

SCO[®]
Open Systems Software
Hardware Configuration Guide



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Basic hardware requirements	2
Typical device interrupts	3
Configuring devices at installation or boot time	3
Using bootstrings	4
QIC-02 cartridge tape configuration	5
SCSI peripheral device configuration	6
SCSI host adapter configuration	7
hd driver configuration	8
Disable driver	9
Select console device	9

Chapter 1***Adding memory and bus cards*****11**

Installing bus cards	11
DIP switches and jumpers	11
Installing the hardware	12
Using the manufacturer's setup diskette	13
Adding more memory	13
Memory card compatibility notes	14
Disabled high memory on Corollary architectures	14
32-bit memory	15
Math chips	15
Intel 387 coprocessor problems	16
Intel RapidCAD Engineering Coprocessor	16
Weitek coprocessors	17

Chapter 2***Disk controllers and host adapters*****19**

ST506 and ESDI controllers	20
SCSI host adapters	20
Olivetti ESC (EISA) host adapter notes	20
Relinking the kernel	21
Tape drive accessing delay	21
Installing on an EISA system containing two SCSI host adapters sharing the same interrupt	21

Western Digital WD7000 SCSI host adapter notes	21
Interrupt 12 conflict	22
Reported to work with the WD7000	23
Western Digital WD7000EX host adapter notes	24
DPT 2011 host adapter notes	25
DPT 2012 host adapter notes	25
Adaptec 152x host adapter notes	26
Adaptec AHA-154x host adapter notes	26
Formatting and verifying devices	26
Hardware incompatibilities	27
Adaptec 174x host adapter notes	28
Future Domain TMC-950 IC-based host adapters	29
Future Domain TMC 1800 chip-based host adapters	30
Future Domain TMC 7000-FASST2 host adapter notes	30
Future Domain TMC-7000EX host adapter notes	30
Storage Plus SCSI-AT (SUMO) host adapter notes	31
Defining the primary host adapter	31
Adding a secondary SCSI host adapter	31
Referencing a second host adapter	31
Tuning SCSI disk performance	32
IDE drives and disk controllers	33

Chapter 3

Adding hard disks **35**

Adding secondary hard disks	36
Configuring a SCSI hard disk	38
Installing the hard disk	41
Relinking the kernel	52
Disks larger than 1024 cylinders	52
Hard disk interleave	53
Standard architecture specific notes	53

Chapter 4

Adding tape drives and controllers **55**

Installing a tape drive	56
Cartridge tape	57
Mini-cartridge (Irwin)	59

QIC-40/80	61
SCSI	62
Compaq SCSI	66
Kernel relinking	67
Device files	68
Boot messages and /etc/default/boot	69
Tape load and unload commands	69
Preventing SCSI DAT or Exabyte drives from ejecting cartridge	70
Creating backups with Irwin and QIC-40 drives	71
Using the dd(C) command with Exabyte tapes	71
SCSI tape drives and ECC	71
tape format command	71
Configuring the tape drive at boot time	72
Tape drives and controllers on ISA	72
Archive notes	72
High-density 150 Mbyte drive notes	72
Irwin notes	72
Olivetti notes	72
QIC format tape notes	72
SCSI tape drive notes	73

Chapter 5

Installing CD-ROM drives 75

Configuring the drive	75
CD-ROM device names	79
Accessing CD-ROM filesystems	79
CD-ROM and the WD7000 SCSI host adapter	79

Chapter 6

Graphics adapters 81

Console display problems when booting	81
Video adapters on ISA and EISA architecture	82
Graphics adapter and network card conflicts	82
8514/a graphics adapters	82
Paradise graphics adapters	82

Texas Instruments 34010 and 34020-type graphics adapters	83
EGA adapters	83
Trident graphics adapters	83
Video cards and monitors on Micro Channel Architecture	84
8514/a graphics adapters	84
Supported monitors	84

Chapter 7

Adding mice and other graphic input devices **87**

Installing the hardware	87
Bus mice	87
Serial mice	88
Keyboard mice	89
Configuring a mouse	89
Changing mouse ports	94
Testing a mouse	94
Removing a mouse	95
Changing the keyboard mouse resolution setting	96
Solving slow or no mouse response	97
Using the mouse	97
Using the mouse with multiscreens	97
Using the mouse on serial terminals	98
Sharing a mouse with several terminals	98
Using a mouse with keyboard-based programs	98
Using the pseudo-mouse driver	98
Configuring a bitpad	99

Chapter 8

Network cards **103**

Standard and Micro Channel architecture notes	103
SMC Ethernet cards	103
NFS and network cards	104
Graphics adapter and network card conflicts	104
Racal Datacomm NI6510 and Microsoft LAN Manager	104
Selecting an interrupt vector for the 3C523	104
WD8003ET/A and WD8013EBT network cards	105

Chapter 10
Installing printers

Installing parallel and serial printers	109
Setting up RTS/CTS protocol serial printers	114

Chapter 11
Adding a serial terminal

Installing a serial terminal	117
Installing a scancode-compatible terminal	121
Running applications on scancode terminals	122
Wyse 60 terminal in scancode mode	123

Chapter 12
Adding serial and parallel ports

Adding and configuring standard serial ports	125
Adding a serial card at a non-standard address or interrupt	130
Serial I/O chip notes	130
Serial boards on ISA	131
AST serial board notes	133
AMI lamb serial board notes	133
Tandon serial board notes	133
CTC Versanet serial board notes	133
Digiboard serial board notes	134
Olivetti RS232C multiport board notes	135
Serial boards on Micro Channel Architecture	135
Arnet serial board notes	136
Stargate serial boards on the Apricot Qi	136

Dumb serial boards	136
Adding and configuring parallel ports	137
Multi-function cards	139

Index

141

Introduction

The information in this guide applies to all supported architectures (Industry Standard Architecture (ISA), Extended Industry Standard Architecture (EISA) and Micro Channel Architecture (MCA)), except where explicitly noted.

There are many other devices that you can use, which require additional vendor supplied software, that are available from and supported by independent hardware vendors. Call your dealer or sales representative and ask for the third-party IHV/ISV catalogue, or the SCO Directory.

If your computer is listed as a supported machine in the SCO list of compatible hardware it should run your SCO system without any additional hardware or without changing any jumper or switch settings, unless otherwise stated.

NOTE Supported machines are not always supplied with video cards by the same manufacturer. Check the video card for compatibility.

The hardware described in this guide has been used with your SCO system. However, because the manufacturers of compatible machines or add-on peripherals may change configuration, functionality, or firmware at any time, no guarantee is implied. Please write to us with detailed hardware information for possible inclusion on our lists.

Basic hardware requirements

To find hardware that is compatible with your machine, you must know the processor (386 or 486) and the bus architecture (ISA, EISA or MCA). You should also be aware of the type of disk controller in your system.

Some computers arrive with the hard disk only partially formatted. If you have such a machine, use the correct low-level or hard format procedure as described in the manual for your hard disk controller before installing your SCO system. This does not apply to most SCSI or IDE hard disk drives.

Your hardware configuration must have the original settings and boards before you install the operating system. It is recommended that you install the operating system without any additional hardware installed on the system. Hardware configuration conflicts can make installation of your SCO system difficult or impossible.

If you have added any boards, make sure that all switches or software-controlled settings are set as recommended in the manufacturer's hardware manual for that board. Some computers require specific switches or software-controlled settings to run your SCO system. If your computer does not run your SCO system with the settings as shipped, contact your computer hardware representative for the proper settings.

Typical device interrupts

The table below lists typical device interrupts. Make sure device interrupts do not conflict and do not use reserved interrupts as indicated in the table.

Interrupt	Octal	Device
0*	0	Clock
1*	1	Console
2	2	Networks, tapes and others
3	3	Serial COM2
4	4	Serial COM1
5	5	Alternate Parallel Port (lp2)
6*	6	Floppy Disk
7	7	Main Parallel Port (lp0 or lp1)
9*	11	Chain from IRQ2
10	12	
11*	13	Adaptec 0
12	14	Adaptec 1
13*	15	FPU
14*	16	ST506 controller 0
15	17	ST506 controller 1

*Do not use these interrupts.

Configuring devices at installation or boot time

You should read this section if any of these conditions are true:

- You are planning to install a combination of devices and do not want to install on the default device. For example, if you plan to install an ESDI device and a SCSI device, the operating system attempts to install on the ESDI device. If you want to install on the SCSI device, you need to override the default behavior using the **hd** bootstring.
- You have a tape distribution and you wish to configure your tape drive at a location other than the default. You can override the QIC-02 defaults using the **ct** bootstring, or the SCSI tape defaults with the **Stp** bootstring.
- You want to disable any erroneous presence tests or driver actions. You can override a device driver using the **disable** bootstring.
- In a post-installation scenario, you need to boot from a device that was not configured at the time that your kernel was created: for example, if you need to use your Emergency Boot Floppy Set to restore your system from tape and the tape configuration on your floppy no longer matches your current tape drive configuration.

