93044-A	43	4	782	28	AT-IDE	27	3.50 HH
WD 93044-X	43	4	782	39	XT-IDE	27	3.50 HH
WD 93048-AD	43	4	782	69	AT-IDE	0	3.50 HH
WD 93048-A	40	4	782	80	AT-IDE	0	3.50 HH
WD 93048-X	43	4	782	70	XT-IDE	0	3.50 HH
WD 95024-A	21	2	782	28	AT-IDE	27	5.25 HH
WD 95028-A	20	2	782	80	AT-IDE	0	5.25 HH
WD 95028-X	20	2	782	80	XT-IDE	27	5.25 HH
WD 95038-X	30	3	782	80	XT-IDE	27	5.25 HH
WD 95048-A	40	4	782	80	AT-IDE	27	5.25 HH
WD 95048-X	40	4	782	80	XT-IDE	27	5.25 HH
WD AB130	63	0	0	19	PRO	0	2.50 4H
WD AB 260	63	0	0	19	PRO	0	2.50 4H
WD AC140	42	2	1082	18	AT-IDE	39	3.50 4H
WD AC280	85	4	1082	18	AT-IDE	39	3.50 4H
WD M1130-44	31	2	0	19	MCA	33	3.50 4H
WD M1130-72	30	2	0	19	MCA	32	3.50 4H
WD SC8320	320	14	0	12	SCSI-2	48	3.50 HH
WD SP2100	104	4	0	14	SCSI-2	41	3.50 HH
WD SP4200	209	8	0	14	SCSI-2	41	3.50 HH
Condor	320	14	0	13	SCSI	0	3.50
Piranha 105A	105	4	0	15	AT-IDE	0	3.50
Piranha 105S	105	4	0	15	SCSI	0	3.50
Piranha 210A	210	8	0	15	AT-IDE	0	3.50
Piranha 210S	210	8	0	15	SCSI	0	3.50

XEBEC

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
OWL I	25	4	0	55	SCSI	17	5.25 HH
OWL II	38	4	0	40	MFM	17	5.25 HH
OWL III	52	4	0	38	SCSI	17	5.25 HH

YE-DATA (also see C. Itoh)

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
YD-3042	44	4	788	28	SCSI	0	3.50 HH
YD-3081B	45	2	1057	28	SCSI	42	3.50 3H
YD-3082	87	8	788	28	SCSI	0	3.50 3H
YD-3082B	90	4	1057	28	SCSI	42	3.50 3H
YD-3083B	136	6	1057	28	SCSI	42	3.50 3H
YD-3084B	181	8	1057	28	SCSI	42	3.50 3H
YD-3161B	45	2	1057	19	AT-IDE	42	3.50 3H
YD-3162B	90	4	1057	19	AT-IDE	42	3.50 3H
YD-3181B	45	2	1057	19	SCSI	42	3.50 3H
YD-3182B	90	4	1057	19	SCSI	42	3.50 3H
YD-3530	32	5	731	0	MFM	17	-
YD-3540	45	7	731	26	MFM	17	5.25 HH

KYOCERA

Model Number	Cap	Hds	Cylind	Avg	Interface	Sect	Form Factor
KC 20A	21	4	616	65	MFM	17	3.50 HH
KC 20B	21	4	615	62	MFM	17	3.50 HH
KC 30A	32	4	615	65	RLL	26	3.50 HH
KC 30B	32	4	615	62	RLL	26	3.50 HH
KC 40GA	41	2	1075	28	AT-IDE	26	3.50 HH
KC 80C	87	8	787	28	SCSI	28	3.50 HH

Controller Information

Listed on the following pages are descriptions of common controller cards with performance ratings and jumper settings. The jumper settings listed are for the default or most common configuration we've seen. The jumpers are listed in order of their physical position looking at the controller card with the fingers down, starting from left to right.

The jumper settings needed to make the card work in your system will likely be different. Use the settings shown as a reference guide only. Be sure to consult the controller card manual for detailed information.

Adaptec Controllers

2070A

Features:	8-bit RLL, controls 2 hard drives only.
Default Jumpers:	None installed.
To Format:	use DEBUG G=C800:CCC.
Notes:	Jumper E-F removable cartridge drive 0, Jumper G-H for removable cartridge drive 1, Jumper K-L for controller internal diagnostics. Boards with P/N 401400 Rev. C or later are required for use in AT-class machines.

2372A

Features:	16-bit RLL, controls 2 hard drives and 2 floppy drives. 1:1 interleave.
Default Jumpers:	J19 pins 1&2, J12 pins 1&2, J20 pins 1&2, J21 pins 1&2, J22 pins 2&3.
To Format:	use DEBUG G=C800:5.

2320

Features:	16-bit ESDI, controls 2 hard drives 10MHz only. 1:1 interleave.
Default Jumpers:	J2 no jumpers installed, J7 pins 1&2, J13 pins 1&2, J20 pins 1&2, J21 pins 1&2, J22 pins 1&2.
To Format:	first select CMOS drive type 1, then use DEBUG G=C800:5.
Notes:	Jumper J2 pin 3 may need to be installed for late bus wait state to permit operation in many fast machines.

2322

Features:	16-bit ESDI, controls 2 hard drives and 2 floppy drives. Sup ports 1:1 interleave and data rate to 10MHz.
Default Jumpers:	J13 pins 1&2, J22 pins 1&2, J21 pins 1&2, J20 pins 1&2, J7 pins 1&2.
To Format:	first select CMOS drive type 1, then use DEBUG G=C800:5.

CCAT Controllers

IDE Card P/N 6620000440

Features: 16-bit IDE paddle board, controls two IDE drives and two floppy drives.

Default Jumpers: W1 pins 3&4, W2 pins 1&2.

Notes: Set jumper for buffered interrupt when using this card with Conner drives.

Conner Peripherals Controllers

IDE Card P/N 02090-002

Features: 16-bit IDE paddle board, controls two IDE drives.

Default Jumpers: E1, E2, and E4 installed.

CSC

Fastcache 32

Features: Supports up to 7 SCSI devices and 4 floppy drives. Up to 32MB on board cache.

Default Jumpers: The Fastcache uses a single eight position DIP switch for hardware configuration. No jumpers are needed. Switch settings are listed in Table C below.

Notes: All drive configuration is done automatically by the formatting software and stored in EEPROM on the card.

Table C - Fastcache 32 Switch Settings

Base Address Setting			Module Type		
SW-0	**SW-1**	**Address**	**SW-2**	**SW-3**	**Type**
ON	ON	D000	ON	ON	256K
ON	OFF	C800	ON	OFF	1 MEG
OFF	ON	E000	OFF	ON	4 MEG
OFF	OFF	D800			
Compatibility Mode			**Floppy Controller**		
SW-5	**Mode**		**SW-6**	**Floppy**	
ON	FAST		ON	Enabled	
OFF	FASTER		OFF	Disabled	

DTC Controllers

3280

Features:	16-bit SCSI, controls 2 hard drives and 2 floppy drives.
Default Jumpers:	W2 pins 1&2, W1 pins 2&3. See manual for switch settings.
To Format:	use DTC GSDIAG program.
Notes:	OS/2, XENIX drivers available.

3290

Features:	EISA SCSI controller, up to 4MB cache RAM. Controls upto 7 SCSI devices and 2 floppies.
Default Jumpers:	None.
To Format:	Use DTC SCSI utility.

5150

Features:	XT MFM, controls 2 hard drives.
Default Jumpers:	W2 on, W7 on, W1 pins 1&2, W3 pins 2&3, W5 pins 1&2.
To format:	use DEBUG G=C800:5

6280A

Features:	16-bit ESDI, controls 2 hard drives 10Mhz and 2 floppy drives.
Default Jumpers:	W2 installed, W3 pins 2&3, SW1-1 OFF, SW1-2 OFF, SW1-3 OFF, SW4-4 ON.
To Format:	use DEBUG G=C800:5

6280-15TX

Features:	16-bit ESDI, controls 2 hard drives and 2 floppy drives. Operates with data rates up to 15MHz.
Default Jumpers:	W4 pins 2&3, SW1 positions 2, 6, 9, and 10 OPEN, all others CLOSED. Other jumpers are for interrupts required by Novell and Unix, but not by DOS.
To format:	use DEBUG G=C800:5.
Notes:	Supports translation modes for large capacity drives.

6290E

Features:	EISA ESDI controller, up to 4MB cache. Controls up to 4 ESDI drives and 2 floppies.
Default Switches:	All switches open, except SW4.
To Format:	Use DTC ESDI utility.

Everex Controllers

See: Wangtec EV-831, SMS 8240

Future Domain Controllers

TMC-885

Features:	8-bit SCSI Host Adapter, controls 2 hard drives and 4 floppy drives.
Default Jumpers:	W1 & W2 installed.
To Format:	use Future Domain software.

NCL Controllers

NDC5125

Features:	16-bit MFM, controls 2 hard drives and 2 floppy drives.
Default Jumpers:	JP5 lower two pins jumpered.
To Format:	use DIAGS, Speedstor, or Disk Manager.

Seagate Controllers

ST-01/02

Features:	8-bit SCSI, supports 2 hard drives. ST-02 also supports 2 floppy drives.
Default Jumpers:	W2 ON, all others OFF.
To Format:	use DEBUG G=C800:5.
Notes:	Extremely low throughput. Complete compatibility limited to Seagate drives.

SMS/OMTI Controllers

510

Features:	8-bit SCSI, controls 2 hard drives only.
Default Jumpers:	W1 pins 2&3, W2 pins 2&3, W3 pins 1 &2, W4 pins 2&3.
To Format:	use OMTIDISK or DEBUG G=C800:5.
Notes:	HA7 BIOS may cause partitioning problems with DOS 4.0 or later.

822

Features:	16-bit SCSI, controls 2 hard drives and 2 floppy drives.
Default Jumpers:	W35, W33 pins 1&2, W21, W24, W5, W7, W28, W38 pins 2&3, W17, W32.
To Format:	use DEBUG G=D800:6.
Notes:	Drives for Novell and more than 2 SCSI drives are available. May not operate in machines with 8MHz bus speed and no bus wait states.

5520

Features:	8-bit MFM, controls 2 hard drives only.
Default Jumpers:	None installed.
To Format:	use DEBUG G=C800:6.

5527

Features:	8-bit RLL, controls 2 hard drives only.
Default Jumpers:	None installed.
To Format:	use DEBUG G=C800:6.

8120

Features:	16-bit MFM, controls 2 hard drives only.
Default Jumpers:	None installed.
To Format:	set CMOS to no drive installed, then use DEBUG G=C800:6.

8240

Features:	16-bit MFM, controls 2 hard drives and 2 floppy drives. Supports 1:1 interleave and fast (average 700Kb/sec transfer).
Default Jumpers:	None.
To Format:	use OMTIDISK software.
Notes:	Incompatible with some motherboards due to timing problem, but runs solid as a rock in boards that comply with the original IBM-AT bus timing specifications.

8630

Features:	16-bit ESDI, controls 2 hard drives and 2 floppy drives. Operates with drive rates up to 10MHz. Supports 1:1 interleave with 32K look-ahead cache.
Default Jumpers:	W20 pins 2&3, W23, W24, W25, W17.
To Format:	set CMOS to drive type 1, then use DEBUG G=CA00:6.

8640

Features:	16-bit ESDI, controls 2 hard drives and 2 floppy drives. Operates with drive rates up to 15MHz. Supports 1:1 interleave with 32K look-ahead cache.
Default Jumpers:	W20 pins 2&3, W23, W24, W25, W17.
To Format:	set CMOS to drive type 1, then use DEBUG G=CA00:6.
Notes:	No known compatibility problems; a good universal card.

Wangtec Controllers

EV-831

Features:	Controls QIC-36 tape drives.
Default Jumpers:	E8-9, E11-12, E3-4, W2, W5, W1.
Notes:	See manual for switch settings and DMA and interrupt jumpers. Most reported problems with this card are a result of DMA interrupt conflicts.

Western Digital Controllers

WD 1002A-FOX F001/003

Features:	F001 Controls 2 floppy drives only. No BIOS on card. F003 includes a ROM BIOS.
Default Jumpers:	W4 pins 2&3.

WD 1002A-FOX F002/004

Features:	F002 Controls 4 floppy drives only. F004 has a BIOS on card which permits installation of 1.2 and 1.44MB drives in XT machines that normally only support 360k or 720k drives.
Default Jumpers:	W1 pins 2&3, W2 pins 2&3, W3 pins 1&2, W5 pins 2&3, W6 pins 2&3.
Notes:	Uses WD-37C65 chip, works well in 286/386 machines.

WD1003-WAH

Features:	16-bit MFM, 3:1 interleave controller supports 2 hard drives only.
Default Jumpers:	W6 pins 2&3, W4 pins 2&3, W5 pins 1&2.
To Format:	use DIAGS, Speedstor, or Disk Manager.

WD1003-WA2

Features:	Controls 2 hard drives at 3:1 interleave and 2 floppy drives.
Default Jumpers:	E2-3, E4-5, E7-8 installed.
To Format:	use DIAGS, Speedstor, or Disk Manager.

WD 1003V-MM1/MM2

Features:	MM1 is a 16-bit MFM, controls 2 hard drives at 2:1 interleave. MM2 also controls 2 floppy drives.
Default Jumpers:	See manual.
To Format:	use DIAGS, Speedstor, or Disk Manager.

WD 1003V-SR1/SR2

Features:	SR1 is a 16-bit RLL, controls 2 hard drives at 2:1 interleave. SR2 also controls 2 floppy drives.
Default Jumpers:	See manual.
To Format:	use DIAGS, Speedstor, or Disk Manager.

WD1006V-MM1/MM2

Features:	MM1 is a 16-bit MFM, controls 2 hard drives at 1:1 interleave. MM2 also controls 2 floppy drives.
Default Jumpers:	None installed.
To Format:	use DIAGS, Speedstor, or Disk Manager.

WD 1006V-SR1/SR2

Features:	SR1 is a 16-bit RLL, controls 2 hard drives at 1:1 interleave. SR2 also controls 2 floppy drives.
Defautl Jumpers:	See manual.
To Format:	use DEBUG G=C800:5.

WD1007V-SE1/SE2

Features:	16-bit ESDI, controls 2 hard drives at 1:1 interleave with 32K look-ahead cache. Model SE2 also controls 2 floppy drives.
Default Jumpers:	W1 none installed, W3 not installed, W5 & W6 (SE2 only) not installed, W12 not installed, W7 1&2, W8 2&3.
To Format:	use DEBUG G=CC00:5 (Use C800:5 if W8 1&2 is jumpered).

WD 1007A-WAH

Features:	16-bit ESDI, controls 2 hard drives. 10 Mb/ps at 1:1 interleave.
Default Jumpers:	See manual.
To Format:	Use DEBUG G=C800:5

7000 FASST

Features:	16-bit SCSI controller supports 2 hard drives any interleave and 2 floppy drives.
Default Jumpers:	See manual
Notes:	Negotiates for synchronous SCSI transfer. Drivers available for Novell and Xenix.

WDXT-GEN2

Features:	8-bit MFM, controls 2 Hard drives only.
Default Jumpers:	See manual
To Format:	use DEBUG G=C800:5.

Connector Pinouts

The following pages contain pinout information on various interfaces.

IDE Interface Pinout

Table D - IDE Pinouts

Pin Number	Signal	Pin Number	Signal
01	-HOST RESET	02	GND
03	+HOST DATA 7	04	+HOST DATA 8
05	+HOST DATA 6	06	+HOST DATA 9
07	+HOST DATA 5	08	+HOST DATA 10
09	+HOST DATA 4	10	+HOST DATA 11
11	+HOST DATA 3	12	+HOST DATA 12
13	+HOST DATA 2	14	+HOST DATA 13
15	+HOST DATA 1	16	+HOST DATA 14
17	+HOST DATA 0	18	+HOST DATA 15
19	GND	20	KEY
21	RESERVED	22	GND
23	-HOST IOW	24	GND
25	-HOST IOR	26	GND
27	RESERVED	28	+HOST ALE
29	RESERVED	30	GND
31	+HOST IRQ14	32	+HOST IO16
33	+HOST ADDR 1	34	-HOST PDIAG
35	+HOST ADDR 0	36	+HOST ADDR 2
37	-HOST CS0	38	-HOST CS1
39	-HOST SLV/ACT	40	GND

ESDI Pinouts

Table E - ESDI Control Signals - J1/P1

CONTROL SIGNAL NAME	GROUND	SIGNAL PIN	TRANSMISSION
-HEAD SELECT 3	1	2	TO DRIVE
-HEAD SELECT 2	3	4	TO DRIVE
-WRITE GATE	5	6	TO DRIVE
-CONFIG/-STATUS DATA	7	8	TO CONTROLLER
-TRANSFER ACK	9	10	TO CONTROLLER
-ATTENTION	11	12	TO CONTROLLER
-HEAD SELECT 0	13	14	TO DRIVE
-SECTOR/-ADDRESS MARK FOUND	15	16	TO CONTROLLER
-HEAD SELECT 1	17	18	TO DRIVE
-INDEX	19	20	TO CONTROLLER
-READY	21	22	TO CONTROLLER
-TRANSFER REQ	23	24	TO DRIVE
-DRIVE SELECT 1	25	26	TO DRIVE
-DRIVE SELECT 2	27	28	TO DRIVE
-DRIVE SELECT 3	29	30	TO DRIVE
-READ GATE	31	32	TO DRIVE
-COMMAND DATA	33	34	TO DRIVE

ESDI Pinouts (Continued)

Table F - ESDI Data Signals - J2/P2

DATA SIGNAL NAME	GROUND	SIGNAL PIN	TRANSMISSION
-DRIVE SELECTED		1	TO CONTROLLER
-SECTOR/-ADDRESS MARK FOUND		2	TO CONTROLLER
-SEEK COMPLETE		3	TO CONTROLLER
-ADDRESS MARK ENABLE		4	TO DRIVE
-RESERVED FOR STEP MODE	6	5	TO CONTROLLER
+WRITE CLOCK		7	TO DRIVE
-WRITE CLOCK		8	TO DRIVE
-CARTRIDGE CHANGED		9	TO CONTROLLER
+READ REF CLOCK		10	TO CONTROLLER
-READ REF CLOCK	12	11	TO CONTROLLER
+NRZ WRITE DATA		13	TO DRIVE
-NRZ WRITE DATA	15, 16	14	TO DRIVE
+NRZ READ DATA		17	TO CONTROLLER
-NRZ READ DATA	19	18	TO CONTROLLER
-INDEX		20	TO CONTROLLER

Table G - ESDI DC Power - J3/P3

	VOLTAGE	GROUND	TRANSMISSION
+12 Volts DC	1	2	To Drive
+5 Volts DC	4	3	To Drive

IBM I/O Channel Pinout

Table H - I/O Channel Connector Pinouts (Sides C & D)

PIN	SIGNAL NAME	PIN	SIGNAL NAME
C1	SBHE	D1	/MEMCS16
C2	LA23	D2	/IOCS16
C3	LA22	D3	IRQ10
C4	LA21	D4	IRQ11
C5	LA20	D5	IRQ12
C6	LA19	D6	IRQ15
C7	LA18	D7	IRQ14
C8	LA17	D8	/DACK0
C9	/MEMR	D9	DRQ0
C10	/MEMW	D10	/DACK5
C11	SD08	D11	DRQ5
C12	SD09	D12	/DACK6
C13	SD10	D13	DRQ6
C14	SD11	D14	/DACK7
C15	SD12	D15	DRQ7
C16	SD13	D16	+5VCC
C17	SD14	D17	/MASTER
C18	SD15	D18	GND

IBM I/O Channel Pinout (Continued)

Table I - I/O Channel Connector Pinouts (Sides A & B)

PIN	SIGNAL NAME	PIN	SIGNAL NAME
A1	/IOCHCK	B1	GND
A2	SD7	B2	RESETDRV
A3	SD6	B3	+5VCC
A4	SD5	B4	IRQ9
A5	SD4	B5	-5VCC
A6	SD3	B6	DRQ2
A7	SD2	B7	-12VCC
A8	SD1	B8	OWS
A9	SD0	B9	+12VCC
A10	/IOCHRDY	B10	GND
A11	AEN	B11	/SMEMW
A12	SA19	B12	/SMEMR
A13	SA18	B13	/IOW
A14	SA17	B14	/IOR
A15	SA16	B15	/DACK3
A16	SA15	B16	DRQ3
A17	SA14	B17	/DACK1
A18	SA13	B18	DRQ1
A19	SA12	B19	/REFRESH
A20	SA11	B20	CLK
A21	SA10	B21	IRQ7
A22	SA9	B22	IRQ6
A23	SA8	B23	IRQ5
A24	SA7	B24	IRQ4
A25	SA6	B25	IRQ3
A26	SA5	B26	/DACK2
A27	SA4	B27	T/C
A28	SA3	B28	ALE
A29	SA2	B29	+5VCC
A30	SA1	B30	OSC
A31	SA0	B31	GND

SCSI Pinout

Table J - SCSI Connector Pinout

SIGNAL **	PIN NUMBER *
-DB(0)	2
-DB(1)	4
-DB(2)	6
-DB(3)	8
-DB(4)	10
-DB(5)	12
-DB(6)	14
-DB(7)	16
-DB(8)	18
GROUND	20
GROUND	22
GROUND	24
TERMPWR	26
GROUND	28
GROUND	30
-ATN	32
GROUND	34
-BSY	36
-ACK	38
-RST	40
-MSG	42
-SEL	44
-C/D	46
-REQ	48
-I/O	50

NOTES: * All odd pins except pin 25 must be connected to ground. Pin 25 is left open.
** The minus sign (-) indicates active low.