Using bootstrings

A bootstring is a special command or string entered at the Boot: prompt displayed at system startup, a process that is normally transparent to the operator. For example, when you press (Return) at the Boot: prompt, the system uses a pre-defined bootstring from */etc/default/boot* that tells the system how to boot (such as: **hd(40)unix**).

There are also special bootstrings that permit you to define device configurations that override system defaults (without relinking the kernel). For example, the UNIX System V tape installation assumes a SCSI cartridge tape configured at *ha=0, id=2, lun=0*. By using the appropriate bootstring, you can tell the system to recognize a different configuration (for example: *ha=1, id=2, lun=0*).

In a similar way, device drivers that are not present on the UNIX System V distribution media can be installed from a vendor-supplied floppy disk using the **link** bootstring as described in the "Using boot-time loadable drivers" appendix of the *Installation Guide (Installation and Upgrade Guide for SCO Open Desktop / SCO Open Server)*.

To define or redefine a device at boot time, do the following:

1. Decide which bootstring you need to use. Use the descriptions in this section to help you. Make certain the bootstring parameters you use actually match your hardware configuration. Additional bootstrings are documented in the **boot(HW)** manual page.
2. Turn the machine on and wait for the Boot: prompt. If you are performing an installation, note that this is the only time the Boot: prompt appears; you are not given the opportunity to reboot during the installation unless you are doing a tape installation.
3. Enter the necessary bootstrings separated by spaces. As mentioned earlier, other bootstring information (such as the location of the kernel) must be included on the boot line. You can use the bootstring **defbootstr** to represent the default boot information (for example: **hd(40)unix**) used when you press (Return). This is defined as **DEFBOOTSTR** in */etc/default/boot* and saves you the trouble of entering the entire line. For example:

```
defbootstr Stp=wdha(1,1,0)
```

In the examples shown in this section, **defbootstr** is not shown, but remember that it should be included on the boot line.

4. The system then boots according to the information you provided. If you entered the bootstring incorrectly, an error message appears to that effect.

The following bootstrings are discussed here:

- QIC-02 cartridge tape (non-SCSI) configuration (**ct**)
- SCSI peripheral device configuration (**Sdsk**, **Stp**, **Srom**)
- SCSI host adapter configuration (**adapter**)
- hd driver configuration (**hd**)
- Disable driver (**disable**)
- System console (**systty**)

For additional information on the boot process and bootstrings, see the **boot(HW)** manual page.

QIC-02 cartridge tape configuration

The **ct** driver bootstring is used to override the default tape configuration included with the tape cartridge distribution. It is intended for use during installation and does not replace the functions of **mkdev tape** described in the “Using floppy disks and tape drives” chapter of the *System Administrator’s Guide* (“Operating System Services” for SCO Open Desktop / SCO Open Server). If you later run **mkdev tape** to add a cartridge tape drive, you are prompted as to whether you wish to modify the current tape bootstring, retain it, or remove it entirely.

NOTE The **ct** bootstring only applies to QIC-02 cartridge tape drives; it does not work for SCSI, QIC-40, or Irwin drives. SCSI bootstrings are described in the next section.

The **ct** bootstring has the general format:

ct=controller(base,irq,dma)

where:

controller	=	Brand name of the tape drive controller
base	=	Base address
irq	=	Interrupt request number
dma	=	DMA channel number

Numbers prefixed with **0x** are assumed to be hexadecimal, otherwise numbers are assumed to be decimal. You must also specify the kernel boot device. Thus, a complete boot line may look like this:

Boot: **hd(40)unix ct=wangtek(0x338,5,1)**

When you invoke the tape bootstring manually, you must specify **hd(40)unix** or **fd(64)unix**, not just **unix**. The tape bootstring is not checked until the driver is initialized. If the configuration information supplied in the bootstring appears to be invalid (for example, the controller named in the bootstring is not supported), then a warning message is printed, and the tape driver ignores the bootstring and uses the default configuration.

SCSI peripheral device configuration

SCSI device bootstrings allow you to install your SCO system from a device connected to the system at a SCSI address other than the default. For example, the **Stp** bootstring should be used if your tape drive is configured at a SCSI id that is not currently allowed as a boot device by the installation kernel. The syntax for SCSI bootstrings is:

periph=adapter(hanum,id,lun)

where:

periph	=	SCSI peripheral driver name (Sdsk , Stp , Srom)
adapter	=	host adapter driver prefix (see below)
hanum	=	host adapter number: 0-7
id	=	peripheral SCSI id: 0-7
lun	=	peripheral SCSI logical unit number (lun): 0-7

The SCSI peripheral driver names are as follows:

Sdsk	Hard disk
Stp	Tape
Srom	CD-ROM

Valid host adapter driver prefixes are:

ad	Adaptec 154x, 154x emulation, 164x
ciha	386/486 CBUS SCSI
dpt	DPT PM2012
eiad	Adaptec 174x
esc	Olivetti ESC-1
fdha	Future Domain tmc-1660, tmc-1680, MCS-700 (1800 chip)
hf	IBM Hard File
spad	Adaptec 152x
sumo	Storage Plus SCSI-AT (SUMO)
tmcha	Future Domain tmc-885, tmc-860 (950 chip)
wdex	Western Digital 7000EX
wdha	Western Digital 7000

For example, to perform a tape install from a SCSI tape device connected to the first Future Domain card (at id 4, lun 0) in a system, use the following bootstring:

Stp=fdha(0,4,0)

You may see the following error when installing from a SCSI tape:

Notice: Stp: Error on SCSI tape...

Press (Return) to continue installation. This error message can be safely ignored if the tape starts installation after you press (Return).

SCSI host adapter configuration

The **adapter** bootstring overrides the kernel's default configuration for a given host adapter. It has the following syntax:

adapter=driver(base, int, dma)

where:

driver = host adapter driver prefix
base = adapter I/O base address
int = adapter interrupt vector
dma = adapter dma channel

A list of host adapter driver prefixes appears in the previous section “SCSI peripheral device configuration.”

If the kernel fails to recognize your SCSI adapter at boot time, or incorrectly identifies it, you can use the **adapter** bootstring to define it. For example, if you have an Adaptec 1522 board installed and the system fails to recognize it as configured, you would use a bootstring similar to the following:

adapter=spad(0x340,11,0)

NOTE Many EISA and MCA boards get configuration data exclusively from CMOS RAM and may ignore bootstrings.

hd driver configuration

The **hd** bootstring allows you to override the default search sequence used by the **hd** driver to determine the root disk. The syntax of the bootstring is:

hd=device

where:

device = disk driver prefix

Valid **hd** driver prefixes are:

wd0 Western Digital WD1000 ST506/ESDI Controller
ida0 Compaq IDA
esdi IBM ESDI for Micro Channel
st506 IBM ST506 for Micro Channel
Sdsk Generic SCSI disk front-end

This bootstring is required by some controllers (for example: Compaq IDA) and SCSI adapters that appear to be wd1010-style controllers; by default, **hd** recognizes the **wd** driver before the **Sdsk** driver, thus preventing **Sdsk** from being configured as the root disk.

To boot from a Compaq IDA drive (in `ida` (non-wd) mode), you would use the following bootstring:

```
hd=ida0
```

Disable driver

The **disable** bootstring is used to disable any erroneous presence tests or driver actions that adversely affect software and/or hardware states. The syntax of the bootstring is:

```
disable=driver[,driver ...]
```

Sometimes the system may detect a device that is not actually present. You can use the **disable** bootstring to disable the driver. For example, if you wanted to disable the `dpt` driver and boot from another device on the system, you would use the following bootstring:

```
disable=dpt
```

The **disable** bootstring is currently only supported for disabling SCSI host adapters.

Select console device

You can select a video card as the system console at boot time by entering:

```
systty=cn
```

or place the keyword **systty=cn** in the file `/etc/default/boot`. If you want to select COM1 (`tty1a`) as the console with 9600bps and no parity, you should enter:

```
systty=sio
```


Chapter 1

Adding memory and bus cards

The bus (or “motherboard”) of your computer is the center of your system. Every system administrator must deal with the bus and the hardware associated with it. To find the bus on your system, you must generally remove the shell from the main body of your computer. Generally, you find a large circuit board with expansion slots for extra boards. These boards are commonly known as “bus cards.”

Bus cards can be extra memory for your system, host adapters, multiport serial boards for extra terminals, controller boards for peripheral devices such as hard disks, tape drives, control cards for monitors with color and graphics capabilities, mouse controllers, or other devices. Serial and parallel boards are discussed in Chapter 12 of this guide. In this chapter we explain a little about bus cards and how to install them in your SCO system. Installation of most devices with bus cards is explained in detail in other chapters of this guide.

Installing bus cards

To install a bus card, you must first shut down the operating system and power down the system. Make sure that the computer is unplugged or you can injure yourself. Before you begin working on the computer, ground yourself by touching a metal object close at hand that is not the computer. Static electricity that builds up and jumps from your hand when you touch the hardware inside the computer can ruin your equipment.

DIP switches and jumpers

Before you plug your board into the bus, make sure that there are no settings on the board that must be changed. Again, your hardware documentation that comes with the board should list the default settings and how to change them.

Generally, to change the settings of a board, there are DIP switches and “jumpers.”

NOTE Your SCO system is designed to work with most hardware using default settings. You will rarely have to change the settings on a board.

DIP switches operate in “down” and “up” positions. Your hardware documentation should list the correct settings if your board has these switches. Jumpers are clips that slide over metal posts that stick out of the board to make a connection. You can change the settings on a board by moving the jumper to connect a different pair of posts. Again, your hardware documentation should provide you with specific instructions for jumper settings on your hardware.

NOTE Micro Channel (MCA) and Extended Industry Standard Architecture (EISA) bus cards do not have DIP switches and jumpers; use the Reference Diskette (for MCA machines) or EISA Configuration Diskette to adjust settings.

Installing the hardware

Carefully perform any steps necessary to expose the expansion slots on your computer. Your hardware documentation should explain this in detail. Once you can examine this area, note the number of available spaces for bus cards. A new system has up to 8 or 10 available slots. Note that some slots are longer than others. There are both short and long cards. Short cards are about half as long as long cards. Usually there are two to three short slots and the rest are long slots. Find a slot that fits your board and gently, but firmly, plug the board into the slot in the bus. The board should have a tab on one side that fits into the slot on the bus. Bus cards only fit one way.

Some bus cards have a port that should face the outside of the computer. There may be a small plate covering an opening in the computer held on with a small screw. You can remove this cover plate if you need to. Boards such as modems, serial and parallel cards, and external device control cards require this.

When you are done, replace the shell for your computer, and turn it on and boot. You may first need to use the manufacturer's setup program as described below to change the system's configuration before you can use the new hardware.

NOTE The `eisa(ADM)` utility can be used to list cards currently installed on the EISA bus. The `slot(C)` utility does the same thing for MCA machines.

Using the manufacturer's setup diskette

Many machines, particularly Micro Channel (MCA) and Extended Industry Standard Architecture (EISA) machines, include a manufacturer's setup program on a bootable floppy disk. (Some machines have a setup program in ROM or "hidden" on the hard disk.) Copy this disk for use and keep the original in a safe place. This disk configures the permanent memory on your computer to describe the system hardware setup. Whenever you add a major device, like an extra hard disk or an extra serial card, you may need to run your setup program to tell your computer about the new hardware. Some computers automatically recognize the presence of new hardware. Your manufacturer's documentation should let you know if you need to run this software.

Adding more memory

You can improve system performance and run larger programs by increasing the amount of internal memory.

To increase internal memory follow these steps:

1. Bring your system down using the **shutdown(ADM)** command and shut off the computer when prompted to do so.
2. Install extended memory according to the manufacturer's instructions. Make sure you have set all switches as noted in the instructions.
3. Boot the operating system. The boot screen details how the additional memory has affected your system.

Many system resources depend on the amount of memory installed. For example, the "kernel i/o bufs" displayed at boot time are determined by the **NBUF** kernel parameter. When this parameter is set to zero, the number of kernel buffers is determined at boot time based on the amount of memory installed. Refer to the performance notes of the *System Administrator's Guide* for more information on system resources related to RAM.

If the memory hardware reports an error, the following message is displayed:

```
PANIC: memory parity error
```

You then see the software reboot message:

```
** Safe to Power Off **
- or -
** Press Any Key to Reboot **
```

If the system repeatedly panics from parity errors, consider replacing the memory chips.

NOTE Some machines have a hardware limitation on the maximum amount of memory that can be installed. Refer to your computer hardware manual to determine the maximum amount of memory you can install.

Your SCO system uses only “extended,” not “expanded,” memory.

Memory card compatibility notes

In general, most memory cards work with your SCO system. If you experience “panic: parity” errors it is often because of low-quality or mixed types and speeds of memory chips or cards. This problem is especially prevalent with the 32-bit static RAM chips used in older 386 machines.

NOTE Memory chips are very susceptible to static electricity damage.

With memory cards, check the switch settings (or software setup) on both the card and motherboard. Refer to the hardware manuals for your computer and for the memory card to find the correct switch settings or software setup. your SCO system supports up to 512 megabytes (Mbytes) of main memory.

NOTE Memory cards must be configured for extended not expanded mode.

Disabled high memory on Corollary architectures

On Corollary EISA based architectures it is possible to use the 15th megabyte address range as memory by using the EISA configuration utility to enable this feature. The default behavior is for this memory range to be disabled. When this memory range is enabled, on certain BIOS implementations (Quadtel BIOS ROMs, versions 3.06.03 and higher), the kernel attempts to map this memory twice resulting in the panic:

```
PANIC: smp_meminit - Adding overlapping memory segment 0x4f00000 - 0x5000000
```

If you have previously enabled this memory range through the EISA configuration utility, you can avoid the problem by disabling it before installing your SCO system. This memory range is reclaimed after the machine is booted, so it still uses all the memory in the system.

32-bit memory

It is *strongly* recommended that you use 32-bit memory from your machine manufacturer. 16-bit memory is much slower, and will degrade overall machine performance.

NOTE Certain manufacturers reserve the upper 384 Kbytes of the first megabyte for MS-DOS. On some machines, this “shadow” RAM cannot be accessed by your SCO system. You may need to install additional memory to run your SCO system. If possible, “BIOS shadowing” and “video shadowing” should be disabled.

If you see messages such as one of the following:

FATAL: parity error on the Motherboard

FATAL: parity error on add-on card

PANIC: Parity error address unknown

PANIC: Parity error at address 0xxxxx

some part of your hardware is sending a “non-maskable interrupt” (a signal sent by the hardware that halts the operating system). The precise message will depend on your particular system. You should run your system’s hardware diagnostics tests if available. In addition, physically reseal your memory cards and chips, and check for bent pins, and so on. If these measures fail to correct the problem, or you do not feel comfortable in checking your hardware yourself, seek assistance from professional hardware experts. One frequent cause of the problem is memory chips that are slower than factory-recommended chips.

Math chips

Your personal computer may include the 80387 math coprocessor, which is automatically detected and supported by your SCO system. These coprocessors improve floating point efficiency. The 80486DX CPU includes an on-chip coprocessor that is also recognized and used as an 80387. The 80486SX CPU does not include a coprocessor.

Use math coprocessors matching your machine’s CPU speed. Follow the manufacturer’s recommendations.

At boot time, your SCO system announces the presence of a math coprocessor with the message:

```
%fpu - 13 - TYPE=80387
```

Please note that switches on the main system board must be set properly to enable 80387 interrupts, and/or your system must be set up with the manufacturer's setup disk, to expect the chip. Ensure that the system diagnostics recognize the coprocessor's presence, and check your hardware manual for the proper switch settings.

Also, please note that on some motherboards, the operating system incorrectly recognizes the presence of an 80387 coprocessor even if the chip is not installed. This problem is prevalent on machines that use the Intel 302 motherboard; if your computer incorrectly recognizes the presence of an 80387 chip, make sure that blocks E48 and E49 are not connected with a jumper connection.

Some 80387 exceptions are masked. Refer to the manual page for **80387(HW)**.

Intel 387 coprocessor problems

Because of design defects in Intel's 80386 chip (B1 stepping, part numbers 540344 and 540362), the Intel 80387 math coprocessor may not operate correctly in some computers, causing the CPU to hang during DMA/paging/coprocessor access. You can work around this problem by changing the tunable kernel parameter **DO387CR3** from 0 to 1 using the **configure(ADM)** utility. See the performance notes in the *System Administrator's Guide* for more information.

You can replace the 386 chip with a newer release of the 386 chip (a D-step part), or bypass the 387 chip by adding the **ignorefpu** keyword to the boot command as follows:

```
Boot
: unix ignorefpu
```

This means that the operating system will not use the 387 chip, but you need not remove it physically; the coprocessor is still usable from MS-DOS. To bypass the 387 chip automatically every time you boot your system, add the **ignorefpu** keyword to the */etc/default/boot* file. See **boot(HW)** for more information.

Hardware devices are available from *Ironwood Electronics* to solve this problem.

Intel RapidCAD Engineering Coprocessor

The Intel RapidCAD Engineering Coprocessor for Intel 386DX PCs is also supported.