ST-506 Pinout

Table K - ST-506 Control Signals - J1/P1

CONTROL SIGNAL NAME	GROUND	SIGNAL PIN	TRANSMISSION
-HEAD SELECT 8	1	2	TO DRIVE
-HEAD SELECT 4	3	4	TO DRIVE
-WRITE GATE	5	6	TO DRIVE
-SEEK COMPLETE	7	8	TO CONTROLLER
-TRACK 0	9	10	TO CONTROLLER
-WRITE FAULT	11	12	TO CONTROLLER
-HEAD SELECT 1	13	14	TO DRIVE
RESERVED (To J2 pin 7)	15	16	- - - - -
-HEAD SELECT 2	17	18	TO DRIVE
-INDEX	19	20	TO CONTROLLER
-READY	21	22	TO CONTROLLER
-STEP	23	24	TO DRIVE
-DRIVE 1 SELECT	25	26	TO DRIVE
-DRIVE 2 SELECT	27	28	TO DRIVE
-DRIVE 3 SELECT	29	30	TO DRIVE
-DRIVE 4 SELECT	31	32	TO DRIVE
-DIRECTION IN	33	34	TO DRIVE

Table L - ST-506 Data Signals - J2/P2

DATA SIGNAL NAME	GROUND	SIGNAL PIN	TRANSMISSION
-DRIVE SELECTED	2	1	TO CONTROLLER
RESERVED	4	3	- - - - -
RESERVED	6	5	- - - - -
RESERVED (To J1 pin 16)	8	7	- - - - -
RESERVED		9	- - - - -
RESERVED		10	- - - - -
GROUND	11,12		- - - - -
+MFM WRITE DATA		13	TO DRIVE
-MFM WRITE DATA		14	TO DRIVE
GROUND	15,16		- - - - -
+MFM READ DATA		17	TO CONTROLLER
-MFM READ DATA		18	TO CONTROLLER
GROUND	19,20		- - - - -

Table M - ST-506 DC Power - J3/P3

	VOLTAGE	GROUND	TRANSMISSION
+12 Volts DC	1	2	To Drive
+5 Volts DC	4	3	To Drive

SA-400 Pinout

Table N - SA-400 Interface Signals and Pin Designations

Signal Name	Direction	Signal Pin Number	Return Pin Number
HD (Hi Density)/LSP (Speed)	OUT/IN	2	1
IN USE/HEAD LOAD	INPUT	4	3
-DRIVE SELECT 3	INPUT	6	5
-INDEX PULSE	OUTPUT	8	7
-DRIVE SELECT 0	INPUT	10	9
-DRIVE SELECT 1	INPUT	12	11
-DRIVE SELECT 2	INPUT	14	13
-MOTOR ON	INPUT	16	15
-DIRECTION SELECT	INPUT	18	17
-STEP	INPUT	20	19
-WRITE DATA	INPUT	22	21
-WRITE GATE	INPUT	24	23
-TRACK 00	OUTPUT	26	25
-WRITE PROTECT	OUTPUT	28	27
-READ DATA	OUTPUT	30	29
-SIDE ONE SELECT	INPUT	32	31
-READY/DISK CHANGE	OUTPUT	34	33

QIC-36 Pinout

The QIC-36 interface is implemented through a 50-pin dual inline header. The suggested mating connector is a 3M P/N 3425-60XX, 3425-70XX or equivalent. Maximum cable length is 10 feet (3 meters).

The connector pins are numbered 1 to 50. All odd pins are signal returns and are connected to the controller board ground. Table O shows pin assignments.

Table O - QIC-36 Connector Pin Assignments

Description	Signal	Source	Pin	Return
Tape Motion Enable	GO-	C	2	1
Tape Direction Control	REV-	C	4	3
Track Select 2/3	TR3-	C	6	5
Track Select 2/2	TR2-	C	8	7
Track Select 2/1	TR1-	C	10	9
Track Select 2/0	TR0-	C	12	11
Reset (Initialize Drive)	RST-	C	14	13
Reserved (not used)	DS3-	C	16	15
Reserved (not used)	DS2-	C	18	17
Reserved (not used)	DS1-	C	20	19
Drive Select 0	DS0-	C	22	21
High Write Current	HC-	C	24	23
Read Data (Pulse Output)	RDP-	D	26	25
Upper Tape Position Code	UTH-	D	28	27
Lower Tape Position Code	LTH-	D	30	29
Drive Select Response	SLD-	D	32	31
Cartridge In Place	CIN-	D	34	33
Unsafe (No Write Protect)	USF-	D	36	35
Capstan Tachometer Pulse	TCH-	D	38	37
Write Data Signal -	WDA-	C	40	39
Write Data Signal +	WDA+	C	42	41
Threshold (35% Read Margin)	TDH-	C	44	43
High Speed Slew Select	HSD-	C	46	45
Write Enable	WEN-	C	48	47
Erase Enable	EEN-	C	50	49

Drive Jumpers

The following pages contain information on jumper settings for common hard drives. For more complete information, refer to the OEM manual available from your supplier.

Atasi 3085

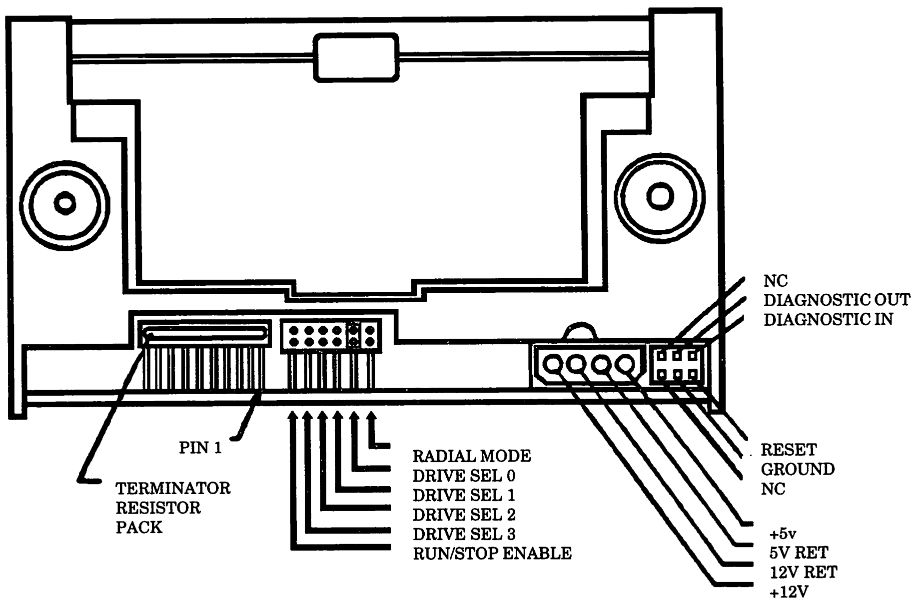


Figure 2 – Atasi 3085 Jumper Locations

CDC Wren III Series

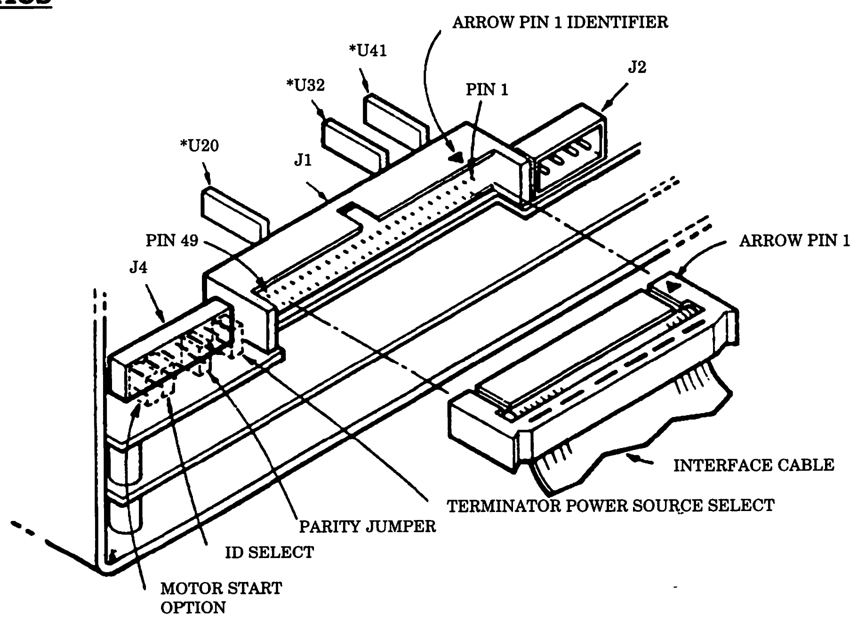
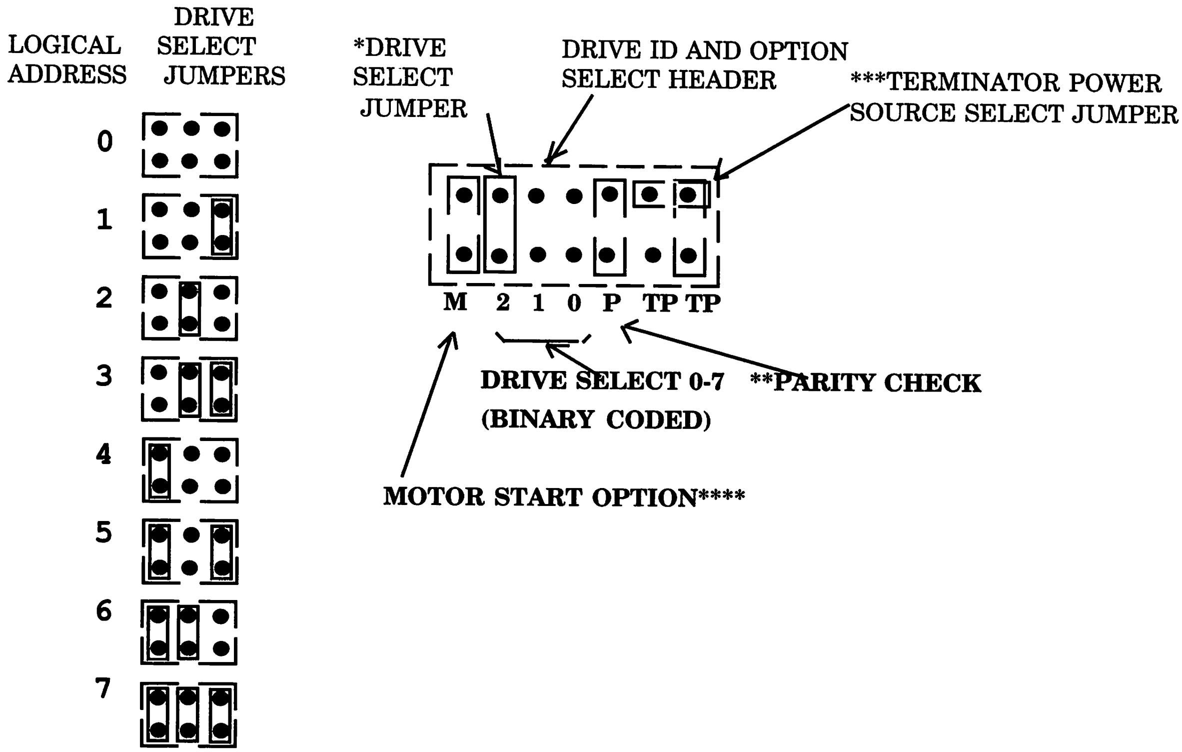


Figure 3 – CDC Wren III Series Jumper Locations

CSC Wren III Series (SCSI Jumpers)



* Drive ID is binary coded jumper position (most significant bit on left). i.e., jumper in position 2 would be Drive ID 4, no jumpers mean ID 0.

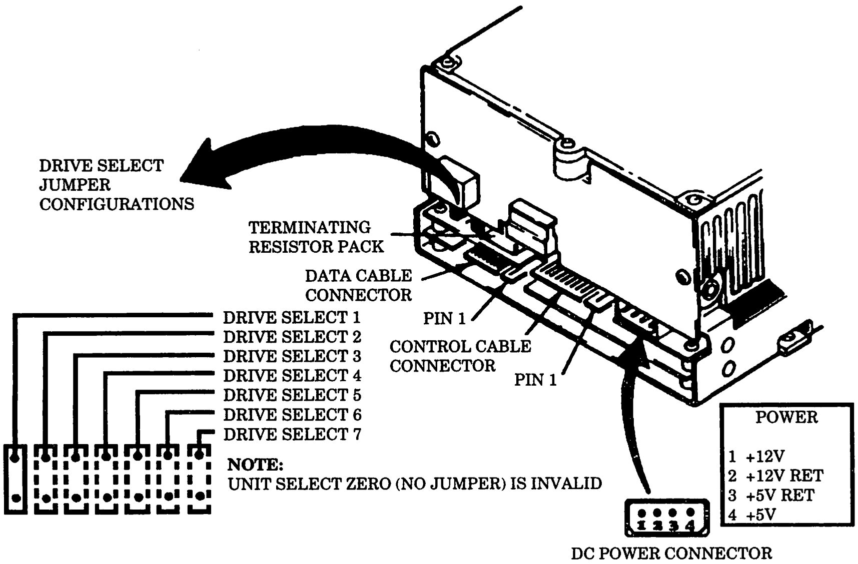
** Jumper plug installed means parity checking by the WREN III is enabled.

*** Jumper in vertical position means terminator power (+5V) is from WREN III power connector. Jumper in horizontal position means terminator power is taken from interface cable.
If unit is not terminated, TP jumper is to be left off.

**** Jumper plug installed enables Motor Start Option. In this mode of operation, the drive will wait for a Start Unit command from the Host before starting the motor. If the jumper plug is not installed, the motor will start as soon as DC power is applied to the unit.

Figure 4 – CSC Wren III Series Jumper Location

CDC Wren III Series (ESDI & SCSI)



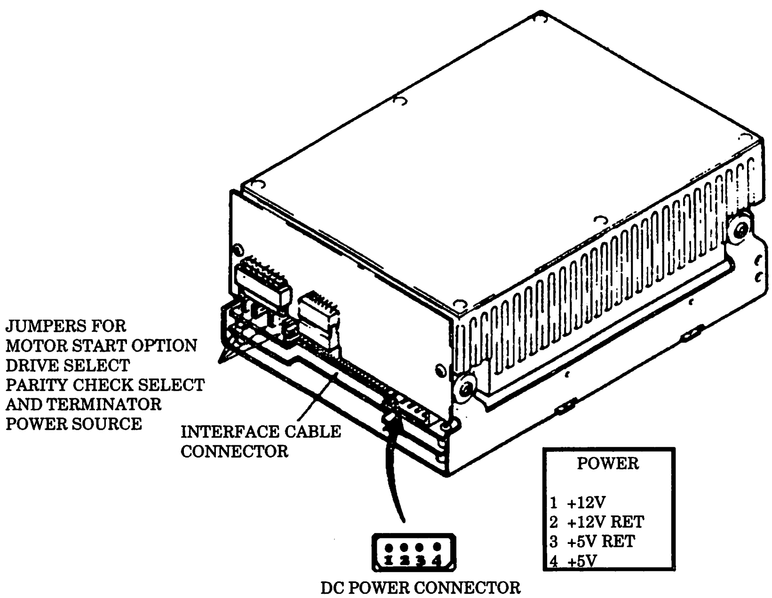


Figure 5 – CDC Wren III Series (ESDI & SCSI) Jumper Locations

CDC Wren V Series

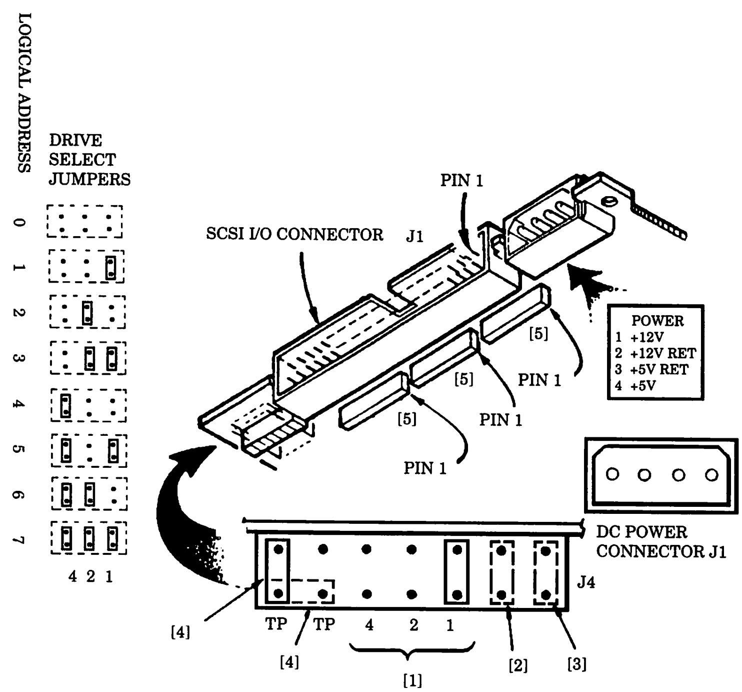


Figure 6 – CDC Wren V Series Jumper Location

Conner IDE Drives

All Conner IDE drives use the four jumpers shown in Table P.