Weitek coprocessors

Weitek numeric coprocessors are also supported. This support extends only to runtime; there is no current development support for creating binaries that take advantage of numeric coprocessors.

In order for the Weitek chip to be recognized by the system, one file needs to be edited in the following way:

1. In the file `/etc/conf/sdevice.d/weitek`, there should be a line similar to the following:

```
weitek N 1 0 0 ...
```

Change the "N" (for no) to a "Y" (for yes).

2. Issue the following commands to relink the kernel:

```
cd /etc/conf/cf.d  
./link_unix -y
```

3. Reboot the machine; the Weitek chip will be recognized.

Chapter 2

Disk controllers and host adapters

Standard PC hard disk controllers that present an ST506 interface to the operating system are supported. Also supported are SCSI host adapters. The following combinations of controllers are supported:

- one or two ST506/ESDI controllers (on Micro Channel machines, only one is supported).
- multiple SCSI adapters from different vendors. Theoretically, there is no upper limit to the supported configuration, but SCO has only tested a maximum of two adapters with up to seven devices per adapter.
- two Compaq IDA controllers plus four intelligent array expansion controllers.

The following table summarizes the number of devices tested on the listed controller/adaptor:

Controller or adapter	Maximum number of devices tested
ST506/ESDI	2 disks per controller
SCSI	7 devices per adapter
IDA controller	4 drive pairs per IDA

ST506 and ESDI controllers

Many ST506 and ESDI hard disks work with your SCO system. Whether or not a disk works depends upon the disk controller board used. For the disk to work, the controller must meet two tests:

1. The disk controller must be register-level compatible with the ST506 specification for that configuration.
2. The controller does not require special vendor software to work under MS-DOS.

If a controller meets these tests, it should work, but if it fails these tests, it will not work.

SCSI host adapters

Each device on the SCSI bus has a unique address pair, which is made up of a device address and a controller address. The controller address on the SCSI bus is an ID number that corresponds to actual jumper settings on the device itself, with the range of IDs being 0-7, for the eight possible controllers. The host adapter itself is usually ID 7, giving it the highest priority on the SCSI bus. The controller address goes by various names including SCSI ID, target id, and controller id. The device address is known as the logical unit number (LUN). (Most devices have an embedded controller, so the LUN is usually 0.)

NOTE IBM proprietary host adapters recognize the boot disk of Host adapter 0, id_6, LUN 0.

Olivetti ESC (EISA) host adapter notes

The following machines incorporate Olivetti ESC EISA host adapter cards:

- Olivetti CP486
- Olivetti M486
- Olivetti LSX 5000 series
- DEC DS425

The manufacturer's EISA configuration utility allows the host adapter card to be configured for either AT mode or SCSI mode. To ensure correct installation of the Operating System, the configuration should be set to SCSI mode. This will also ensure that SCSI peripherals required for installation (tape or CD-ROM) will operate correctly during and after installation.

The following example shows the relevant settings that should be made for the Olivetti CP486:

AT Compatible Disk Controller:	Disabled
ROM BIOS Access Mode:	High Performance SCSI
Direct SCSI:	Enabled

Please consult your system manufacturer's documentation for details of the EISA configuration procedure.

Relinking the kernel

Each time you relink the kernel, you may see this message:

```
warning: no dma channel specified for scsi device: prefix oha
```

You can ignore this message.

Tape drive accessing delay

If you are installing the ESC host adapter on a machine with less than 4 Mbytes of RAM, there is a two-minute delay in accessing the tape drive. This does not occur if you use 8 Mbytes of RAM.

Installing on an EISA system containing two SCSI host adapters sharing the same interrupt

Attempts to perform the Fresh or Update installation will fail on an EISA system containing two SCSI host adapters sharing the same interrupt; the system may lock when the N2 disk is inserted. If possible, move the second host adapter to a different interrupt for the duration of the installation process. If no spare interrupts are available, physically remove the second host adapter from its slot until the installation is complete.

Western Digital WD7000 SCSI host adapter notes

The Western Digital 7000 is a 16-bit, ISA, Bus Mastering host adapter which supports scatter-gather and has an on-board 16-byte FIFO data buffer.

The first Western Digital card must be set to the following configuration:

Base I/O Address	350h
Interrupt	12
DMA	6

NOTE These settings are different from the factory configuration and will have to be set to the above values for this card to work correctly.

The WD7000 uses the **wdha** driver. A line similar to the following is displayed at boot time:

```
  %adapter 0x0350-0x0352 12      6      type=wdha ha=0 id=7 fts=s
```

The difference between the WD7000-ASC and the WD7000-FASST is in the BIOS. The ASC boards use a Western Digital BIOS. The FASST boards use the BIOS developed by Columbia Data Products. If you are using a machine that is not on this list, or is on the list of machines that have problems, the system usually reboots unexpectedly during normal operation. (Note that other systems not listed here may also work.)

Interrupt 12 conflict

The correct configuration for the first WD7000 SCSI Host Adapter is as follows:

Interrupt	12
DMA	6
Base I/O Address	0x350

Systems which contain a keyboard style mouse at interrupt 12 may hang during the installation of the N2 floppy. The WD7000 driver in your SCO system is set to interrupt 12 and will conflict with this type of mouse. You should disable the mouse before attempting to install your SCO system. If the mouse cannot be disabled on your system, you will need to change the interrupt of the WD7000 card from 12 to an unused value, and use the **adapter** boot string during the installation. See your WD7000 manual for instructions on changing the card's interrupt.

In the following example, the WD7000 card is installed using a bootstring with the interrupt set to 14:

```
defbootstr adapter=wdha(0x350,14,6)
```

After successfully installing and rebooting, you should use the following procedure to correct this interrupt conflict:

1. In the file `/etc/conf/sdevice.d/twdha`, there should be a line similar to the following:

```
wdh Y 1 5 0 12 350 0 0
```

Change the 12 (interrupt vector) to another interrupt value which is not currently used in the machine.

2. Issue the following commands to relink the kernel:

```
cd /etc/conf/cf.d
./link_unix -y
```


3. Shut down the machine as described in the "Starting and stopping the system" chapter of the *System Administrator's Guide* ("Operating System Services" for SCO Open Desktop / SCO Open Server) and change the interrupt vector jumper setting on the WD7000 card to match the value entered in step 1.
4. Re-enable the mouse and reboot.

Reported to work with the WD7000

The following systems have been reported to work with the WD7000, but have not been tested by SCO. They are supported only by the hardware manufacturer.

ACER 386/20
ALR Flexcache 25386 (IOCR mod on 7000)
AMI Mark II
ARC Skyscraper
AST Premium 386/16
AST Premium 386/25 (IOCR mod on 7000)
AT&T 6386WGS
COMPAQ Deskpro 386/25
Everex Step 25
Rose Hill 386
Tandon 386/20
Tandy 3000
TI 386/20
Wyse 16MHz
Wyse 3216-40

NOTE IOCR means I/O Channel Ready. If the System Motherboard asserts this signal, then the adapter will extend the memory cycle. This signal is typically used by systems with slow memory. If a system uses IOCR and the adapter does not support IOCR, then the DMA will not work properly. The following revisions of the 7000 boards support IOCR:

WD7000-FASST2 X5
WD7000-FASST2 A through H

All boards previous to revision X5 do not have IOCR.

Difficulties or incompatibilities have been reported with the following machines:

COMPAQ 386/20E
PC Kraft 386/25 with 387/20

Western Digital WD7000EX host adapter notes

The Western Digital 7000EX in DACB mode, is a 32-bit EISA, Bus Mastering SCSI host adapter which implements scatter-gather data transfers. In compatibility mode, the 7000EX emulates the Western Digital 7000 ISA host adapter.

Before installing on the 7000EX, the card should be set to DACB mode to utilize its full functionality. Use the EISA configuration utility provided with the computer and change the protocol mode from ASC to DACB.

The WD7000EX uses the `wdex` driver. A line similar to the following is displayed at boot time:

```
%adapter 0x6C80-0x6CB2 14 - type=wdex ha=0 id=7 fts=sdb
```

If you have already installed with the 7000EX card in standard mode, use the following instructions to switch the card to enhanced mode:

1. Log in as root and change directories to `/etc/conf/cf.d`.
2. Use a text editor to manually edit the `mcscli` file. You should see something similar to the following:

```
wdha Sdisk 0 0 0
wdha Stp 0 2 0
```

This is an example; you may or may not have entries for SCSI peripherals other than a SCSI hard drive at ID=0.

Change all occurrences of the string `wdha` in the left column of the `mcscli` file to read `wdex`. If you have another card using the `wdha` or `wdex` driver, only change the lines corresponding to the devices attached to the WD7000EX being reconfigured.