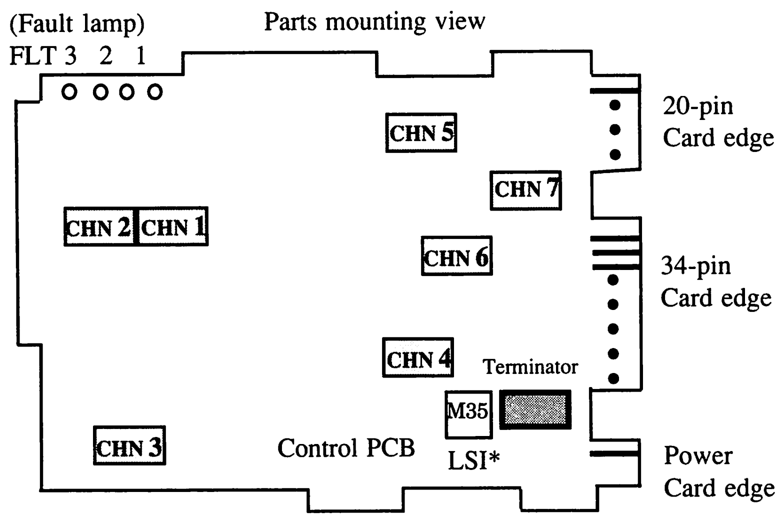
Table P - IDE Drive Jumpers

Jumper Configuration	1 Drive	2 Drive Master	2 Drive Slave
ACT	J	Note 1	Note 1
C/D	J	J	NJ
HSP	NJ	NJ	NJ
DSP	NJ	J	NJ

Note 1: This signal is used to drive an external LED for drive activity.

Fujitsu 2244, 2245, 2246

All of these Fujitsu drives use identical electronics. CNH7 selects the size of the HDA.



Jumpers are inserted as follows when shipped from the factory.

CNH7: Between 1 and 2, 3 and 4, 9 and 10, and 15 and 16
CNH6: Between 1 and 2, and 15 and 16
CNH5: Between 11 and 12, and 15 and 16
CNH4: Between 5 and 6
CNH2: Between 15 and 16

The following settings are model specific.

CNH7: M2246 Between 3 and 4
M2245 Between 5 and 6
M2244 No jumpers between 3 and 4, or 5 and 6.

* Identify that the LSI (M35) is MB114T071. See Appendix in manual which describes the shorting plug settings in case that the LSI is MB113T047

Figure 7 – Fujitsu 2244,2245, & 2246 Shorting Plug Locations

Fujitsu 226X Series

Note: The read-ahead cache on this drive may not work with all controllers.

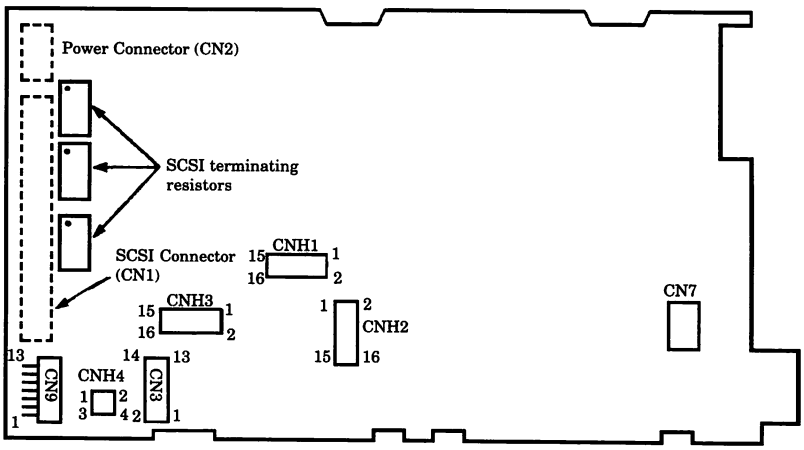


Figure 8 – Fujitsu 226X Series Jumper Locations

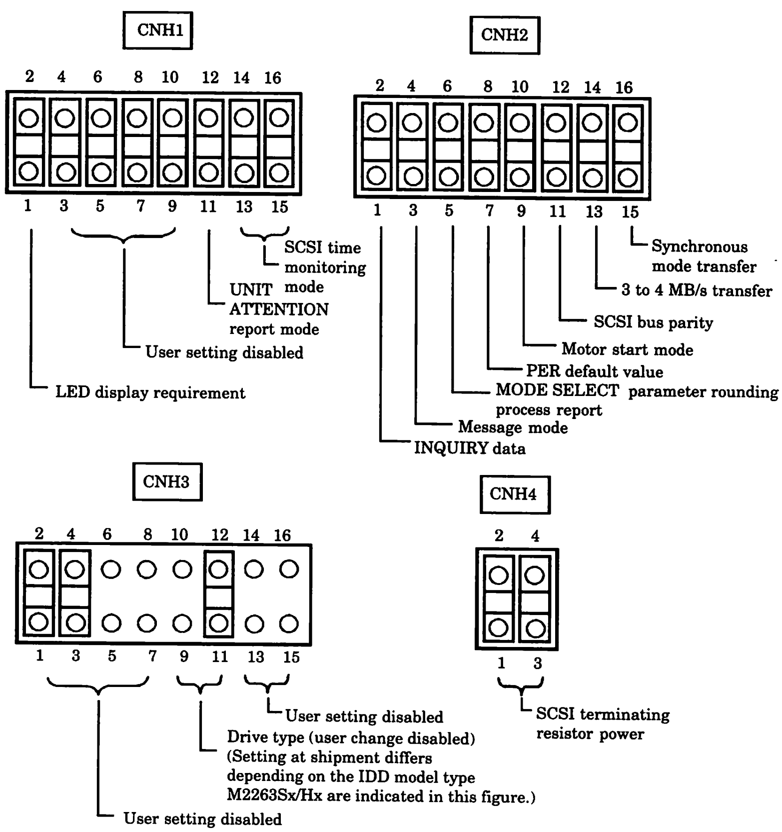


Figure 9 – Fujitsu 226X Series Jumper Settings

Fujitsu 226X (Continued)

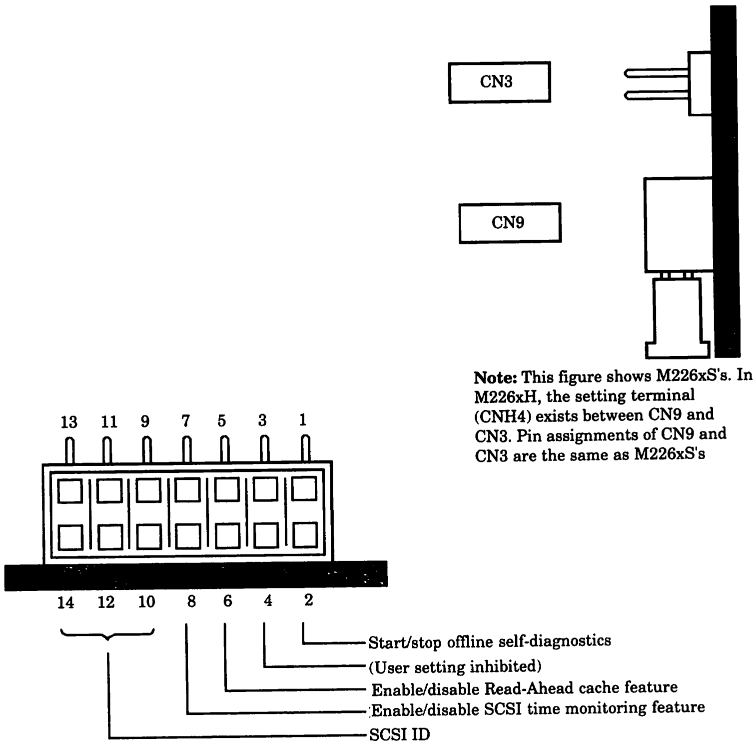
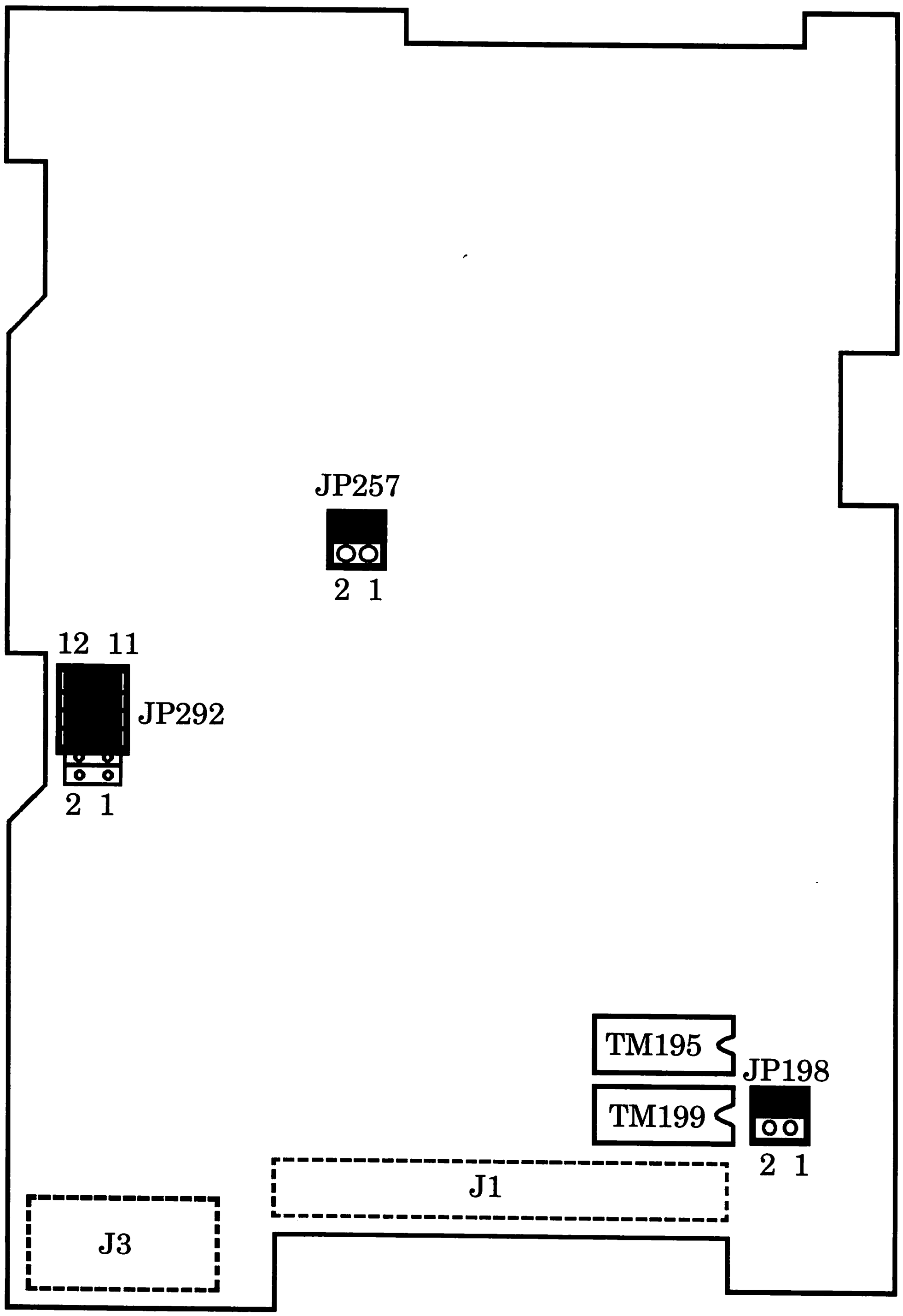


Figure 10 – Fujitsu 226X Jumper Settings (Continued)

Hitachi DK514C

(PCB Rev A/D2 or later)



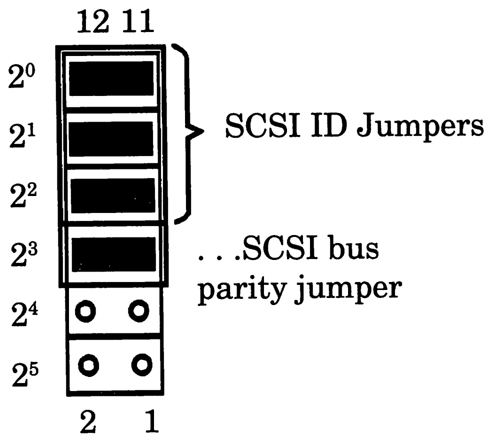
Note: The terminator of the DK514C must be removed except for the last drive of the daisy-chain.

Figure 11 - Hitachi SZ916 PCB Default Jumper Settings

Hitachi DK514C (Continued)

1) SCSI ID setting jumper (JP292 Bits 2^0 - 2^2)

JP292



SCSI ID Jumper Settings

2^2	2^1	2^0	SCSI ID#
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

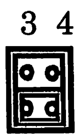
Shipped with ID# = 0

2) SCSI bus parity jumper (JP292 bit 2^3)

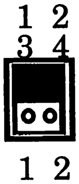
1: Disables SCSI bus parity
0: Enables SCSI bus parity

Note: 0 = Jumper plug installed
1 = Jumper plug removed

3) Terminator power on/off jumper (JP198 bit 2^6)



+ 5V source for terminator is supplied from the SCSI bus or the controller

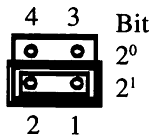
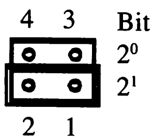


+ 5V source for terminator is supplied only from the controller (default)

■ Jumper installed □ User changeable (Green Jumper)

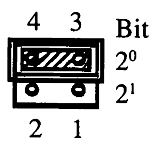
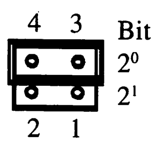
<u>Hitachi DK514C</u> (Continued)

4) Write protect jumper

No.	Jumper plug JP 257 bit 2^1	Meaning
1		Write protected. The DK514C can only be read from and cannot be written to.
2		Read or Write. The DK514C is enabled for both read and write operations.

This jumper is installed in the read/write position when shipped from the factory.

5) Motor Start/Stop option jumper

No.	Jumper plug JP 257 bit 2^2	Meaning
1		When the motor start/stop option is not selected, the spindle motor is started when the DK514C power is applied. (Note 1)
2		When the motor start/stop option is selected, the spindle motor is started by using a SCSI command.

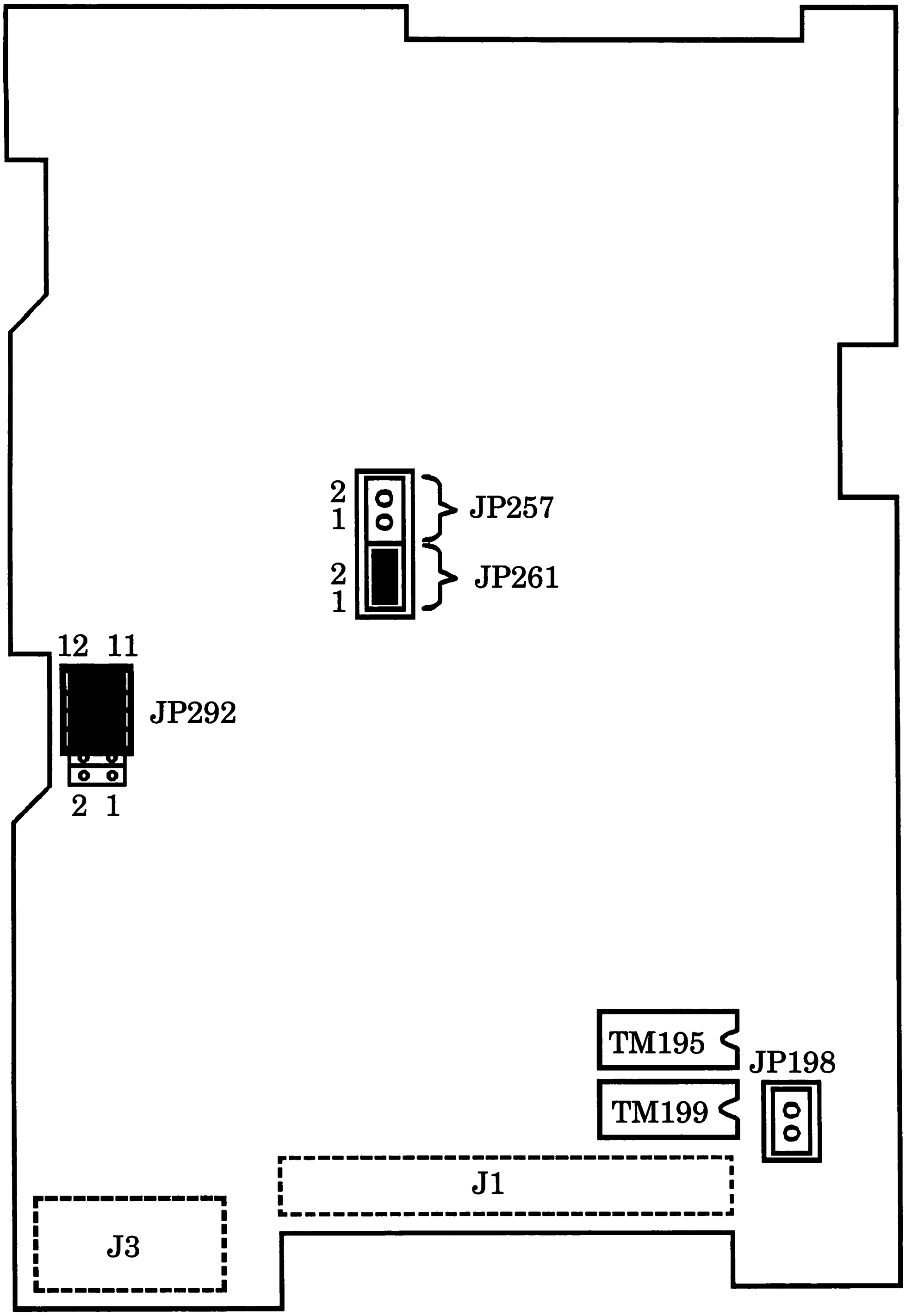
When shipped from the factory, this jumper is installed in position #1 (option not selected).

When the motor start/stop option (No. 2) is selected, the drive enters the motor stop state when its power is turned on. Use the Start/Start Unit command (1BH) to start or stop the drive.