3. Save the changes you have made to the `mcscli` file and quit out of the editor.
4. Change directories to `/etc/conf/sdevice.d`.
5. Edit the `wdha` file. You should see something similar to the following:

```
wdha Y 1 5 0 12 350 352 0 0
```

Change the `Y` in the second field to an `N`. If you have a 7000, or another 7000EX in standard mode currently configured in the machine, only change the line corresponding to the 7000EX you are reconfiguring.

Save the change you made to the `wdha` file and quit out of the editor.

6. Next you must edit the `wdex` file. You should see something similar to the following:

```
wdex N 1 5 0 15 0 0 0 0
```

Change the `N` to a `Y` in the second field. Do not make any other changes to this file. The zeros (0) indicate auto-configuration of the appropriate values. Save the change you made to the `wdex` file and quit the editor.

7. Change directories to `/etc/conf/cf.d`.
8. Relink your kernel with the following command:
`./link_unix`
Respond `y` when asked if you wish to recreate the kernel environment.
9. When the link process is complete, shut down the system.
10. Run the EISA configuration utility to change the mode of the WD7000EX SCSI host adapter.
11. Reboot your system.

Your system should now be running with the WD7000EX host adapter in enhanced mode.

DPT 2011 host adapter notes

The DPT 2011 is a 16-bit, ISA, Bus Mastering, caching SCSI host adapter with scatter-gather support.

The first DPT controller should be set to the default configuration:

Base I/O Address	1F0h
Interrupt	14
DMA	5

See the DPT documentation for additional configuration information.

The 2201 uses the `dpt` driver. A line similar to the following is displayed at boot time:

```
%adapter 0x01F0-0x01F8 14 5 type=dpt ha=0 id=7 Primary, BusMaster
```

DPT 2012 host adapter notes

The DPT 2012 is a 32-bit, EISA, Bus Mastering, caching SCSI host adapter with scatter-gather support. The first DPT 2012 SCSI controller should be configured as the *primary* controller, using the computer's EISA configuration utilities. See the DPT documentation for this information.

The 2012 uses the `dpt` driver. A line similar to the following is displayed at boot time:

```
%adapter 0x6C88-0x6C90 14 - type=dpt ha=0 id=7 Primary, BusMaster
```

The address range and interrupt vector may be different on your system.

Adaptec 152x host adapter notes

The Adaptec 152x/1510 is a programmed I/O, 16-bit, ISA SCSI host adapter with a 120 byte FIFO data buffer, and uses the Adaptec 6260 chip.

The Adaptec 152x/1510 card should be set to its default configuration. The correct configuration is as follows:

Base I/O Address	340
Interrupt	11
DMA	0

The Adaptec 152x/1510 use the **spad** driver. A line similar to the following is displayed at boot time:

```
%adapter 0x0340-0x035f 11          type=spad ha=0 id=7
```

The Adaptec 1510 card does not have a BIOS, and cannot be used as a boot device.

Adaptec AHA-154x host adapter notes

Not all computer systems are compatible with Adaptec AHA-154x host adapters. If you are unable to get the host adapter to function, or you experience file corruption, use the test documented in "Hardware incompatibilities" (page 27) to see if an incompatibility exists. You can also contact your manufacturer or Adaptec to determine if your hardware is incompatible.

The Adaptec 154x range of SCSI host adapters should run correctly with the manufacturer's default settings:

Base address	0x330
IRQ	11
DMA	5

The Adaptec 154x use the **ad** driver. A line similar to the following is displayed at boot time:

```
%adapter 0x0330-0x0332 11          5          type=ad ha=0 id=7 fts=s
```

If you are installing a second Adaptec AHA-154x board, you must reset several jumpers to be configured at base address 0x230, IRQ 12, and DMA channel 6. For two AHA adapters to coexist, the BIOS must be disabled on the second adapter. (For more information, refer to your Adaptec documentation.)

Formatting and verifying devices

The Adaptec 154x series of controllers have a set of BIOS routines to maintain and debug SCSI devices.

First you will need to know what BIOS address is on the Adaptec controller. This information can be found in the Adaptec manual. The default address is 0xDC000H. Once you have this number you can perform a number of tasks. One such task is the formatting and verifying of SCSI devices. All SCSI hard disks must be formatted prior to installing your SCO system on a SCSI host adapter. This is usually done by the hard disk manufacturer.

To format your devices you will need to do the following:

1. Boot DOS.
2. Run the **DEBUG** program.
3. At the "-" prompt enter: **g=dc00:6** (notice how the BIOS address is truncated). A menu is displayed.
4. Select the format option on the drive specified. (Note that this destroys all data on that disk.)
5. When the format is complete, select the verify option on the drive specified.
6. Exit the menu.

Hardware incompatibilities

There is an option that will allow you to test the interface between the Adaptec host adapter and motherboard. To run this test, do the following:

1. Boot DOS.
2. Run the **DEBUG** program.
3. At the "-" prompt enter: **g=dc00:9** (notice how the BIOS address is truncated).

You should see a set of diagnostic messages displayed as the test is run. If you see a fail message, or no diagnostic messages are displayed, a hardware incompatibility exists. Your computer may have trouble loading and running your SCO system. Since this is a hardware level inconsistency, there is no software patch available; call your hardware manufacturer.

Adaptec 174x host adapter notes

The Adaptec 174x, in enhanced mode, is a 32-bit, EISA, Bus Mastering SCSI host adapter with a 1K FIFO data buffer and scatter-gather support. In standard mode, the Adaptec 174x emulates the Adaptec 154x host adapter.

In enhanced mode, the Adaptec 174x cards use the `eiad` driver. A line similar to the following is displayed at boot time:

```
%adapter 0x8000-0x8CDC 11 - type=eiad ha=0 id=7 fts=std
```

The address range and interrupt vector may be different on your system.

Before installing on the Adaptec 174x, the card should be set to enhanced mode to utilize its full functionality. Use the EISA configuration utility provided with the computer and follow Adaptec's instructions to change the Host Adapter I/F to enhanced mode.

If you have installed with the 174x card in standard mode, use the following instructions to switch the card to enhanced mode:

1. Log in as `root` and change directories to `/etc/conf/cf.d`.
2. Use a text editor to manually edit the `mcscli` file. You should see something similar to the following:

```
ad      Sdsk    0      0      0
ad      Stp     0      2      0
```

This is an example; you may or may not have entries for SCSI peripherals other than a SCSI hard drive at ID=0.

Change all occurrences of the string `ad` in the left column of the `mcscli` file to read `eiad`. If you have an Adaptec 154x, or another 174x in standard mode, only change the lines corresponding to the devices attached to the 1740 being re-configured.

3. Save the changes you have made to the `mcscli` file and quit out of the editor.
4. Change directories to `/etc/conf/sdevice.d`.
5. Use a text editor to manually edit the `ad` file. You should see something similar to the following:

```
ad      Y      1      5      0      0      330      332      0      0
```

Change the `Y` in the second field to an `N`. If you have a 154x, or another 1740 to remain in standard mode, configured in the machine, only change the line corresponding to the 174x you are reconfiguring.

6. Save the change you made to the `ad` file and quit out of the editor.

- Next you must edit the *eiad* file. You should see something similar to the following:

```
eiad  N      1      5      0      0      0      0      0      0
```

Change the *N* to a *Y* in the second field. Do not make any other changes to this file. The zeros (0's) imply auto-configuration of the appropriate values. Save the change you made to the *eiad* file and quit out of the editor.

- Change directories to */etc/conf/cf.d*.
- Relink your kernel with the following command:
./link_unix
Respond *y* when asked if you wish to recreate the kernel environment.
- When the link process is complete, shut down the system.
- Run the EISA configuration utility to change the mode of the Adaptec 174x SCSI host adapter.
- Reboot your system.

Your system should now be running with the Adaptec 1740 host adapter in enhanced mode.

Future Domain TMC-950 IC-based host adapters

The Future Domain TMC-950 SCSI chip is used on cards such as TMC-850, TMC-860, and the TMC-885. It is an 8-bit, memory mapped I/O, ISA SCSI host adapter.

Consult the Future Domain documentation for further information on the proper configuration of these cards.

These cards use the **tmcha** driver. A line similar to the following is displayed at boot time:

```
%adapter -          5 -          type=tmcha ha=0 id=6
```

Future Domain TMC 1800 chip-based host adapters

The Future Domain TMC 1800 SCSI chip is used on cards such as the TMC-1660/1680 and MCS-600. These cards are 16-bit programmed I/O host adapters with a dual 8K FIFO architecture.

The first Future Domain card should be set to the following configuration:

Base I/O Address	140h
Interrupt	14

Consult the Future Domain card documentation for information on the proper configuration of these cards.

These cards use the **fdha** driver. A line similar to the following is displayed at boot time:

```
%adapter 0x0140-0x014F 14 - type=fdha ha=0 id=6
```

Future Domain TMC 7000-FASST2 host adapter notes

The TMC 7000-FASST2 is a 16-bit Bus Mastering SCSI host adapter that supports scatter-gather data transfers and has an on-board 16-byte FIFO data buffer. This host adapter uses the **wdha** (wd7000) driver. See “Western Digital WD7000 SCSI host adapter notes” (page 21) for additional configuration information.

Future Domain TMC-7000EX host adapter notes

The TMC-7000EX host adapter is a 32-bit, Bus Mastering, SCSI host adapter which implements scatter-gather data transfers. The TMC-7000EX host adapter uses the **wdex** (WD7000EX) driver. See “Western Digital WD7000EX host adapter notes” (page 24) for additional important configuration information.

Storage Plus SCSI-AT (SUMO) host adapter notes

The correct configuration for the Storage Plus SCSI-AT Host Adapter is as follows:

Interrupt	14
Base Address	0x310

The first SUMO card is configured at the factory default settings.

Defining the primary host adapter

If you have a SCSI root disk, then the SCSI host adapter attached to the root disk is the primary host adapter. Refer to your hardware documentation for detailed instructions.

Adding a secondary SCSI host adapter

Follow these steps to add a secondary SCSI host adapter:

1. Place the secondary board in any available slot.
2. Configure the secondary host adapter. You may need to run some setup or configuration utilities. Refer to your hardware documentation for detailed instructions.
3. Reboot your machine.

The next time you access a device that is attached to the secondary board with a **mkdev**(ADM) script (such as **mkdev tape**), the system notes the existence of the secondary host adapter. The **mkdev** script then prompts you for configuration information as described in the next section.

Referencing a second host adapter

The **mkdev** scripts prompt you for information when you add the first SCSI device to a SCSI host adapter. Be prepared to supply the following information the first time that you reference the second adapter:

- interrupt vector
- start I/O hexadecimal address
- stop I/O hexadecimal address

Refer to your hardware documentation for information on determining these values.

Tuning SCSI disk performance

The SCSI subsystem in your SCO system kernel is set up to perform well with a broad range of SCSI adapters and system loads. It may be possible to improve the performance characteristics for specific load conditions by experimenting with certain SCSI configuration variables. There are two variables which reside in the file `/etc/conf/pack.d/Sdsk/space.c` called `Sdsk_sleep_option` and `Sdsk_no_sg`. These variables can take the values 0 or 1. The `Sdsk_sleep_option` variable controls the way that requests are sent to the adapter, and the `Sdsk_no_sg` variable determines whether the adapters perform scatter-gather or not. Before running suitable performance tests, edit these variables by hand and then relink a new kernel.

In addition, the value of the `SDSKOUT` tunable parameter can also be modified by directly adding an entry in the `/etc/conf/cf.d/stune` file. This parameter controls the maximum number of outstanding requests sent to the adapter. If you only have a Corollary SCSI adapter installed in your system, you may get some performance gains by tuning this value to a number below 255. If an adapter other than Corollary SCSI is present in your system, this value should be 16 or below. The default value for `SDSKOUT` can be found by looking in the `/etc/conf/cf.d/mtune` file.

NOTE The `/etc/conf/cf.d/configure` utility cannot be used to view or edit the value of the `SDSKOUT` tunable parameter.

If no gain is noticed after modifying the above parameters, then they should all be changed back to their original values. Note that changing these parameters may produce gains under some conditions at the expense of losses under others.

IDE drives and disk controllers

The Integrated Drive Electronics (IDE) interface design is characterized by the connection of a low cost IDE adapter (frequently embedded in the motherboard) to one or two IDE hard drives.

The drives are connected to the adapter by a single 40 pin cable which carries both control and data information.

Each of the two IDE drives which may be connected to a single adapter plays one of three roles :

1. If only one drive is connected it must be jumpered for single drive mode.
2. If two drives are connected, one drive must be jumpered for the two drive master mode.
3. If two drives are connected, one drive must be jumpered for the two drive slave mode.

You cannot take a one drive system and just add another drive without changing the jumpers.

IDE drives, as commonly marketed today, emulate the ST506 interface common to all MFM and RLL, and most ESDI controller/drive combinations. So, when installing an IDE drive, the ST506 interface selection should be used.

Another feature of most IDE drives is that the embedded controller can do sector translation automatically. This allows the drives to be configured with several different head/cylinder/sectors per track settings. You may want to use some settings other than the factory defaults if your drive has more than 1024 cylinders or if the new settings more closely match some drive type in the ROM BIOS (an important issue if you are also installing DOS).

This advanced automatic translation feature sometimes has an associated cost. Many IDE hard drives cannot be low-level formatted by normal formatting utilities. The utility program will not understand the underlying hardware of the IDE drive and may render the drive useless. It is important to check with the manufacturer of any IDE hard drive before attempting to low-level format the drive.

Most IDE drives work the same way and most will work with your SCO system without any special effort.

Chapter 3

Adding hard disks

This chapter explains how to add and maintain conventional hard disks. Many hard disks can be used with your SCO system provided that the disk controller supports the drive. Controllers supporting drive interfaces, such as RLL or ESDI, work as long as the controller presents a compatible interface to the bus.

NOTE This section applies only to ST506 and ESDI hard disks. SCSI and IDE disks are preformatted and use a different cylinder/head/sector translation logic, which means that the considerations for ST506 and ESDI disks do not apply. Use `mkdev hd` to add hard drives to the system, regardless of their type.

Some hard disks come from the factory only partially formatted (for example, the Maxtor 1140 140 Mbyte). This may create a problem which becomes evident during installation, when `badtrk(ADM)` indicates that every sector past a certain cylinder/head location is bad. You should contact the manufacturer to determine whether or not the disk is completely formatted. There are several products available that format hard disks.

Compatible hard disk controllers are discussed in Chapter 2, "Disk controllers and host adapters."

- For a disk supported by the ROM Fixed Disk BIOS, the motherboard ROM must have an entry for the disk (type) determined by the number of heads, cylinders, tracks per cylinder (heads), sectors per track, and other characteristic information.

Follow the manufacturer's instructions to set switches or configuration.

- For a disk not supported by the ROM Fixed Disk BIOS, the user can type in information that overrides the ROM disk configuration information during installation.

If you are unsure of the parameters that should be entered for a disk not supported by the ROM Fixed Disk BIOS, you should contact your disk manufacturer for the information. The **dkinit** program (called during installation) allows you to input the disk parameters.

Many hard disks can be used with your SCO system. In the case of ST506/ESDI drives, the drive must be supported by the ROM BIOS, or the ROM parameters must be entered at installation time. Check your computer hardware reference manual for the appropriate ROM table entries for your computer.

Adding secondary hard disks

When your system suffers from chronic lack of space, you probably need to add a hard disk to give the system extra space for storing user files and directories. The following types of secondary hard disks and controllers are supported:

- Standard disk support (ST506, ESDI, MFM, RLL, IDE)
- SCSI host adapters
- Compaq IDA/Intelligent Array Expansion Controllers on Compaq systems only

Three configurations are possible:

- root disk on a SCSI host adapter with an option to add one or more SCSI host adapters, each supporting up to seven controllers (Target IDs), and each SCSI controller supporting up to eight devices
- root disk on an ST506/ESDI controller with an option to add one ST506/ESDI controller, each supporting two ST506 or ESDI disks and SCSI host adapters (which can be configured as in the first option)
- root disk on an IDA controller with an option to add a maximum of four logical pairs on two IDA controllers.

Figure 3-1 illustrates a configuration of the second type.

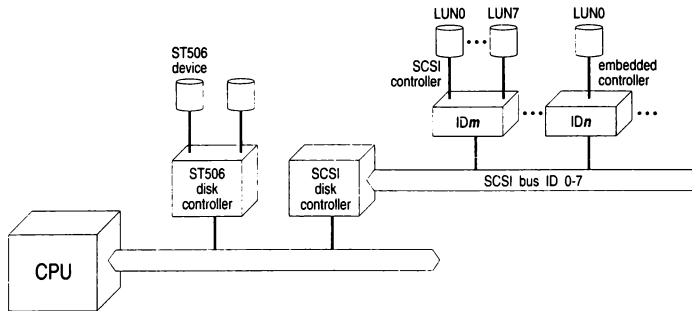


Figure 3-1 ST506 and SCSI configuration examples

Each device on the SCSI bus has a unique address pair, which is made up of a device address and a controller address. The controller address on the SCSI bus is an ID number that corresponds to actual jumper settings on the device itself, with the range of IDs being 0-7, for the eight possible controllers. The device address is known as the logical unit number (LUN). (Most devices have an embedded controller, so the LUN is usually 0).

When you installed the operating system and initialized your root disk, the root disk was configured as the first hard disk on the first controller (for ST506 or ESDI disks) or first host adapter (for SCSI disks).