Note 1: When the motor start/stop option is used, the controller does not respond to the host for about 35 seconds from Powerup to Drive Ready

Hitachi DK514C (Continued)

(PCB Rev A/D1 or earlier)

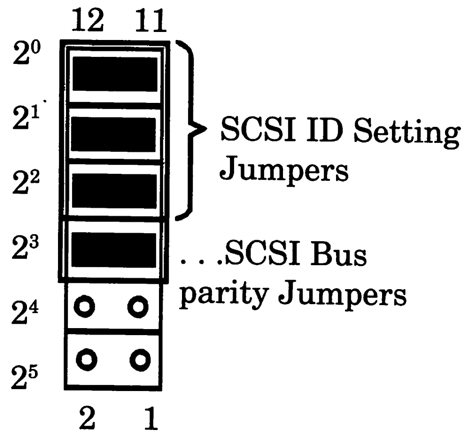


Note: The terminator of the DK514C must be removed except on the last drive of the Daisy Chain.

Figure 12 - SZ916 PCB Jumper Locations

Hitachi DK514C (Continued)

1) SCSI ID setting jumper (JP292 Bits 2^0 - 2^2)



SCSI ID Setting Jumpers

2^2	2^1	2^0	SCSI ID#
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

Shipped with ID# = 0

2) SCSI bus parity jumper (JP292 bit 2^3)

1: Disables SCSI bus parity
0: Enables SCSI bus parity

Note: 0 = Jumper plug installed
1 = Jumper plug removed

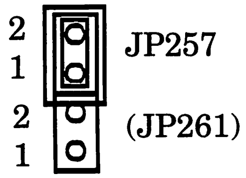
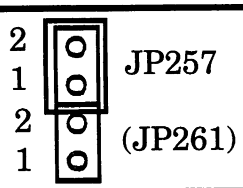
3) Terminator power on/off jumper (JP198 bit 2^6)

 + 5V source for terminator is supplied from the SCSI bus or the controller

 + 5V source for terminator is supplied only from the controller (default)

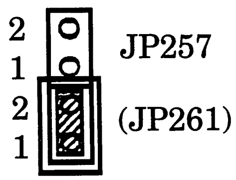
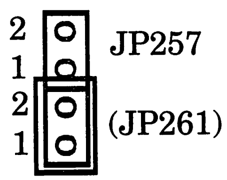
Hitachi DK514C (Continued)

4) Write protect jumper

No.	Jumper plug JP 257	Meaning
1		Write protected. The DK514C can only be read from and cannot be written to.
2		Read or Write. The DK514C is enabled for both read and write operations.

This jumper is installed in the read/write position when shipped from the factory.

5) Motor Start/Stop option jumper

No.	Jumper plug JP 261	Meaning
1		When the motor start/stop option is not selected, the spindle motor is started when the DK514C power is applied. (Note 1)
2		When the motor start/stop option is selected, the spindle motor is started by using a SCSI command.

When shipped from the factory, this jumper is installed in position #1 (option not selected).

When the motor start/stop option (No. 2) is selected, the drive enters the motor stop state when its power is turned on. Use the Start/Stop Unit command (1BH) to start or stop the drive.

Note 1: When the motor start/stop option is used, the controller does not respond to the host for about 35 seconds from Powerup to Drive Ready

Hitachi DK 515

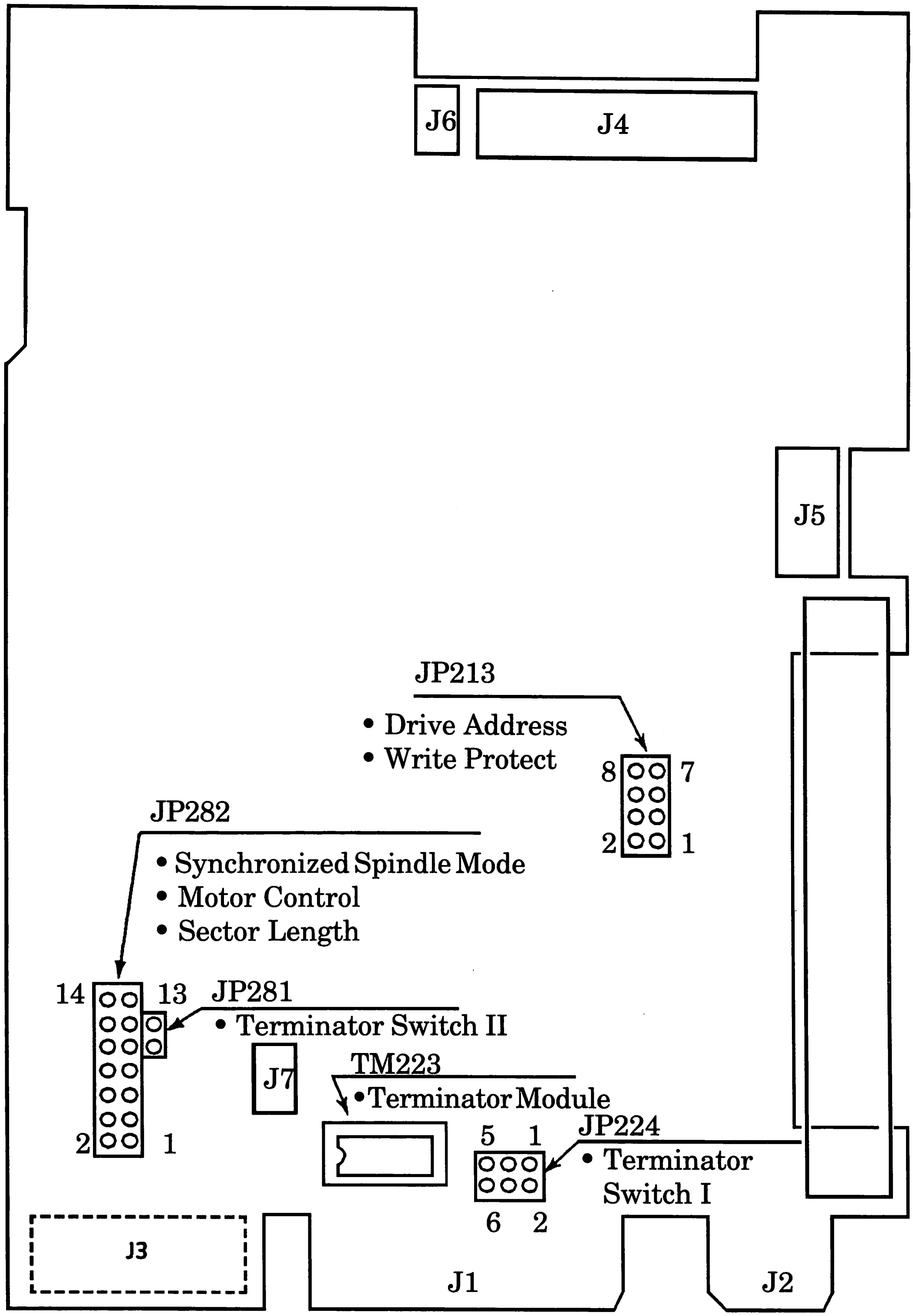


Figure 13 - SZ931 PCB Layout (PCB Rev. 0)

Hitachi DK515 (Continued)

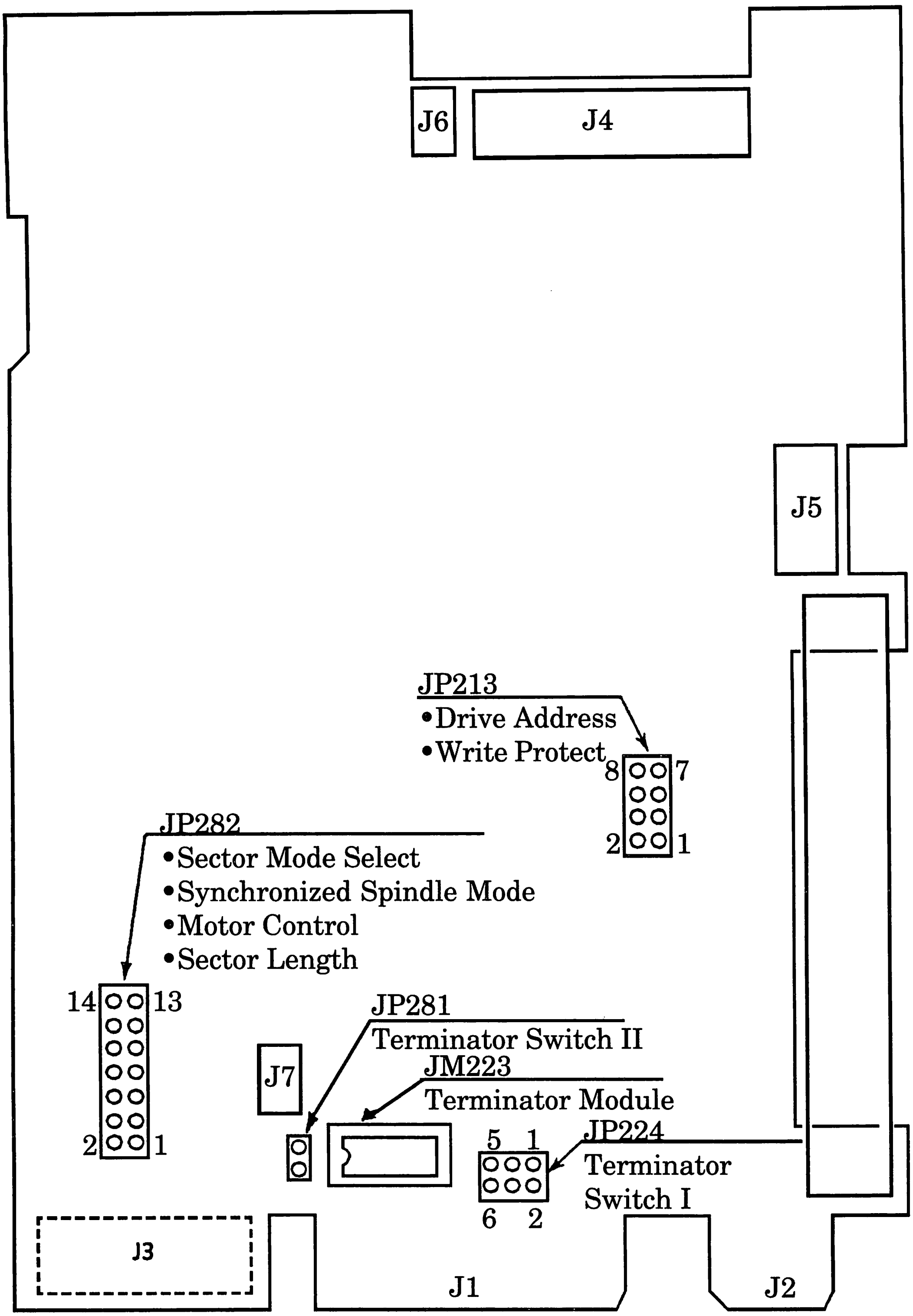


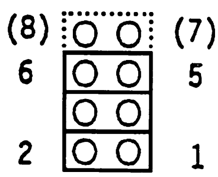
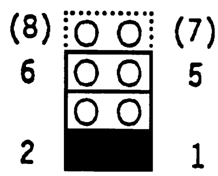
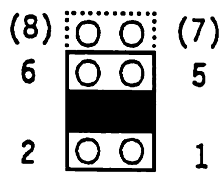
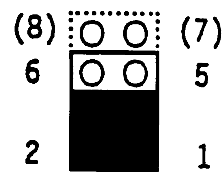
Figure 14 - SZ931 PCB Layout (Rev. 1 or later)

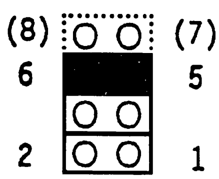
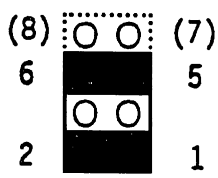
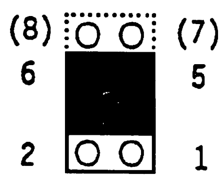
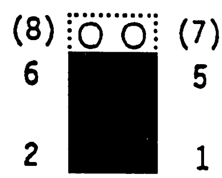
Hitachi DK515 (Continued)

(i) Drive Address Jumper (JP213, Pin 1-6)

Drive address can be selected by using the jumper switch (JP213) the jumper setting and the selected drive address is shown in the following table. Drive #0 is not used.

Jumper Settings for Drive Address

Drive No.	None	#1	#2	#3
				

Drive No.	#4	#5	#6	#7
				

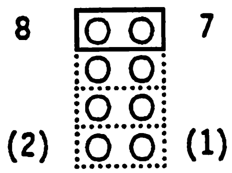
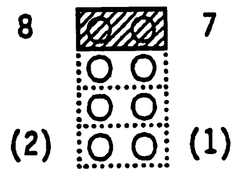
Drive #1 is selected when shipped from the factory

Hitachi DK515 (Continued)

(ii) Write Protect Jumper (JP213, Pin 7-8)

Write operation of a drive is inhibited by setting a jumper on JP213, Pin 7-8 (Write protect mode), this condition will generate an ATTENTION status on receipt of a WRITE GATE-N signal.

Jumper Setting for Write Protect

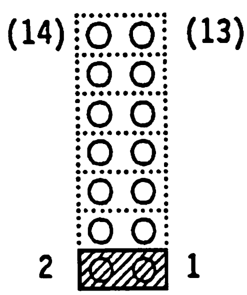
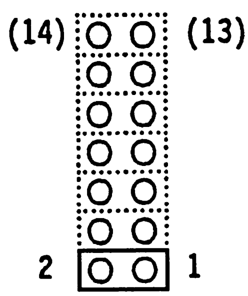
JP213 (pins 7-8)		
Function	Write Enable	Write Protect

Write Enable mode is selected when shipped from the factory.

(iii) Sector Mode Select Jumper (JP282, Pins 1-2)

The drive with Hard Sector mode issues SECTOR clock on J1 pin 16 and J2 pin 2, and with Soft Sector mode does ADDRESS MARK FOUND-N on J1 pin 16 and J2 pin 2. The SET CONFIGURATION command takes precedence over this jumper setting.

Jumper Setting for Sector Mode Selection

JP282 (pins 1-2)		
Function	Hard Sector	Soft Sector

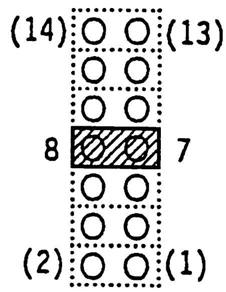
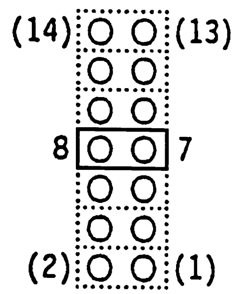
Hard Sector mode is selected when shipped from the factory

Hitachi DK515 (Continued)

(iv) Motor Control Jumper (JP282, Pins 7-8)

The Start/Stop jumper should be installed only if the controller supports remote start/stop.

Jumper Setting for Motor Start/Stop

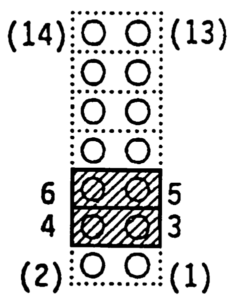
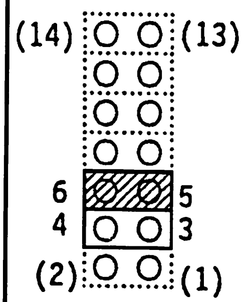
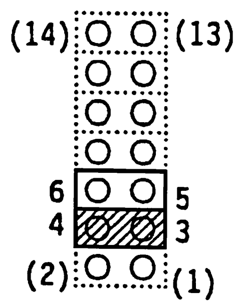
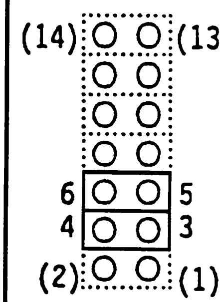
JP282 (Pins 7-8)		
Function	Not Supported	Supported

Not Supported mode is selected when shipped from the factory

(v) Synchronized Spindle Mode Select Jumper (JP282, pins 3-6).

Synchronized spindle mode can be selected by using the jumper switch (JP282, pins 3-6). This jumper setting will be aborted by the following Set Configuration command. Set the jumpers before turning on the DC power. For details, refer to DK51X Winchester Disk Drive Synchronized Spindle Feature Specification.

Jumper Setting for Synchronized Spindle Mode

JP282 (Pins 3-6)				
Function	Off Line	Slave	Master	Remote

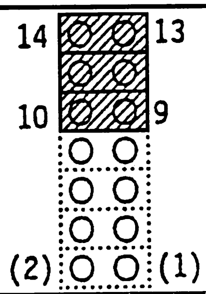
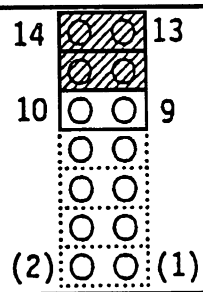
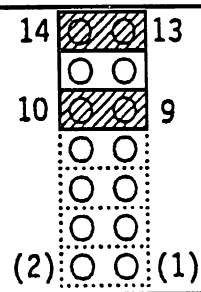
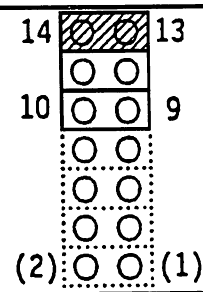
Off Line mode is selected when shipped from the factory

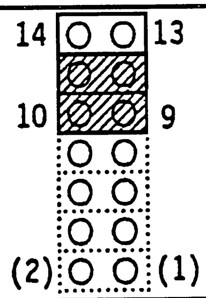
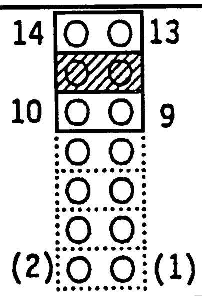
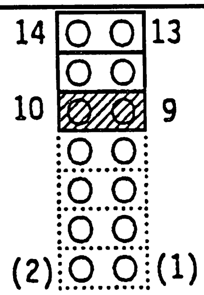
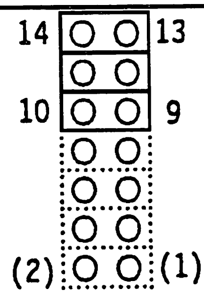
Hitachi DK515 (Continued)

(vi) Sector Length Jumper (JP282, pins 9-14)

This jumper setting function is effective with Hard Sector mode. This jumper setting will be aborted by the SET BYTES PER SECTOR command. All the applicable configurations of Bytes/Sector or Sectors/Track are listed in the following table. Set the jumper(s) before turning on the DC power.