If you are installing a ST506, ESDI, or IDA disk, simply follow the procedure in “Installing the hard disk” (page 41). In the case of SCSI disks, you must configure the disk with `mkdev hd` as instructed in the next section, then proceed to “Installing the hard disk” (page 41), where you invoke the same command a *second* time. This is necessary because the SCSI configuration files must be prepared in the first pass and the disk initialized in the second.

NOTE Your hardware must first be jumpered or configured according to the documentation provided with your machine. Many machines include a setup or configuration disk that must be booted and used to configure your system; this must be done before running `mkdev hd`.

Make sure the additional drive is formatted and passes the manufacturer diagnostic tests before installing the system. If it does not pass the diagnostic tests, you cannot use it with your system.

Configuring a SCSI hard disk

To configure a SCSI device with the **mkdev hd** command, you must know:

- *ID Number*. This is the number of the controller on the host adapter (0-7); the host adapter itself is usually ID 0, giving it the highest priority on the SCSI bus.
- *Host Adapter Type*. This is the code that refers to the type of host adapter. Several types are supported. For example: **ad** refers to an Adaptec host adapter (**ad** is also the default type).
- *Host Adapter Number (0 or 1)*. This shows which host adapter the device is connected to. It can be either a 0 or a 1.
- *Logical Unit Number*. This is the number of the device (0-7) on the "Target ID"; on an embedded controller (where the controller and the device are one physical unit), the LUN is usually 0.

Refer to Figure 3-1 for a pictorial representation of each value.

You must run **mkdev hd** twice to configure a SCSI disk; be sure and provide the same configuration input when you invoke **mkdev hd** the second time.

To add your SCSI disk, follow these steps:

1. Enter the following command:

```
mkdev hd
```

```
Δ sysadmsh users select: System ⇄ Hardware ⇄ HardDisk
```

2. If your root disk is attached to an ST506 controller, you see the following:

```
Your root hard disk is attached to an ST506 controller.  
Pick one of the choices below or you may quit and  
invoke mkdev hd -u for a detailed usage message.  
  
1) Add a hard disk to ST506 controller  
2) Add a hard disk to SCSI controller  
3) Add a hard disk to an IDA controller (EISA)  
  
Enter 1, 2, 3 or enter q to quit:
```

Enter **2** and press **(Enter)**.

3. If your root disk is attached to a SCSI controller, you see the following:

```
Your root disk is attached to a SCSI controller.  
  
The only available choice is to add another SCSI disk.  
Do you want to add another SCSI disk?
```

Enter **y** and press **(Enter)**.

4. Now you must identify the type of the adapter that the disk is attached to:

```
Enter the prefix of the SCSI host adapter that supports this device
or press <Return> for the default: type
Enter h for a list of host adapters or enter q to quit:
```

Enter the code that describes your host adapter: for example, **ad** for Adaptec AHA-154x. Entering **h** displays a list of supported adapters.

5. Now you are prompted for the number of the adapter:

```
Which type SCSI host adapter supports this device?
Select 0-n or q to quit:
```

Enter **0** if it is the first **type** host adapter or **1** for the second **type** host adapter.

6. If you are adding a device to a previously configured host adapter, skip to step 9. If you are configuring a secondary host adapter of a type already installed, you see the following:

```
hatype SCSI host adapter n is not configured.
Would you like to update the link-kit?
```

The kernel already recognizes one of each type of host adapter; an additional entry must be created for the new one. Respond **y** and press (Enter).

7. You may be prompted for one or more of the following, depending on your host adapter type (the system attempts to autoconfigure any values it can obtain from default files and other adapters installed of the same type):

```
What is the interrupt vector for this adapter?

What is the start IO address (hex) for this adapter?

What is the end IO address (hex) for this adapter?

What is the start controller memory address (hex) for this adapter?

What is the end controller memory address (hex) for this adapter?
```

You should check for conflicts before entering values; other hardware devices may already be using the same interrupt vector, I/O address, and so forth. Enter each value as prompted and press (Enter).

8. You are asked to confirm the values you supplied. Then the following prompt is displayed:

```
The following parameters will be used to configure
hatype SCSI host adapter ha

list of parameters

Update the link-kit?
```

If you need to make corrections, enter **n** and press (Enter), and then press (Del) to exit **mkdev hd** and start over. If the values are correct, enter **y** and press (Enter) to add these values to the link kit.

9. Next you see:

```
What is the Target ID for this device?
Select 0-7, or h for help, or q to quit:
```

Enter the Target ID of the controller attached to the adapter.

10. You are then prompted:

```
What is the LUN of this device? Press RETURN to use the default: 0
Select 0-7, or h for help, or q to quit:
```

Enter the Logical Unit Number of the device attached to the controller. With most disks, the controller and the device are a single unit, in which case the Logical Unit Number is 0.

11. The information you supplied earlier for the device configuration is then displayed as in the following example. You are asked to confirm that you wish to update the configuration:

```
You are about to add the following SCSI device:

Host
Adapter          Adapter
Type  Device  Number  ID    LUN
-----
ad    Sdsk    0      1     0

Update SCSI configuration (y n)?
```

If the information is correct, enter **y** and press (Enter).

12. Now that the data is entered, the program acknowledges the information and prompts for relinking of the kernel:

```
The SCSI configuration file has been updated.  
  
A new kernel must be built and rebooted before disk configuration can continue.  
Would you like to relink at this time? (y n)
```

The kernel must be reconfigured to recognize the new disk. You are given the option of not relinking in case you are adding a number of devices. This way the kernel needs to be relinked only once before running **mkdev hd** the second time. After the reconfiguration is complete, the following message is displayed:

```
After the system is rebooted with the new kernel,  
reinvoke mkdev hd to initialize the new SCSI hard disk.
```

You now have configured the necessary software support for your new disk. You can now proceed to “Installing the hard disk” (this page).

WARNING You must relink the kernel and reboot before running **mkdev hd** for the second time.

Installing the hard disk

These are the steps to install another hard disk with one UNIX filesystem and no DOS area:

1. After you have connected the hard disk and booted the system, enter system maintenance mode and use the appropriate form of the **mkdev** command, specifying the required configuration information on the command line:

mkdev hd

Δ **sysadmsh** users select: System ⇄ Hardware ⇄ HardDisk

2. If your root disk is attached to an ST506 or IDA controller, you see the following, where *type* is replaced by ST506 or IDA:

```
Your root hard disk is attached to an type controller.

Pick one of the choices below or you may quit and
invoke mkdev hd -u for a detailed usage message.

    1) Add a hard disk to ST506 controller
    2) Add a hard disk to SCSI controller
    3) Add a hard disk to an IDA controller (EISA)

Enter 1, 2, 3 or enter q to quit:
```

Enter a number and press (Enter). If you are adding an ST506 disk, proceed to step 8. If you are adding a SCSI disk, proceed to step 6. If you are adding an IDA disk, proceed with the next step.

3. You see:

```
Note: This kernel is configured to support n hard disks.
If your system will have more than n disks, the kernel
must be reconfigured.
```

If you plan to install more than the number of disks indicated, you must first increase the value of the NDISK kernel parameter. You can then reboot the system and invoke `mkdev hd` again.

4. Next, you see:

```
Will this be the first or second logical disk on this controller?
Enter 1 (first) or 2 (second):
```

Enter the number of the logical disk and press (Enter).

5. You are then asked to indicate the controller number:

```
Which controller will this logical disk attach to?
Enter 1 (first controller), 2 (second controller), etc.
```

Enter the IDA controller number and press (Enter). Proceed to step 10.

6. If your root disk is attached to a SCSI controller, you see the following:

```
Your rootdisk is attached to a SCSI controller.  
The only available choice is to add another SCSI disk.  
Do you want to add another SCSI disk?
```

Enter **y** and press **(Enter)**.

7. You are then prompted to enter the same controller, host adapter, and LUN information you provided earlier:

```
Enter the prefix of the SCSI host adapter that supports this device  
or press Enter for the default: type  
Enter h for a list of host adapters  
  
Which type SCSI host adapter supports this device?  
Select 0-n, or h for help, or q to quit:  
  
What is the Target ID for this device?  
Select 0-7, or h for help, or q to quit:  
  
What is the LUN of this device?  
Select 0-7, or h for help, or q to quit:
```

Enter each as instructed and proceed to step 10.

8. If you are adding an ST506 or ESDI disk, you see the following:

```
Will this disk be the first or second disk on this controller?  
Enter 1 (first) or 2 (second):
```

Enter a number and press **(Enter)**.

9. If you are adding an ST506 disk only, you see the following:

```
Will this disk attach to the first or second ST506 controller?  
Enter 1 (first) or 2 (second):
```

Enter a number and press **(Enter)**.