Jumper Setting for Sector Length

JP282 (Pins 9-14)				
Bytes Per Sector	335	338	593	602
Sectors Per Track	122	121	69	68
Data Length	256	256	512	512

JP282 (Pins 9-14)				
Bytes Per Sector	Adjustment Mode	1107	Not Used	
Sectors Per Track		37		
Data Length		1024		

122 sectors per track is selected when shipped from the factory
69 sectors per track required for PC applications

Maxtor LXT-100

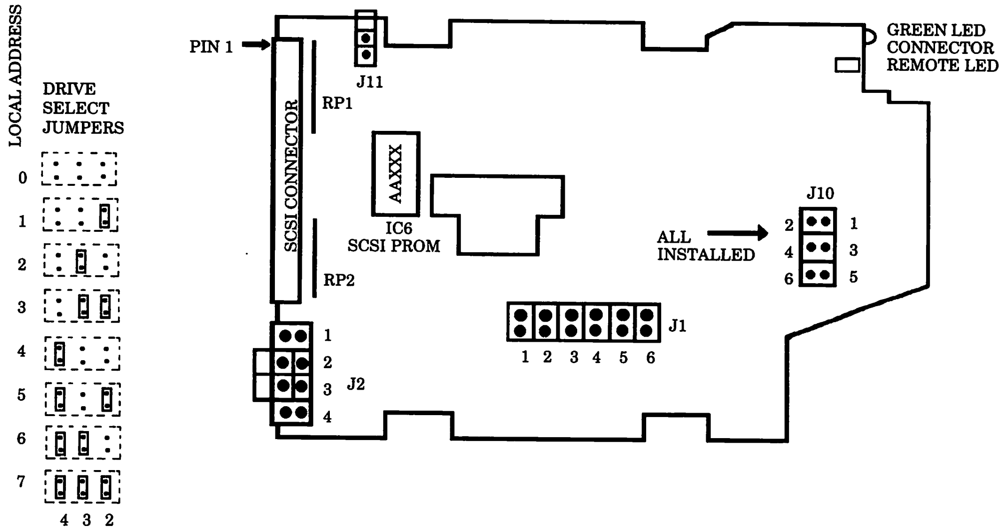


Figure 15 - Maxtor LXT-100 Jumper Locations

Maxtor LXT-200A

Jumper locations are identified in Figure 12, PCB Layout and Table Q Jumper Configurations.

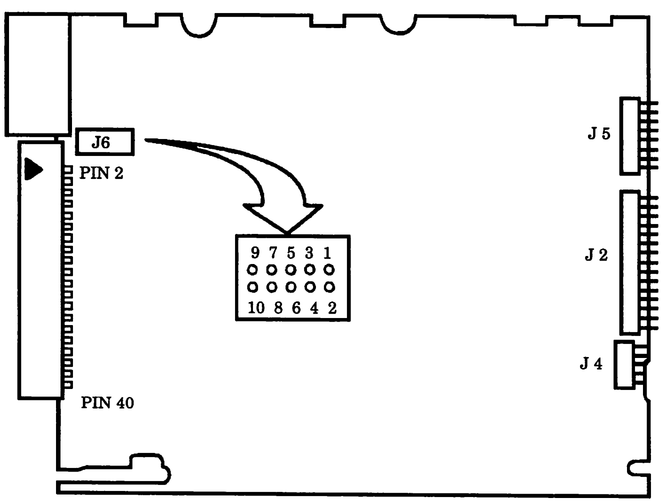


Figure 16 - Maxtor LXT-200A PCB Layout

Table Q - Maxtor LXT-200A Jumper Configurations

PIN NUMBERS		JUMPER	SINGLE DRIVE SYSTEM	DUAL DRIVE SYSTEM	
				MASTER	SLAVE
9	10	Manufacturing Jumper	Removed	Removed	Removed
7	8	Two Drive System Jumper	Removed	Installed	Removed
5	6	Slave Present Jumper	Removed	Removed	Optional
3	4	Drive Active Jumper	Optional	Optional	Removed
1	2	Master/Slave Jumper	Removed	Removed	Installed

Maxtor XT 1000/2000 Series

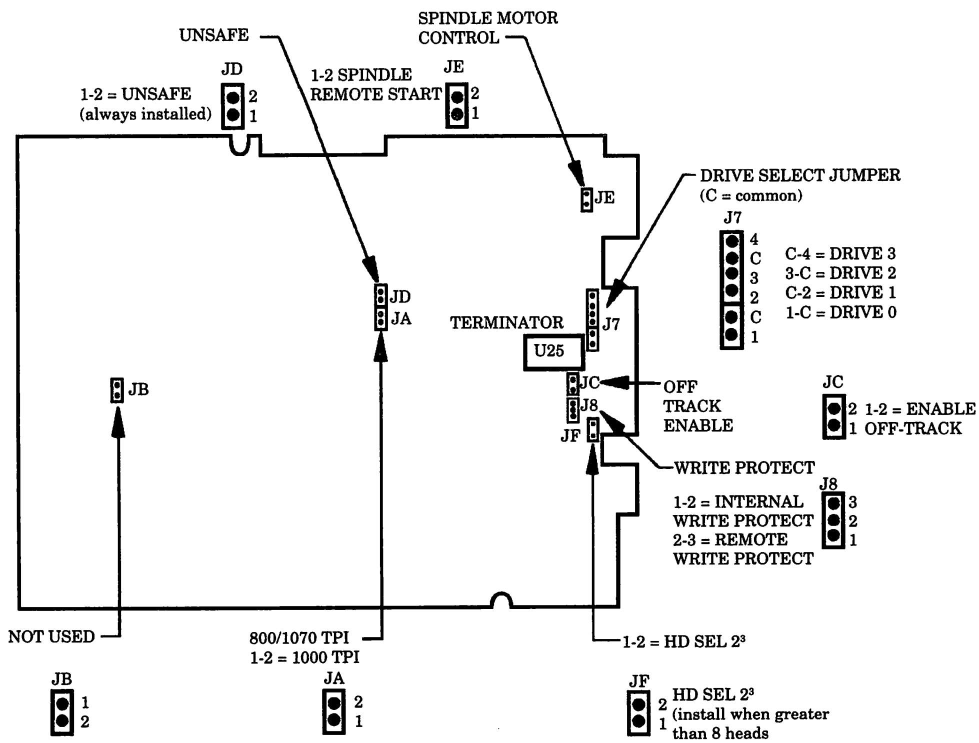


Figure 17 – Maxtor XT 1000/2000 Series Drive Select Jumper Options

Maxtor 4000E Series

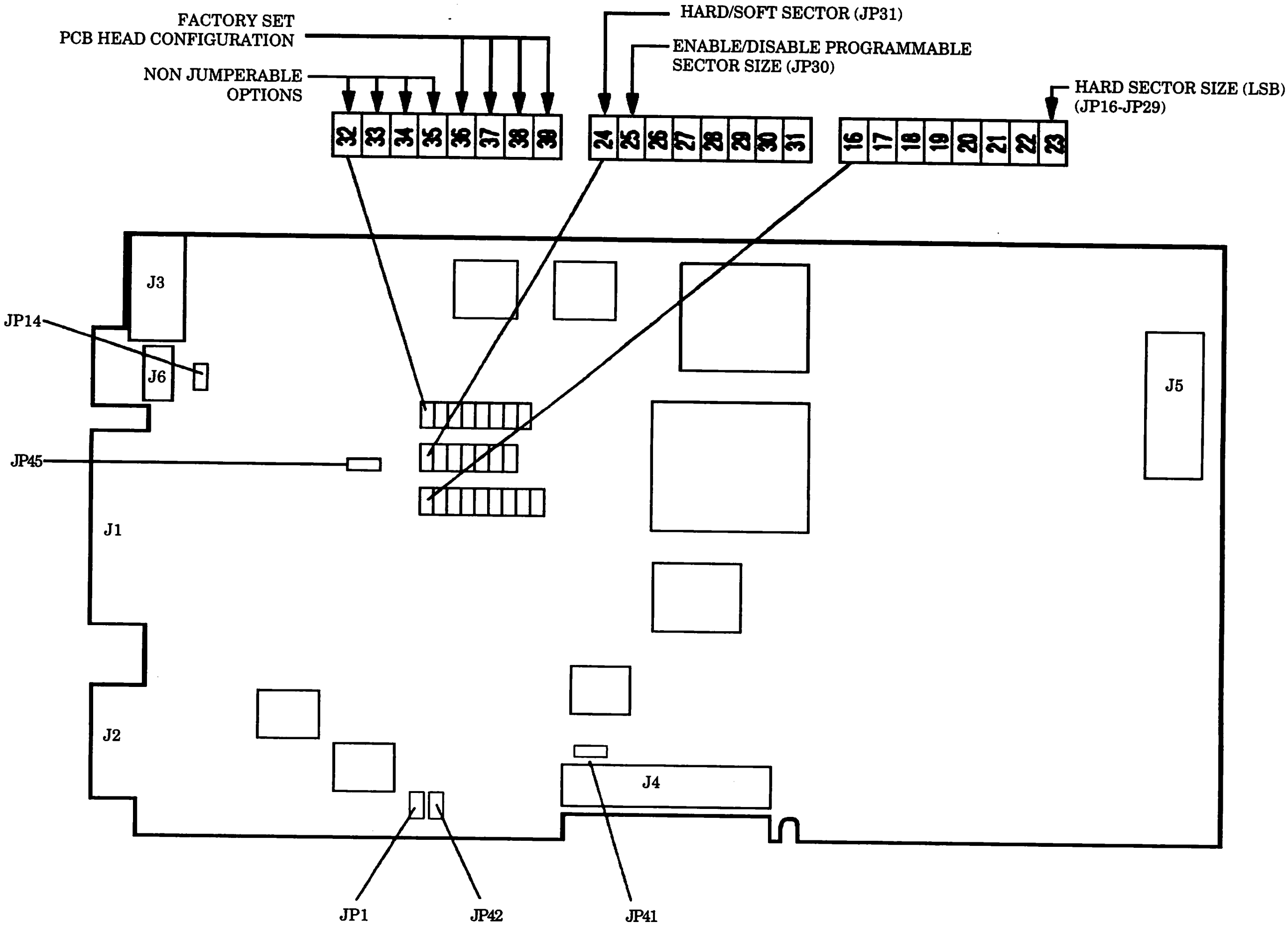


Figure 18 – Maxtor 4000E Jumper Options

Table R – Maxtor 4000E Drive Select Jumpers

FUNCTION	JUMPER BLOCK PIN NUMBERS
DRIVE SELECT 0	1, C
DRIVE SELECT 1	2, C
DRIVE SELECT 2	3, C
DRIVE SELECT 3	4, C

Maxtor 4000E Series (Continued)

Table S – Maxtor 4000E Series, Drive Jumper Descriptions

JUMPER	DESCRIPTION
JP1 (in)	Used for Maintenance Testing
JP6 (in)	In = Motor Spinup Option Disabled Out = Remote Motor Spinup Option Enabled
DS1-DS7 (DS1 in)	Drive Select
JP14 (out)	In = Write Protected Out = No Write Protection
JP16-JP29	Unformatted Hard Sector Size in Bytes Jumpers, LSB = JP16, MSB = JP29
JP30	In = Enables Programming of theHard Sector Size Through the interface Out = Disable this function
JP31	In = Soft Sector Mode Out = Hard Sector Mode
JP32-JP35	PCB Head Configuration
JP41	Test Connection, Not a Jumperable Option
JP 42 (in)	Used for Manufacturing Testing
Note: Jp4, Jp5, Jp15, JP36, JP37, JP38, JP39, JP40, and JP41 ARE NOT JUMPERABLE OPTIONS. THE ONLY CUSTOMER CONFIGURABLE OPTIONS ARE JP6, JP14, JP16-JP29, JP30, JP31, AND DS1-DS7.	

Maxtor XT 8000E Series

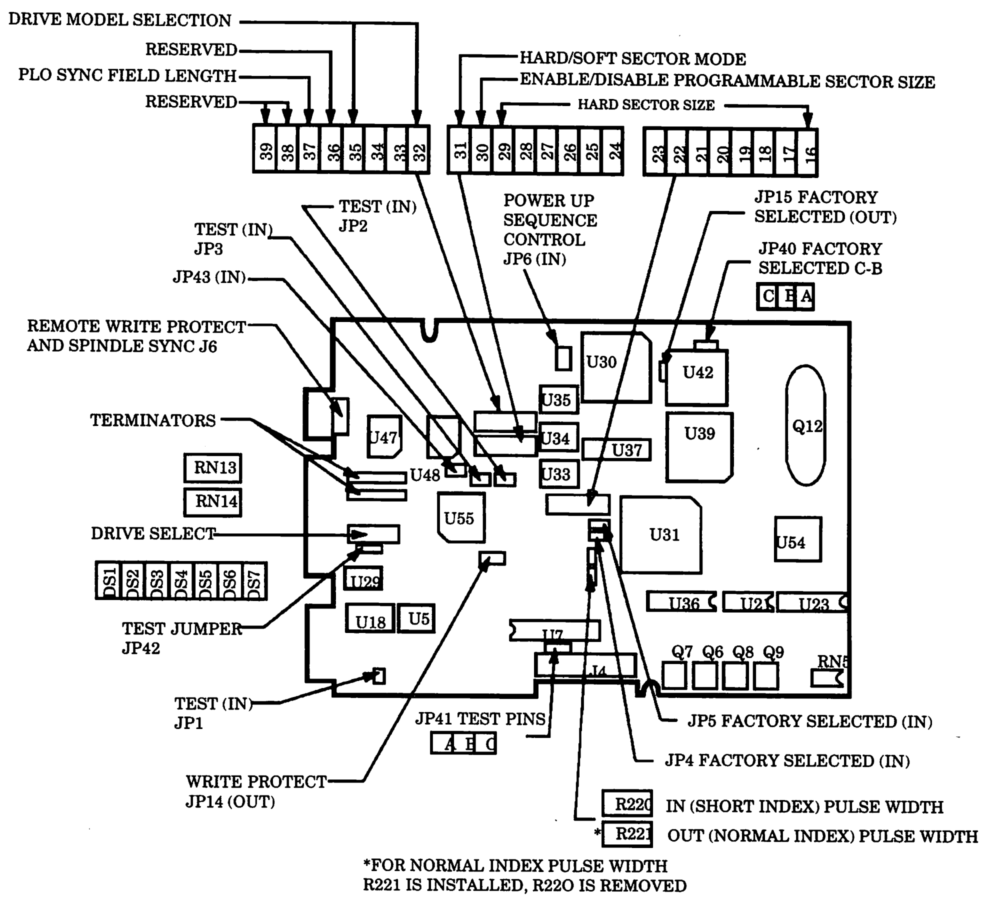


Figure 19 – Drive Jumper Options (PCB P/N 1014150)

Maxtor XT 8000E Series (Continued)

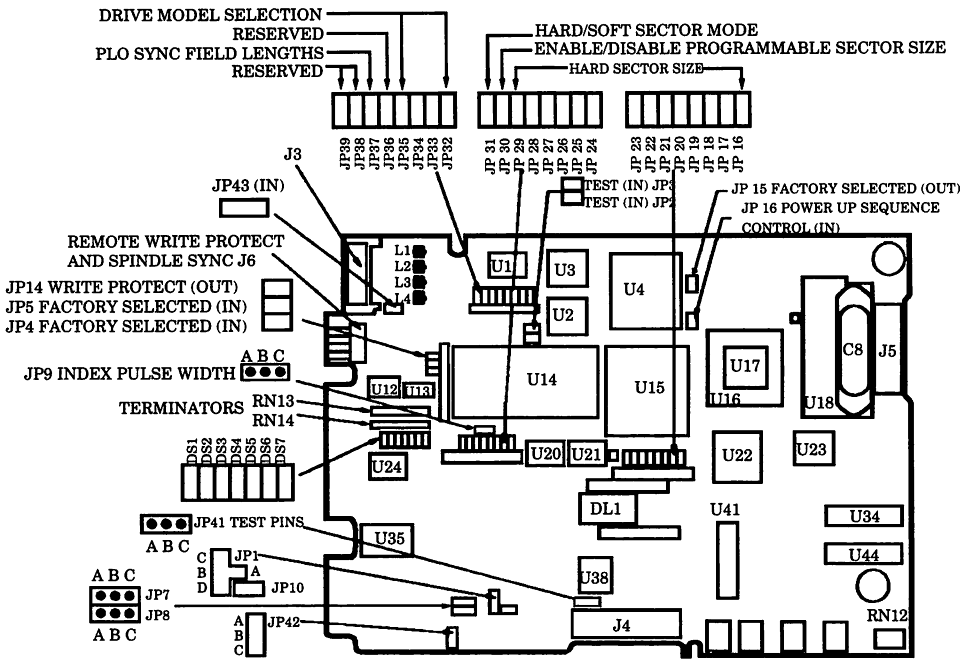


Figure 20 – Drive Jumper Options (PCB P/N 1015468)

Micropolis 132X Series

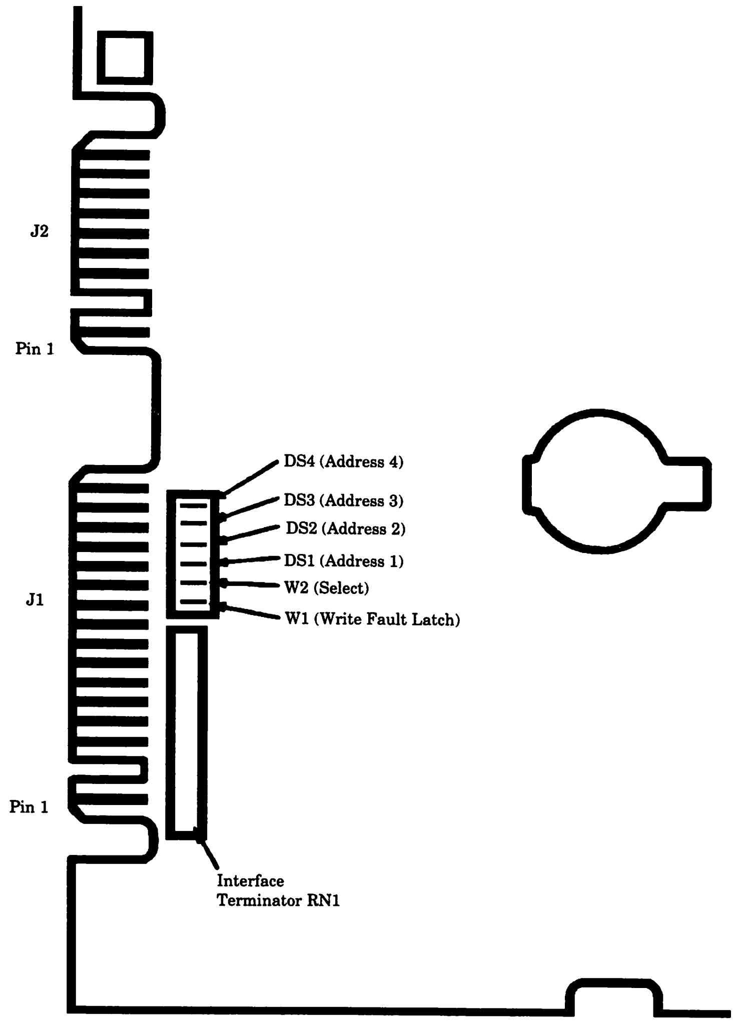


Figure 21 – Micropolis 132X Drive Jumper Options

Micropolis 135X Series

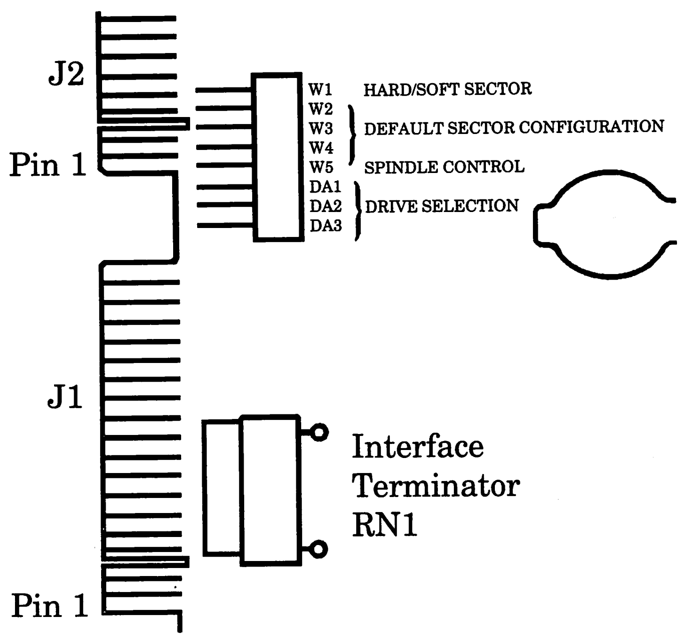


Figure 22 – Micropolis 135X Jumper Settings

Micropolis 137X Series

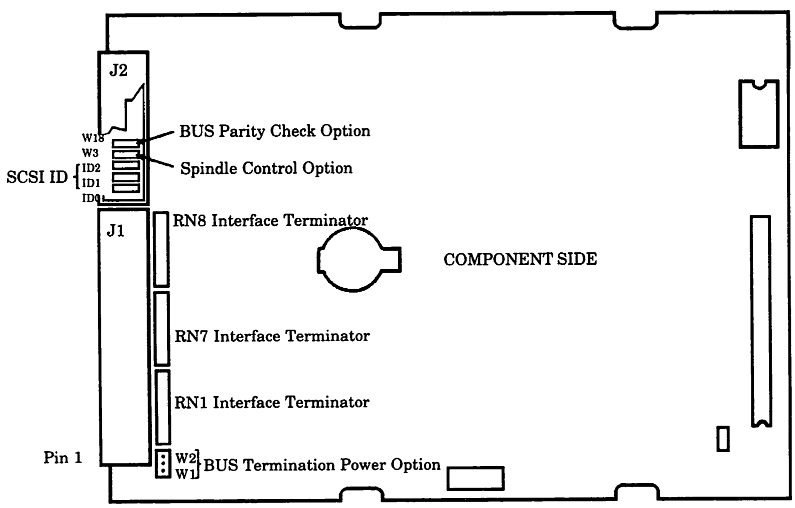


Figure 23 – Micropolis 137X Jumper Settings

Micropolis 155X Series

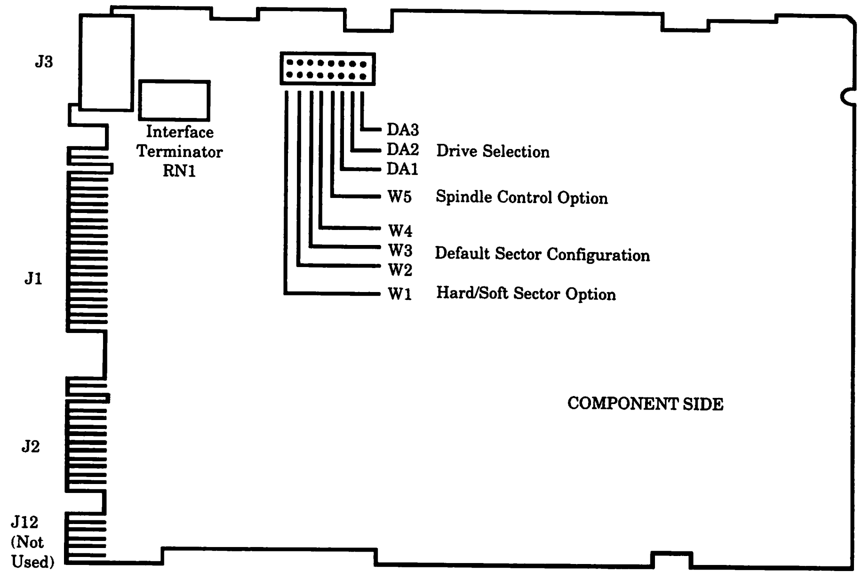


Figure 24 – Micropolis 155X Jumper Settings

Micropolis 157X Series

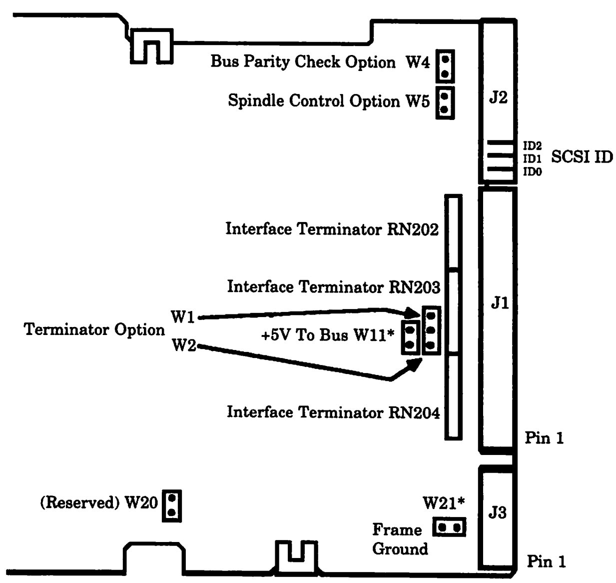


Figure 25 – Micropolis 157X Jumper Settings

Miniscribe 9380 E Drives

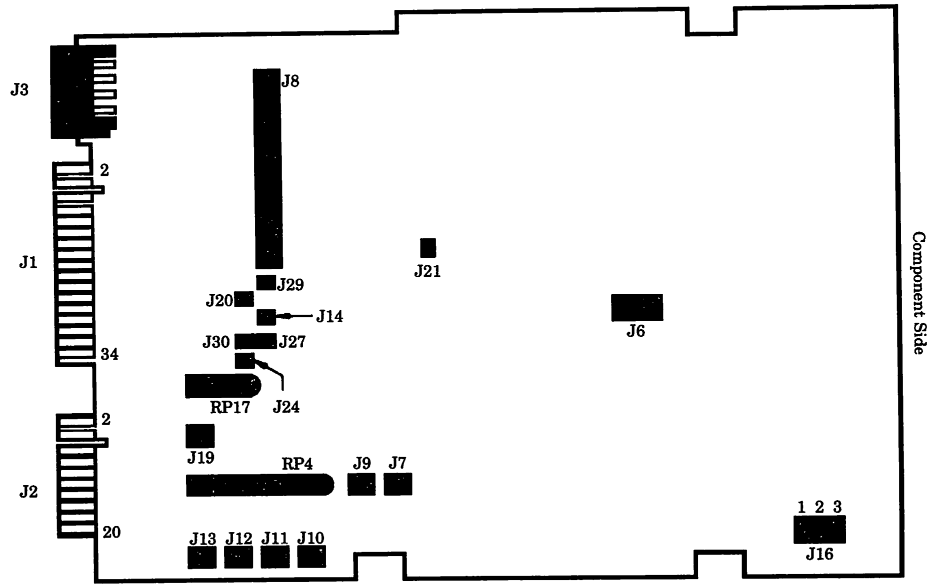


Figure 26 – Miniscribe 9380E Jumper Locations

Table T – 9380E Option Jumpers and Test Point Description

Option Jumpers:			
J7	Start/Stop Spindle Motor Enable		
J9	Diagnostic Jumper		
J10, J11	Head Configuration		
Heads	**J10**	**J11**	
7	S	O	
11	O	S	
13	S	S	
15	O	O	
Sectors	**J12**	**J13**	**J19**
34	S	O	O
35	O	O	O
36	O	S	O
SOFT	S	S	S (Controller will select Sector #)
Drive Select Address Configuration			
Drive	**J16-1**	**J16-2**	**J16-3**
No Selection	0	0	0
1	1	0	0
2	0	1	0
3	1	1	0
4	0	0	1
5	1	0	1
6	0	1	1
7	1	1	1
Terminators: RP4, RP17			
Note: These 7 jumpers must be installed for drive operation: J14, J20, J21, J24, J27, J29, and J30			

Miniscribe 9380S Drives

J701 is a group of two pairs of jumper pins. The first pair controls terminator power supplied by the target, while the second pair controls power supplied from elsewhere on the bus.

Table U – Miniscribe 9380S Jumper Settings

SCSI TERMINATOR POWER	J701-1	J701-2	
Local Terminator Power	ON	OFF	
Remote Terminator Power	OFF	ON	
ADDITIONAL JUMPER DEFINITIONS			
J7	Start/Stop Spindle Motor Enable		
J9	Diagnostics Jumper		
J10/J11	Head Configuration		
J12/J13/J19	Sector Setting		
Note:	These 7 jumpers must be installed for drive operation: J14, J20, J21, J24, J27, J29, and J30.		
Terminator Resistors:	RP701 and RP702		
Drive Select Address Configuration	**J601-1**	**J601-2**	**J601-3**
SCSI Address 0	OFF	OFF	OFF
SCSI Address 1	OFF	OFF	ON
SCSI Address 2	OFF	ON	OFF
SCSI Address 3	OFF	ON	ON
SCSI Address 4	ON	OFF	OFF
SCSI Address 5	ON	OFF	ON
SCSI Address 6	ON	ON	OFF
SCSI Address 7	ON	ON	ON
SCSI Parity Enable	**J602-2**		
SCSI Parity Enabled	OFF		
SCSI Parity Disabled	ON		

Priam 514, 519

Table V – Option/Select Switch Settings

Position	Switch ON
POS-6	PRIAM UNIQUE MODE
POS-5	RADIAL OPTION
POS-4	DRIVE SELECT 4
POS-3	DRIVE SELECT 3
POS-2	DRIVE SELECT 2
POS-1	DRIVE SELECT 1

Priam 617, 628, 638

Table W – Drive Select Jumpers

DRIVE SELECTED	SWITCH POSITION		
	1	2	3
NONE	OFF	OFF	OFF
1	ON	OFF	OFF
2	OFF	ON	OFF
3	ON	ON	OFF
4	OFF	OFF	ON
5	ON	OFF	ON
6	OFF	ON	ON
7	ON	ON	ON

Table X – Sector Settings

S1-4	S1-5	Physical Size in Bytes	Logical Size in Bytes	Track Capacity
OFF	OFF	Reserved Setting		
OFF	ON	64 Sectors of 324	256	16,384
ON	OFF	36 Sectors of 578	512	18,432
ON	ON	19 Sectors of 1096	1024	19,456

Priam 717, 728, 738

Table Y – Jumper Settings

J11 JUMPERS	SETTING	FUNCTION	
1-2		Device ID 1	
3-4		Device ID 2	
5-6		Device ID 4	
7-8	ON	Auto Sequence Up	
9-10	ON	Parity Enable	
11-12		Block Size 1	
13-14		Block Size 2	
	13-14	**11-12**	
	OFF	OFF	Block Size Set By Mode Select Command (15H)
	OFF	ON	256 Bytes/Block
	ON	OFF	512 Bytes/Block
	ON	ON	1024 Bytes/Block
15-16	ON	Unit Attention Disabled	
17-18	(Output)	-Drive Ready	
19-20		Enable Write Protect	
OTHER JUMPERS	**SETTING**	**FUNCTION**	
W6*	OPEN	Soft SCSI Bus Reset	
W6**	INSTALLED	Hard SCSI Bus Reset	
W5**	INSTALLED	Auto Sequence Up Delay	
W3*	INSTALLED	Terminator Power To J1-26	

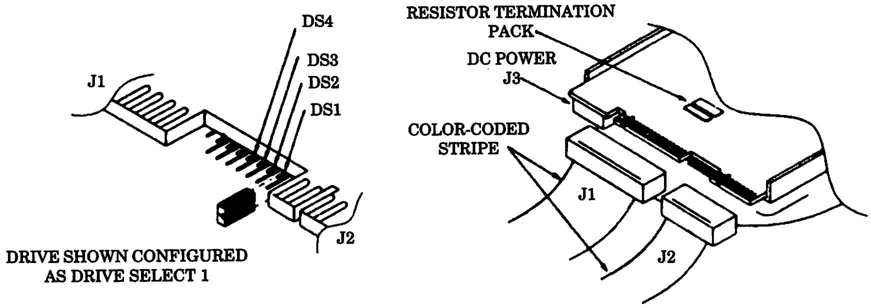


Figure 27 – Half-Height Interface Connectors

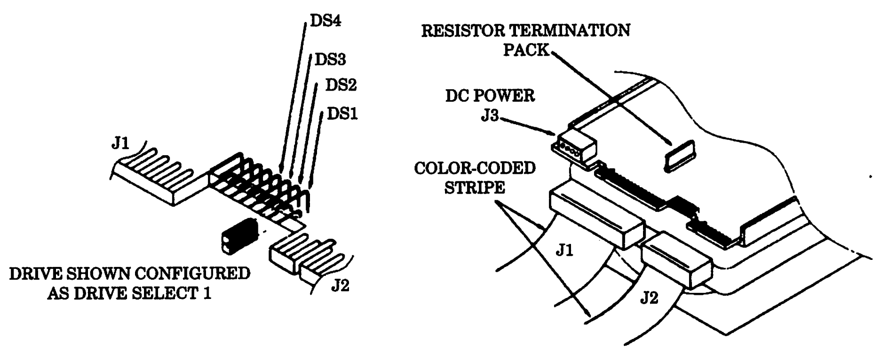


Figure 28 – Full-Height Interface Connectors

Seagate 3.5" MFM/RLL Drives

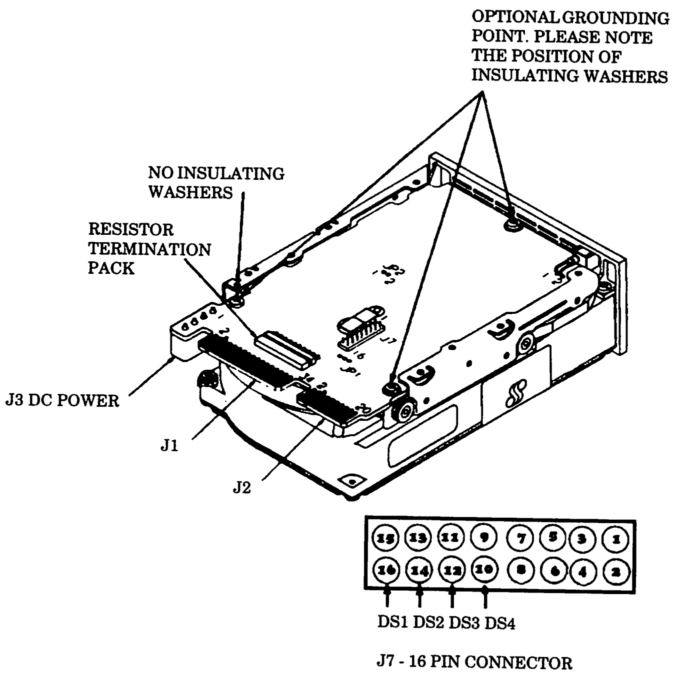


Figure 29 – 3.5" Interface Connectors

Seagate SCSI Drives

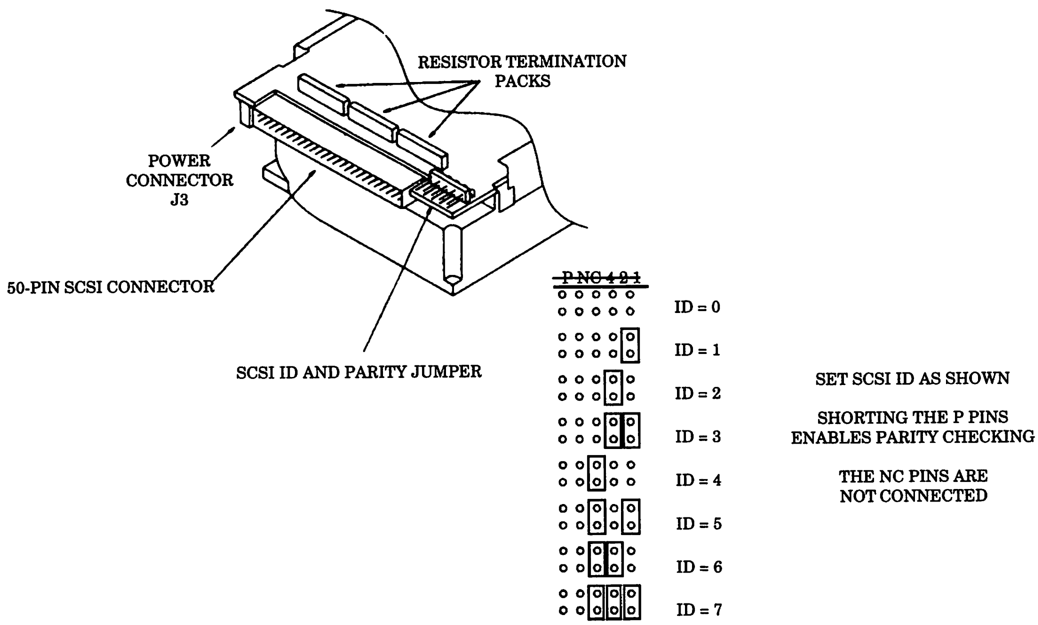


Figure 30 – 3.5" SCSI Interface Connectors

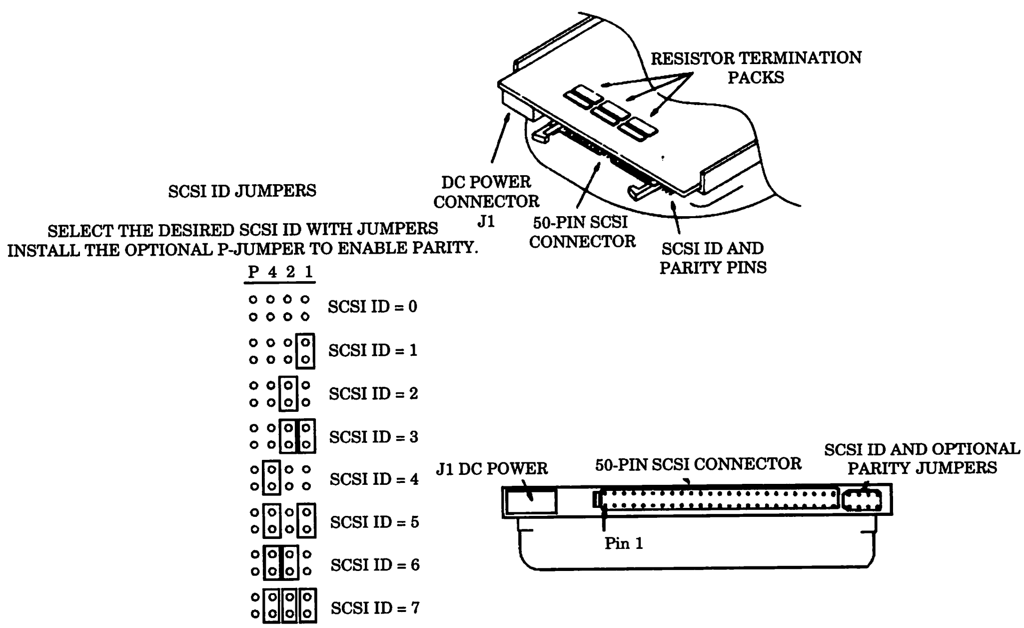


Figure 31 – 5.25" SCSI Interface Connectors

CSC Benchmark Tests

About the Benchmarks

CSC has selected several high performance high capacity drives and controllers for review on the following pages.

The average seek times listed are those purported by the manufacturer and what we actually tested. Seek times were tested on Wilson and Flexstar testers the type used for factory final tests.

We have included the Manufacturer's reliability rating in Power On Hours (POH). One year of continuous operation is 8760 POH. So a drive with a Mean Time Between Failures (MTBF) rating of 50,000 POH, should last at least 5 years. The MTBF rating for drives which are operated at elevated temperatures or used in heavy seek applications (such as network servers) should be derated by 50%. Experience has taught us not to take MTBF ratings over 100,000 POH seriously.

Since CSC both sells and services disk drives, we have included our own confidence rating. This rating is based on the number of drives returned to us for service.

The controller card thoughputs listed were achieved on a typical 33MHz motherboard with an 8MHz bus speed. The throughput you receive will vary based on I/O channel clock speed and wait states. All of the boards we have tested operate at bus speeds up to 10MHz.

ESDI Drives

Maxtor EXT-8380E

Formatted Capacity:	361MB
Rated Access:	14.5ms
Tested Access:	13.8ms
Transfer Rate:	15MHz
Rated MTBF:	75,000 POH
Confidence:	Maxtor's 8380E is based on the 8760 design. It is identical to an 8760E with three disks and six heads removed. The lower actuator mass results in improved seek times. CSC rates the 8380 as an overall reliable drive. Unfortunately, most PC applications will not notice the improved 15MHz data transfer rate since the PC's I/O channel is the performance limiting bottleneck. The 8380 is an excellent buy in a fast, large capacity hard drive.

Hitachi DK515C-78

Formatted Capacity:	642MB
Rated Access:	16ms
Tested Access:	15.2ms
Transfer Rate:	20MHz
Rated MTBF:	75,000 POH
Confidence:	Hitachi's DK515 drive is one of the best selling 700MB class drives in the industry. This drive features simple electronics and conservative mechanical design for long term reliability. CSC rates this drive as highly reliable and feels that this is the best buy in a 700MB class drive.

Miniscribe 9380E

Formatted Capacity:	335MB
Rated Access:	16ms
Tested Access:	15.8ms
Transfer Rate:	10MHz
Confidence:	This drive uses a clamshell design for accurate and rigid mechanical clamping. Due to the recent purchase of Miniscribe Corporation by Maxtor, a large quantity of these drives have become available at significantly reduced cost. Overall reliability is good. These are the best buy in a 380MB class drive.

IDE Drives

Conner CP 3104

Formatted Capacity:	100MB
Rated Access:	23ms
Tested Access:	25ms
Throughput:	850KB/s
Rated MTBF:	75,000 POH
Confidence:	The 3104 is a reliable 3.5" 100MB drive. These drives appear to be sensitive to rough handling. The 3104 is an overall good buy in a 100MB IDE drive.

Maxtor LXT 200A

Formatted Capacity:	200 MB
Rated Access:	15ms
Tested Access:	14.2ms
Throughput:	1020KB/s
Rated MTBF:	80,000 POH
Confidence:	The Maxtor LXT-200 is one of the fastest 3.5" high capacity drives we have tested. It is also the quietest drive we have come across. This drive uses a three zone recording technique to achieve high capacity without reducing reliability. The LXT-200 is the best buy in a large capacity 3.5" drive.

Quantum Q80A

Formatted Capacity:	80MB
Rated Access:	19ms
Tested Access:	19.2ms
Throughput:	865KB/s
Rated MTBF:	75,000 POH
Confidence:	Quantum's 80MB Pro Drive uses a unique glass scale positioning system. This drive has proven to be highly reliable and is an overall good buy in a low capacity IDE.

ESDI Controllers

Adaptec 2322

Controls:	2 ESDI up to 10Mbit/s and 2 Floppy drives
Throughput:	820KB/sec
Confidence:	The 2322 is the most compatible controller card we have found. We have yet to find a motherboard or drive that the 2322 will not work with. The 2322 isn't the fastest and doesn't use the latest technology, but its ease of installation and compatibility make it a good buy.

DTC 6280-15TX

Controls:	2 ESDI up to 15Mbit/sec and 2 Floppy drives.
Throughput:	1125KB/sec
Confidence:	The DTC 6280-15TX is one of the best new ESDI controllers we have found. It includes a 32K read-ahead cache buffer which speeds transfer and makes drive operation interleave independent. DTC's firmware permits update of the ESDI defect tables and is compatible with everything we've tried. The 6280-15TX is the best performing, best buy on an ESDI controller.

Ultrastor U12F/32

Controls:	2 ESDI up to 20Mbit/sec and 2 floppy drives
Throughput:	740KB/sec
Confidence:	The Ultrastor U12F offers a reasonable throughput at a very low cost. It is the least expensive of all the controllers we've tested and has a sophisticated ROM BIOS with built in formatting routines. Unfortunately, the Rev F board we tested in November 1990 had incompatibility problems with several of our test drives including an Imprimis 94161, a Miniscribe 9380E and a Maxtor 8760. Ultrastor claims that some of these problems are the fault of the drive manufacturers, and that some will be fixed in the future with a controller card BIOS upgrade.

SCSI Controllers

CSC Fast Cache 32

Controls: 4 floppy drives and up to 7 SCSI devices

Throughput: With Cache, typically 2000KB/s, up to 4000KB/s depending on bus speed.

Confidence: CSC has sold thousands of SCSI drives for PC applications. Since the SCSI bus offers the ability to expand to future SCSI devices including Optical drives, a SCSI controller for the PC should include cache. CSC has developed our own caching SCSI controller called the Fast Cache 32. This board includes a 4 drive floppy controller with the ability to control the new 2.88MB 3.5" drives. SCSI hardware support is included for up to 7 devices. The cache memory on board can be expanded using standard 256K, 1MB, or 4MB SIMM modules to a total of 32MB. These cards are now available in volume and have proven extremely effective in workstation applications. Al though we are slightly biased, we feel that this represents the best controller buy on the market.

DTC 3280

Controls: 2 floppy drives and up to 7 SCSI devices

Throughput: 753KB/s

Confidence: The DTC 3280 is the best buy we've found in a low cost SCSI controller. Software drivers are available for Novell, DOS, OS/2 and Xenix. These controllers work well in all motherboards that support 16-bit memory transfers. At under $150 wholesale, they are the best buy we've found in a 16-bit SCSI card.

Floppy Drives

At present, the computer industry seems to have standardized on the 5 floppy drives listed below. 1.2 and 1.44MB drives are the most popular, although low density 360K diskettes are most commonly used for software distribution.

Industry Standard Floppy Drives

Capacity	Tracks	Transfer Rate	Form Factor	Tracks/Inch
360K	40	250KHz	5.25"	48
1.2MB*	40/80	250/500KHz	5.25"	48/135
720K	40	250KHz	3.50"	48
1.44MB	40/80	250/500KHz	3.50"	48/135
2.88MB	80	1000KHz	3.50"	135

Note: some early 1.2MB drives used a data transfer rate of 300KHz when reading 360K disks.

Floppy Drive List

The floppy drive list below is designed to aid in identifying some of the more common floppy drives.

Manufacturer	Model Number	Form Factor	Capacity	Trks
ALPS	FDD2124	5.25 HH	180KB	40
AT&T	KS-23114	5.25 HH	720KB	80
AURORA TECH	FD350 (SCSI)	3.50 HH	-	-
AURORA TECH	FD525 (SCSI)	5.25 HH	-	-
CANNON	531	5.25 HH	360KB	40
CANNON	MD5501	5.25 HH	1.2MB	80
CDC	9409	5.25 FH	360KB	40
CDC	9409T	5.25 FH	720KB	80
CDC	9429	5.25 HH	720KB	80
CHINON	FJ205	2.00	1.4MB	135
CHINON	C354	3.50 HH	720KB	80
CHINON	C359	3.50 HH	1.4MB	80

Floppy Drive List (Continued)

Manufacturer	Model Number	Form Factor	Capacity	Trks
CHINON	C502	5.25 HH	360KB	40
CHINON	C506	5.25 HH	1.2MB	80
CHINON	F2506	5.25 HH	1.2MB	80
EPSON	SMD-1040	3.50	1.4MB	135
EPSON	SMD-340	3.50	1.4MB	135
EPSON	SMD-349	3.50 HH	1.4MB	135
EPSON	SMD-380	3.50 1.0"	720KB	135
EPSON	SMD-389	3.50 HH	720KB	135
EPSON	SD-520	5.25 HH	360KB	40
EPSON	SD-521	5.25 HH	360KB	40
EPSON	SD-621L	5.25 HH	360KB	48
EPSON	SD-680L	5.25 HH	1.2MB	96
FUJITSU	M2532	3.50 HH	720KB	80
FUJITSU	M2537	3.50 HH	1.4MB	80
FUJITSU	M2551A	3.50	720KB	80
FUJITSU	M2553A,K	3.50	1.4MB	80
FUJITSU	M2552A	5.25 HH	720KB	96
MITSUBISHI	MF353B,C	3.50 HH	720KB	135
MITSUBISHI	MF355A,B,C	3.50 1.0"	1.4MB	135
MITSUBISHI	4852	5.25 FH	360KB	40
MITSUBISHI	4853	5.25 HH	720KB	80
MITSUBISHI	4854	5.25 HH	1.2MB	80
MITSUBISHI	MF501A,B	5.25 HH	360KB	48
MITSUBISHI	MF504A,B	5.25 HH	1.2MB	96
MITSUBISHI	289-63	8.00 HH	-	-
MITSUMI		3.50	720KB	80
MITSUMI		3.50	1.4MB	80
MITSUMI		5.25 HH	360KB	40
MITSUMI		5.25 HH	1.2MB	80
MPI	51-S	5.25 FH	180KB	40
MPI	52-S	5.25 FH	360KB	40
NEC	FD-1335H	3.50 1.0"	1.2MB	80
NEC	FD-1157C	5.25 HH	1.2MB	80

Floppy Drive List (Continued)

Manufacturer	Model Number	Form Factor	Capacity	Trks
NEC	FD-1157C	5.25 HH	1.2MB	80
NEC	FD-1165FQ	8.00 HH	-	-
OLIVETTI	XM4311	5.25 HH	360KB	40
PACIFIC RIM	U1.44	3.50	1.4MB	80
PACIFIC RIM	U4	3.50 1.0"	2.8MB	80
PACIFIC RIM	U720	3.50	720KB	80
PACIFIC RIM	U1.2	5.25 HH	1.2MB	80
PACIFIC RIM	U360	5.25 HH	360KB	40
PANASONIC	JU475	5.25 HH	1.2MB	80
QUME	542	5.25 FH	360KB	40
QUME	842	8.00 FH	-	-
SANYO	FDA-5200	5.25 HH	360KB	40
SEIKO	8640	5.25	720KB	80
SHUGART	SA400L	5.25 FH	180KB	40
SHUGART	SA455	5.25 HH	360KB	40
SHUGART	SA460	5.25 FH	360KB	40
SHUGART	SA800-1	8.00 FH	-	-
SHUGART	SA800-2	8.00 FH	-	-
SHUGART	SA860	8.00 HH	-	-
SHUGART	SA900-1	8.00 FH	-	-
SIEMENS	FDD100-5	5.25 FH	180KB	40
TANDON	65-4	5.25 HH	720KB	80
TANDON	65-8	5.25 HH	1.2MB	80
TANDON	75-8	5.25 HH	1.2MB	80
TANDON	TM100-1A	5.25 FH	180KB	40
TANDON	TM100-2A	5.25 FH	360KB	40
TANDON	TM100-4	5.25 FH	720KB	80
TANDON	TM101-4A	5.25 FH	720KB	80
TANDON	848-02	8.00 HH	-	-
TEAC	FD-235FN	3.50 1.0"	720KB	135
TEAC	FD-235HFN	3.50 1.0"	1.4MB	135
TEAC	FD-235J	3.50 1.0"	2.8MB	135
TEAC	FD-50A	5.25 FH	180KB	40

Floppy Drive List (Continued)

Manufacturer	Model Number	Form Factor	Capacity	Trks
TEAC	FD-55A	5.25 HH	180KB	40
TEAC	FD-55BR	5.25 HH	360KB	40
TEAC	FD-55BV	5.25 HH	360KB	40
TEAC	FD-55E	5.25 HH	360KB	40
TEAC	FD-55FV	5.25 HH	720KB	80
TEAC	FD-55GFR	5.25 HH	1.2MB	80
TEAC	FD-55GFV	5.25 HH	1.2MB	80
TEAC	FD-55GR	5.25 HH	1.2MB	80
TEC	FB501	5.25 HH	180KB	40
TOSHIBA	FDD4603	3.50 HH	720KB	80
TOSHIBA	FDD6471	5.25 HH	360KB	40
TOSHIBA	FDD6784	5.25 HH	1.2MB	80
TOSHIBA	FDD6882	5.25 HH	1.2MB	80
TOSHIBA	ND-352T,S	3.50 1.0"	720KB	80
TOSHIBA	ND-354A	3.50 1.0"	720KB	80
TOSHIBA	ND-356T,Y,S	3.50 1.0"	1.4MB	80
TOSHIBA	PD-211	3.50 1.0"	2.9MB	80
TOSHIBA	ND-04D	5.25 HH	360KB	40
TOSHIBA	ND-08DEG	5.25 HH	1.2MB	80
YE-DATA	646	3.50 HH	720KB	80

Optical Drives

The following is a list of Optical Drive specifications.

Optical Drive List

Manufacturer	Model Number	Form Factor	Type	Capacity	Interface	Media	Audio	Access Time
A.D.I.C.	Data Optic 600	5.25	WMRM	594MB	SCSI	-	-	67mS
A.D.S.I.	MQO-151	5.25	WMRM	594MB	SCSI	-	-	95mS
A.D.S.I.	MVO-151	5.25	WMRM	594MB	SCSI	-	-	95mS
A.D.S.I.	MZO-151	5.25	WMRM	594MB	SCSI	-	-	95mS
A.D.S.I.	Optical/HSC	5.25	WMRM	594MB	SCSI	-	-	95mS
Accel	AEO650	5.25	WMRM	650MB	SCSI	-	-	95mS
Alphatronix	IDQ10-M	5.25	WMRM	650MB	Q-BUS	-	-	83mS
Alphatronix	IDQ20-D,T,S,R	5.25	WMRM	1300MB	Q-BUS	-	-	83mS
Alphatronix	IDU10-M	5.25	WMRM	650MB	UNIBUS	-	-	83mS
Alphatronix	IDU20-D,T,S,R	5.25	WMRM	1300MB	UNIBUS	-	-	83mS
Alphatronix	IMC10-M	5.25	WMRM	616MB	SCSI(M)	-	-	83mS
Alphatronix	IMC20-D,T,S,R	5.25	WMRM	1232MB	SCSI(M)	-	-	83mS
Alphatronix	IPA10-M	5.25	WMRM	650MB	XT/AT	-	-	83mS
Alphatronix	IPA20-D,T,S,R	5.25	WMRM	1300MB	XT/AT	-	-	83mS
Alphatronix	IPN10-M	5.25	WMRM	650MB	XT/AT	-	-	83mS
Alphatronix	IPN20-D,T,S,R	5.25	WMRM	1300MB	XT/AT	-	-	83mS
Alphatronix	IPS10-M	5.25	WMRM	650MB	MCA	-	-	83mS
Alphatronix	IPS20-D,T,S,R	5.25	WMRM	1300MB	MCA	-	-	83mS
Alphatronix	ISS10-M	5.25	WMRM	592MB	SCSI(S)	-	-	83mS
Alphatronix	ISS20-D,T,S,R	5.25	WMRM	1184MB	SCSI(S)	-	-	83mS

Optical Drive List (Continued)

Manufacturer	Model Number	Form Factor	Type	Capacity	Interface	Media	Audio	Access Time
Apple Computer	CD SC	5.25 FH	-	550MB	SCSI-M	DISK	YES	600mS
Arix Computer	RO-5030E	5.25	WMRM	652MB	SCSI	-	-	67mS
CD Technology	T3201 Portadriv	5.25 HH	-	-	SCSI,M	DISK	YES	350mS
Chinon	CDA-431	5.25 HH	-	550MB	SCSI,M	-	YES	350mS
Chinon	CDS-431	5.25 HH	-	550MB	SCSI	-	YES	350mS
Chinon	CDX-431	5.25 HH	-	550MB	SCSI	-	YES	350mS
Concurrent	R/W Optical	5.25	WMRM	1000MB	SCSI	-	-	49mS
Consan, Inc.	RS600/N	5.25	WMRM	596MB	SCSI	-	-	67mS
Corel Systems	650-MO	5.25	WMRM	650MB	SCSI	CART	-	95mS
Deltaic Systems	OptiServer 600	5.25	WMRM	595MB	SCSI	-	-	67mS
Deltaic Systems	OptiServer 600P	5.25	WMRM	595MB	SCSI	-	-	67mS
Denon	DRD-253	5.25 HH	RO	-	SCSI	-	YES	400mS
Dolphin Systems	Sonar-600S	5.25	WMRM	600MB	SCSI	-	-	95mS
Dynatek Systems	DROS600	5.25	WMRM	1200MB	SCSI	-	-	50mS
Dynatek Systems	MOS1600	5.25	WMRM	600MB	SCSI	-	-	50mS
Dynatek Systems	MOS2600	5.25	WMRM	600MB	SCSI	-	-	50mS
Dynatek Systems	MOS3600	5.25	WMRM	600MB	SCSI	-	-	50mS
Dynatek Systems	ROS600	5.25	WMRM	600MB	SCSI	-	-	50mS
Exsys Storage	Laser-RA-2M	5.25	WMRM	934MB	SDI	-	-	35mS
Exsys Storage	Laser-RA-2S	5.25	WMRM	574MB	SDI	-	-	95mS
Exsys Storage	Laser-RA-4M	5.25	WMRM	1868MB	SDI	-	-	35mS
Exsys Storage	Laser-RA-4S	5.25	WMRM	1188MB	SDI	-	-	95mS
Exsys Storage	Laser-RA-7M	5.25	WMRM	3269MB	SDI	-	-	35mS
Exsys Storage	Laser-RA-7S	5.25	WMRM	2079MB	SDI	-	-	95mS
FWB	Hammerdisk 1000	5.25	WMRM	1000MB	SCSI	-	-	35mS
FWB	Hammerdisk 600	5.25	WMRM	600MB	SCSI	-	-	67mS
General Microsys	MO/D 220	5.25	WMRM	924MB	SCSI(S)	-	-	35mS
Herstal	50652A	5.25	WMRM	652MB	SCSI	-	-	44mS
Herstal	51000A	5.25	WMRM	1000MB	SCSI	-	-	35mS
Hewlett-Packard	50720A	5.25 HH	RO	-	PRO.	-	-	500mS

Optical Drive List (Continued)

Manufacturer	Model Number	Form Factor	Type	Capacity	Interface	Media	Audio	Access Time
Hewlett-Packard	C1711A	5.25	WMRM	650MB	SCSI	-	-	107mS
Hitachi	CDR-1700S	5.25	RO	600MB	SCSI	DISK	-	350mS
Hitachi	OD-112-1	5.25	WMRM	644MB	SCSI	-	-	75mS
Laser Magnetic.	CM-201	5.25 HH	RO	600MB	IDE	CART	DIG	500mS
Laser Magnetic	CM-212	5.25 HH	RO	600MB	SCSI	CART	DIG	400mS
Laser Magnetic	CM-221	5.25 HH	RO	600MB	IDE	CART	ANA	500mS
Laser Magnetic	CM-231	5.25 HH	RO	600MB	SCSI	CART	ANA	400mS
Laser Magnetic	LM-510	5.25 FH	WORM	654MB	SCSI	CART.	-	61mS
Laser Magnetic	LM-520	5.25 FH	WMRM	654MB	SCSI	CART.	-	70mS
Laser Magnetic	LD-4100	RACK	WMRM	5.6GB	SCSI	CART.	-	80mS
Laser Magnetic	LF-4500	RACK	WMRM	28.0GB	SCSI	CART.	-	80mS
M.O.S.T.	RMD-5100-S	3.50 HH	WMRM	128MB	SCSI	-	-	35mS
Macsetra	Genesis 6000i	5.25	WMRM	600MB	SCSI	-	-	95mS
Maxcess	M-600L	5.25	WMRM	600MB	SCSI	-	-	95mS
Maxoptix	RXT-800HS	5.25 HH	WORM	786MB	SCSI	CART.	-	108mS
Maxoptix	Tahiti	5.25 FH	WMRM	1GB*	SCSI	CART.	-	35mS
Meridian	100T Network	5.25 HH	RO	-	-	DISK	N/A	250mS
Micro Design	Laserbank 600CD	5.25 HH	RO	600MB	SCSI	DISK	YES	350mS
Micro Design	Laserbank 600R	5.25	WMRM	650MB	SCSI	-	-	65mS
Mirror Tech.	CDR-10	5.25	RO	600MB	SCSI	DISK	YES	350mS
Mirror Tech.	RM600	5.25	WMRM	594MB	SCSI	-	-	61mS
Mitsubishi	MW-5D1	5.25 FH	-	300MB	ESDI*	-	-	63mS
Mitsubishi	MW-5U1	5.25 FH	WORM	300MB	SCSI	-	-	68mS
N/Hance Systems	R6501mce-DOS	5.25	WMRM	650MB	SCSI	-	-	95mS
N/Hance Systems	R6501mce-LAN	5.25	WMRM	650MB	SCSI	-	-	95mS
N/Hance Systems	R6501mce-OS/2	5.25	WMRM	650MB	SCSI	-	-	95mS
N/Hance Systems	R6501sce-DOS	5.25	WMRM	650MB	SCSI	-	-	95mS
N/Hance Systems	R6501sce-LAN	5.25	WMRM	650MB	SCSI	-	-	95mS
N/Hance Systems	R6501sce-MAC	5.25	WMRM	650MB	SCSI	-	-	95mS
N/Hance Systems	R6501sci-DOS	5.25	WMRM	650MB	SCSI	-	-	95mS

Optical Drive List (Continued)

Manufacturer	Model Number	Form Factor	Type	Capacity	Interface	Media	Audio	Access Time
Online Products.	OPC-OSU-202	5.25 HH	RO	600MB	SCSI,P	DISK	N/A	350mS
Panasonic	LF-5010	5.25 FH	WORM	940MB	SCSI-2	CART.	-	90mS
Panasonci	LF-7010	5.25 HH	WMRM	1000MB	SCSI-2	CART.	-	90mS
Pinnacle Micro	RE0-6500	5.25 FH	RO	6500MB	SCSI,M	DISK	OPT	65mS
Pinnacle Micro	REO-130	5.25 HH	RO	128MB	SCSI,M	DISK	OPT	28mS
Pinnacle Micro	REO-1300	5.25 FH	WMRM	1300MB	SCSI,M	DISK	OPT	65mS
Pinnacle Micro	REO-36000	5.25 FH	RO	36000MB	SCSI,M	DISK	OPT	65mS
Pinnacle Micro	REO-650	5.25 FH	WMRM	650MB	SCSI,M	DISK	OPT	65mS
Pioneer	DD-U5001	5.25 FH	-	654MB	SCSI	CART	-	60mS
Pioneer	DE-S7001	5.25	WMRM	654MB	SCSI	CART.	-	53mS
Pioneer	DE-U7001	5.25 FH	WMRM	654MB	SCSI	CART.	-	53mS
Pioneer	DRM-600	5.25 FH	RO	6x540MB	SCSI	DISK	YES	600mS
Pioneer	DD-8001	8.00 FH	WMRM	1500M	SCSI	CART.	-	250mS
Pioneer	DJ-1	8.00	WMRM	1500MB	SCSI	CART.	-	250mS
Procom Tech.	MCDRom-650	5.25 HH	RO	-	SCSI,M	DISK	YES	350mS
Reference Tech.	500AT DUAL SCSI	5.25 HH	RO	-	SCSI	DISK	OPT	500mS
Reference Tech.	500AT EXT.	5.25 HH	RO	-	PRO.	DISK	OPT	500mS
Reference Tech.	500AT EXT. SCSI	5.25 HH	RO	-	SCSI	DISK	OPT	500mS
Reference Tech.	500AT INT.	5.25 HH	RO	-	PRO	DISK	OPT	500mS
Reference Tech.	500AT INT. SCSI	5.25 HH	RO	-	SCSI	DISK	OPT	500mS
Reference Tech.	500PS2 EXT.	5.25 HH	RO	-	PRO	DISK	OPT	500mS
Reference Tech.	500PS2 EXT.SCSI	5.25 HH	RO	-	SCSI	DISK	OPT	500mS
Relax Tech.	25-2160	5.25	WMRM	570MB	SCSI	-	-	65mS
Ricoh	RO-5030E II	5.25 FH	WMRM	652M	SCSI	CART	-	67mS
Ricoh	RS-9100H	5.25 HH	WORM	800MB	SCSI	CART.	-	168mS
Ricoh	RS-9200E II	5.25 FH	WMRM	652M	SCSI	CART.	-	67mS
Sony	SMO-D501/C501	5.25	WMRM	650MB	SCSI	-	-	95mS
Sony	SMO-S501	5.25	WMRM	650MB	SCSI	-	-	95mS
Storage Dimen.	LNE1-1000AT	5.25	WMRM	900MB	SCSI	-	-	49mS
Storage Dimen.	LSE1-1000AT	5.25	WMRM	900MB	SCSI	-	-	49mS

Optical Drive List (Continued)

Manufacturer	Model Number	Form Factor	Type	Capacity	Interface	Media	Audio	Access Time
Storage Dimen.	MCE880-HC1	5.25	WMRM	900MB	SCSI	-	-	49mS
Summus Comput.	SO-600	5.25	WMRM	594MB	SCSI	-	-	90mS
Sumo Systems	RSSM600-C (PC)	5.25	WMRM	594MB	SCSI	CART.	-	50mS
Sumo Systems	RSSM600-D (DEC)	5.25	WMRM	594MB	SCSI	CART.	-	50mS
Sumo Systems	RSSM600-S (SUN)	5.25	WMRM	594MB	SCSI(S)	CART.	-	50mS
Sun Moon Star	CDR-3600U	-	-	-	-	-	-	-
Sun Moon Star	SYST. 286-12 CD	-	-	-	-	-	-	-
Tecmar	Laservault	5.25	WMRM	650MB	SCSC	-	-	95mS
Toshiba	WM-070	5.25 FH	WORM	900MB	SCSI	-	-	90mS
Toshiba	XM-3201A1-MAC	5.25 HH	RO	600MB	SCSI(M)	-	YES	350mS
Toshiba	XM-3201A1-PCF	5.25 HH	RO	600MB	SCSI	-	YES	350mS
Toshiba	XM-3201A1-PS2	5.25 HH	RO	600MB	SCSI	-	YES	350mS
Toshiba	XM-3201B	5.25 HH	RO	683MB	SCSI	CART.	YES	350mS
Toshiba	XM-5100A-MAC	5.25 HH	RO	683MB	SCSI(M)	CART.	YES	380mS
Toshiba	XM-5100A-PCF	5.25 HH	RO	683MB	SCSI	CART.	YES	380mS
Toshiba	XM-5100A-PS2	5.25 HH	RO	683MB	SCSI	CART.	YES	380mS
Toshiba	WM-500	-	WORM	5000MB	SCSI	CART.	-	160mS
Trimarchi	LaserAce	5.25	WMRM	600MB	SCSI	-	-	45mS
Tristar	PE3660-1D	5.25	WMRM	600MB	SCSI	-	-	61mS
Tristar	PE3660-1DQ	5.25	WMRM	600MB	Q-BUS	-	-	61mS
Tristar	PE3660-1R	5.25	WMRM	600MB	SCSI	-	-	61mS
Tristar	PE3660-2R	5.25	WMRM	1200MB	SCSI	-	-	61mS
U. S. Design	QD1000-Q	5.25	WMRM	1000M	Q-BUS	-	-	35mS
U. S. Design	QD1000-S	5.25	WMRM	1000M	SCSI(S)	-	-	35mS
U. S. Design	QD1000-U	5.25	WMRM	1000M	UNIBUS	-	-	35mS
U. S. Design	QT1000-Q	5.25	WMRM	1000M	Q-BUS	-	-	35mS
U. S. Design	QT1000-S	5.25	WMRM	1000M	SCSI(S)	-	-	35mS
U. S. Design	QT1000-U	5.25	WMRM	1000M	UNIBUS	-	-	35mS
Xyxis	XY600RW	5.25	WMRM	574MB	SCSI	-	-	61mS
Zetaco	SKR-600	5.25	WMRM	650MB	SCSI	-	-	95mS

Tape Drives

Tape Drive Interfaces

Listed below are the most common tape drive interfaces.

Floppy Tape

The Floppy Tape interface is simply an SA-400 floppy drive pinout. Floppy tape drives can be connected just like a floppy drive and usually do not require a separate interface card. There is a performance penalty paid for this convenience though: most floppy tape drives can not transfer data faster than 500Kbits/sec.

Pertec

The Pertec standard interface dates back to the mainframe tape drives of the early 70's. Nearly all 9 track reel to reel tape drives use the Pertec interface.

QIC-02

QIC-02 is a hardware interface and software command set standard. QIC-02 drives have an imbedded microprocessor which controls them and uses standard commands to read and write blocks of data and control the tape (similar to the SCSI interface). A QIC-02 style command set is also used by most QIC-36 controllers.

QIC-36

QIC-36 is a low level hardware interface used by most all DC600 style tape drives. This interface offers no "intelligence"; it connects directly the drive motors and heads. An intelligent controller is required to use the QIC-36 interface.

SCSI

The SCSI interface is now used on all of the newer DAT and most of the DC600 style tape drives. Many companies offer "bridge controllers" which connect QIC-02 and QIC-36 drives to the SCSI bus.

Data Compression and Honest Capacity

Since digital tape drives have inherently slow access times, they are used primarily for backup and archival storage and large capacity information transfer. Since most backup and archival processes benefit greatly from data compression, many manufacturers include data compression software with their tape drives. Many also advertise the capacity of the tape drive AFTER DATA COMPRESSION.

This advertising is deceptive because the actual storage capacity of the tape will vary depending on how much the incoming data can be compressed before it is recorded. Most data compression schemes will compress typical data to a maximum 2:1 ratio. The actual compression ratio you get will depend on the type of files you are compressing. Most graphics and text files can be easily compressed, while programs generally do not compress well.

Choosing a Tape Drive

To choose a tape drive, first determine the maximum capacity you need. Beware of deceptive advertising when selecting a drive based on capacity. Colorado Memories sells the Colorado Jumbo as a 120 Megabyte floppy tape drive. The actual uncompressed storage capacity of this drive using standard length tapes is 40MB. Extended length tapes boost capacity to 60MB. If data can be compressed 2:1 using the included Colorado data compression software, the capacity could be as high as 120MB. The actual storage capacity you get will probably be much less.

Another main consideration in selecting a tape drive is data transfer rate. Floppy Tape drives are generally the slowest and QIC-36 and SCSI drives are generally the fastest available. Using data compression will slow data transfer tremendously. The table below lists the backup times and transfer rates of some typical drives tested at CSC. The actual transfer rate and backup time you achieve will depend on several factors including: bus speed, hard drive speed, and controller setup, but this chart provides a relative reference.

Tape Drive Performance Ratings

Tape Drive:	Colorado Jumbo "120MB"
Interface :	Floppy Tape
Controller:	AT Floppy
Rated Capacity:	120MB
Honest Capacity:	40MB
Transfer Rate:	1.3MB/minute
Time to write	40MB: 31 minutes

Tape Drive:	Caliper CP-150B
Interface:	QIC-36
Controller:	Wangtec (DMA mode)
Rated Capacity:	150MB
Honest Capacity:	150MB
Transfer Rate:	6.1MB/minute
Time to write	40MB: 6.5 minutes

Tape Drive:	JVC 4MM SCSI DAT
Interface:	SCSI
Controller:	CSC FastCache 32 controller
Rated Capacity:	800MB
Honest Capacity:	800MB
Transfer Rate:	7.5MB/minute
Time to write 40MB:	5.4 minutes

Tape Drive:	PerSci 9 Track 6250BPI reel-reel
Interface:	Pertec
Controller:	MicroTech
Capacity with 9" tape:	80MB
Transfer Rate:	5MB/minute
Time to write 40MB:	8 minutes

The above performance tests were made in a typical 25MHz 486 clone with a SCSI hard drive. It's interesting to note that the QIC-36 drives offer a transfer rate similar to the DAT drives. The speed of the floppy tape drive was close to most floppy disk backup programs.

Extended Length Tapes

The maximum capacity of a tape drive can also be increased using an extended length tape. To increase the length of a tape cartridge, the tape material must be made thinner than normal. Thin tapes tend to tear under heavy use. If you do not need the extra capacity that extended length tapes provide, or if you use your tapes frequently, a standard length tape will prove more reliable. Thin tapes usually have an XL added to the tape part number. The chart below lists the standard capacities of most common standard and extra length tape cartridges.

STANDARD TAPE CAPACITY			
Tape Cartridge	**Length (feet)**	**Tracks**	**Capacity (no compression)**
DC 100	185	16	10MB
DC 1000	185	16	10MB
DC 1000 Alphamat	185	24	20MB
DC 2000	200	24	40MB
DC 2000XL	200	24	60MB
DC 615	150	9	15MB
DC 600	600	9	60MB
DC 600A	600	9	60MB
DC 600XTD	600	15	125MB
DC 600XL	960	15	200MB
1/2" Cartridge	1000	36	200MB
4MM DAT	91	Helical Scan	800MB
8MM DAT	175	Helical Scan	1200MB

STANDARD TAPE CAPACITY			
Reel to Reel Tapes	**Length**	**Tracks**	**Capacity**
9 Track 1400BPI	1000'	9	17MB
9 Track 6250BPI	1000'	9	75MB

Technical Support

The following is a list of telephone numbers for many of the manufacturers listed in this manual. These numbers are provided for your convenience and should not be considered an endorsement of these companies or their products.

NAME	PHONE	NAME	PHONE
AST	(416) 756-0711	Jasmine Technologies	(415) 550-2900
Adaptec	(408) 945-2550	JCT	(503) 474-5678
Alps Electric	(800) 950-2557	Kalok Corp.	(408) 747-1315
Ampex	(800) 231-1036	Kyocera	(619) 576-2600
Areal Technology	(408) 954-0360	Maxtor	(408) 432-1700
Atasi Technology	(408) 986-1303	Megadrive Systems	(800) 327-4744
Award Software	(408) 370-7979	Memorex Corporation	(408) 957-1000
B.A.S.F	(617) 271-4000	Micro Memory	(818) 998-0070
C. Itoh	(800) 227-0315	Micronet Computer	(714) 739-2244
Cardiff Peripherals	(619) 931-8032	Micronics	(415) 651-2300
CDC (Imprimis)	(800) 852-3475	Micropolis	(818) 709-3300
Century Data	(714) 632-7500	Microscience	(408) 730-5965
CMI	(818) 709-6445	Miniscribe	(303) 651-6000
CMS Enhancements	(714) 222-6000	Mitsubishi	(213) 515-3993
CSC	(408) 737-7312	NCL	(408) 734-1006
Central Point	(503) 690-8080	NCR	(316) 636-8000
Chips & Technology	(408) 434-0600	NEC	(800) 227-9001
Club AT	(415) 490-2201	Newbury Data	(213) 372-3775
Cogito	(408) 942-8262	Okidata	(609) 235-2600
Columbia Data	(707) 862-4724	Olivetti	(201) 526-8200
Conner Peripherals	(408) 433-3340	OPTI	(408) 980-8178
Core International	(407) 997-6055	Optima Technology	(714) 476-0515
Disk Technologies	(800) 553-0337	Ontrack	(612) 937-2121
DTC/Qume	(408) 262-7700	Orca Technology	(408) 441-1111
Diamond Flower	(210) 390-2815	Orchid Technology	(415) 683-0300
Emulex Corporation	(800) 368-5393	Otari Corporation	(415) 341-5900
Espert Company	(408) 452-5771	Pacific Magtron	(800) 828-2822
Everex	(415) 498-1115	Panasonic	(408) 262-2200
Fuji	(415) 651-0811	Paradise	(415) 960-3360
Fujitsu	(800) 345-0845	Peripheral Land	(800) 288-8754
Future Domain	(714) 253-0400	Perstor	(602) 894-4601
Genoa	(408) 432-9090	Prairietek Corporation	(800) 825-2511
Hewlett-Packard	(800) 752-0900	Priam	(408) 434-9300
IBM	(800) 999-7778	Procom Technology	(714) 549-9449
Irwin Magnetics	(801) 778-3000	PTI	(805) 581-1000

NAME	PHONE	NAME	PHONE
Quantum	(408) 432-1100	Tandon	(805) 523-0340
Rodime	(800) 346-0270	Tandy Corporation	(817) 390-3011
SMS/OMTI	(408) 954-1633	Teac Incorporated	(213) 726-0303
Seagate Technology	(800) 468-3472	Toshiba	(408) 727-3939
Siemens	(818) 706-8872	Tulin	(408) 432-9025
Storage Dimensions	(408) 879-0300	Vertex	(408) 946-4600
Syquest	(415) 490-7511	Western Digital	(800) 832-4778
Sysgen Incorporated	(800) 821-2151	Xebec	(800) 982-3232

Sutie
714-753-1234
ISPFMT.EXE

714 932 4952

G=C800:5

Notes

Please use this page to enter data pertaining to your system.

Drive Interface:

IDE____ RLL____ MFM____ SCSI____ ESDI____

Floppy Types:

1.________ 2.________ 3.________ 4.________

Hard Drive #1 Parameters:

HEADS________ CYLS________ SECT/TRACK________

Hard Drive #2 Parameters:

HEADS________ CYLS________ SECT/TRACK________

OTHER____

Motherboard:

BUS SPEED____________ WAIT STATES____________

Notes:

____

____

____

____

____