10. The following prompt is displayed:

```
During installation you may choose to overwrite all  
or part of the present contents of your hard disk.  
  
Do you wish to continue? (y n)
```

Enter **y** and press **(Enter)**.

11. If you have a SCSI host adapter, you see the following message:

```
The hard disk installation program will now invoke etc fdisk.  
Entering 'q' at the following menu will exit etc fdisk.  
and the hard disk installation will continue.
```

```
If you wish to exit the entire installation at this menu,  
press the (Del) key.
```

Skip to step 15.

NOTE The SCSI installation skips steps 12-14.

12. If you have an ST506/ESDI (standard interface) controller, or an IDA controller, you see the following message and prompt:

```
The hard disk installation will now invoke etc dkinit.  
Entering 'q' at the following menu will exit etc dkinit,  
and the hard disk installation will continue.
```

```
If you wish to exit the entire installation at this menu,  
press the (Del) key.
```

```
Hard Disk Drive 1 Configuration
```

1. Display current disk parameters
2. Modify current disk parameters
3. Select default disk parameters

```
Enter an option or 'q' to quit:
```

The **dkinit** menu is intended for unusual or nonstandard disks. If you have a standard hard disk, one that is supported by your computer hardware or special motherboard ROM, enter **3** followed by **(Enter)** and then **q** and **(Enter)** to continue the installation.

Entering **q** at this point selects the default parameters for your hard disk. Unless you know that your disk is nonstandard, assume that it is standard and enter **q** and press **(Enter)** to continue your installation. Skip to step 15.

NOTE If you are not sure if your disk is nonstandard, check the default parameters using option 1 of the **dkinit** menu. Calculate the size of your disk in bytes using the following calculation:

$$\text{size} = \text{cylinders} \times \text{heads} \times \text{sectors/track} \times 512$$

In addition, some drives are sold by formatted size, others by unformatted size. The formatted size of a drive is approximately 85% of its unformatted size. Note that the parameters displayed by **dkinit** may not match the drive manufacturer's documentation. Some controllers have optional "translation," "mapping," or "63-sector" modes. If one of those modes was chosen during low-level formatting, your SCO system must be initialized with the translated parameters and not those of the physical drive. In all cases, the known size of the drive should approximately match the size calculated above from the disk parameters.

If your disk is nonstandard, you must enter information that overrides the ROM disk configuration information, replacing it with the new information. If you are unsure of what parameters to enter for your nonstandard disk, contact your disk manufacturer for this information.

If you enter 1 or 2, you see the following display:

Disk Parameters	Values
1. Cylinders	value
2. Heads	value
3. Write Reduce	value
4. Write Precomp	value
5. Ecc	value
6. Control	value
7. Landing Zone	value
8. Sectors track	value

In the actual display, *value* is replaced with the default value for that variable.

NOTE The "Cylinders" value refers to the number of cylinders on the entire hard disk and should not be confused with the number of cylinders you allocated (or intend to allocate) to a given partition.

If you entered a 1, you now see the first menu again. If you entered a 2, you are now prompted:

Enter a parameter to modify or q to return to the main menu:

13. Enter any number from 1 to 8 to change the disk parameters, or **q** to return to the previous menu. You see the following:

```
Enter the new value or Enter to use the existing value:
```

If you wish to change the value, enter a new value now or press (Enter) to use the existing value.

14. After you finish changing the disk parameters, enter **q** to return to the main menu. Next, enter **q** again to save the changes you made. Exiting from **dkinit** by entering **q** overwrites any parameters you changed with the new values. If you wish to restore the default parameters after making modifications, enter **3** from the first menu.
15. The installation program next runs the **fdisk(ADM)** utility to partition the hard disk. You can also partition your disk to support DOS on the same hard disk (if you have DOS already installed), or you can use the whole disk for your SCO system.

After a moment, the **fdisk** menu appears on the screen. You see this option list:

- ```
1. Display Partition Table
2. Use Entire Disk for UNIX
3. Use Rest of Disk for UNIX
4. Create UNIX Partition
5. Activate Partition
6. Delete Partition
```

```
Enter your choice or q to quit:
```

Select option **1** and press (Enter).

If you have never installed an operating system on your disk, you see a table similar to this:

```
Current Hard Disk Drive: dev rhd10
```

| Partition | Status | Type | Start | End | Size |
|-----------|--------|------|-------|-----|------|
|           |        |      |       |     |      |
|           |        |      |       |     |      |

```
Total disk size: 1220 tracks (5 reserved for masterboot and diagnostics)
Press Enter to continue
```

If you have previously installed an operating system on your disk, the **fdisk** table is filled in. DOS is usually displayed as partition number 4.



16. Press **(Enter)** to return to the main **fdisk** menu. If you would like the UNIX partition to occupy the whole disk, select option 2. After you have made your selection, quit out of the **fdisk** menu by entering **q**. If any other operating systems were previously installed on your system, you also see the following warning message:

```
Warning! All data on your disk will be lost!
Do you wish to continue? (y n)
```

Enter **y** and press **(Enter)** only if you want your SCO system to occupy the whole disk. This ensures that **fdisk** partitions the whole disk.

**NOTE** If you choose option 3, which allocates the remainder of the hard disk for your SCO system, you must next activate the UNIX partition by selecting option 5. If you do not activate the UNIX partition, your first partition is activated.

Most computers have diagnostic programs that write to the last cylinder of the hard disk. This means that the last cylinder should not be allocated to a partition. The last cylinder is not allocated when you choose option 2 from the **fdisk** menu. If you choose option 4, you should not allocate the last cylinder of the hard disk to the UNIX partition.

If you have an ST506/ESDI controller, continue with step 17.

If you have an IDA controller or SCSI host adapter, skip to step 25.

**NOTE** Bad tracks are handled automatically by IDA controllers and certain SCSI host adapters; steps 17-24 are omitted. In the case of SCSI host adapters, you should run the **scsibadblk(ADM)** utility after completing this procedure.

17. Now you see a menu from the program **badtrk**(ADM). With the **badtrk** program, you can scan your hard disk for defective tracks. The program maps any flawed locations to good tracks elsewhere on the disk. It also creates a bad track table, which is a list of all the bad tracks on your hard disk.

The main **badtrk** menu looks like this:

- ```
1. Print Current Bad Track Table
2. Scan Disk (You may choose Read-Only or Destructive later)
3. Add Entries to Current Bad Track Table by Cylinder: Head Number
4. Add Entries to Current Bad Track Table by Sector Number
5. Delete Entries Individually from Current Bad Track Table
6. Delete All Entries from Bad Track Table
```

```
Enter your choice or q to quit:
```

Enter **2**, then press **(Enter)**.

18. You see the following submenu:

- ```
1. Scan entire UNIX partition
2. Scan a specified range of tracks
3. Scan a specified filesystem
```

```
Enter your choice or q to quit:
```

Select option **1**.

19. After you select the area you want scanned, you are given the following choices:

- ```
1. Quick scan (approximately 7 megabytes min)
2. Thorough scan (approximately 1 megabyte min)
```

```
Enter your choice or q to quit:
```

Select option **2**.

20. You are prompted:

```
Do you want this to be a destructive scan? (y n)
```

Enter **y**. You are warned:

```
This will destroy the present contents of the region you are scanning.
Do you wish to continue? (y n)
```

Enter **y** and press **(Enter)**.

You see the following message:

```
Scanning in progress, press 'q' to interrupt at any time.
```

21. After you respond to the above prompts, the program scans the active partition of the new disk for flaws. The larger your disk, the longer the scanning process takes, so a very large disk may take a while.

As **badtrk** scans the disk, it displays the number of each track it examines, and the percentage of the disk already scanned. Pressing the **q** key at any time interrupts the scan. If you press **q** to interrupt the scan, you do not need to press **<Enter>**. You are then prompted to continue scanning or to return to the main menu.

Whenever **badtrk** finds a defective track, it lists the location of that track using both the sector number and cylinder or head conventions. Defective track information is entered into the table and displayed on the screen. Here is an example of a bad track:

```
WARNING : wd: on fixed disk cttl=0 dev=0 47 block=31434 cmd=00000020
          status=00005180, sector = 62899, cylinder head = 483 4
```

22. When the scan is complete, the menu reappears. Select option 1 to see the results of the scan. Your bad track table looks something like this:

```
Defective Tracks
```

```
+-----+
| Cylinder  Head   Sector Number(s) |
+-----+
| 11.      190     3       12971-12987 |
+-----+
```

```
Press Enter to continue
```

Press **<Enter>** to return to the main menu.

NOTE If there is a flaw in the first few tracks of the UNIX partition, you are returned to the **fdisk** utility (see step 15). Repartition the disk with **fdisk** so that the UNIX partition no longer includes the defective tracks. You have to experiment to determine how many tracks to exclude. Leave these defective tracks unassigned to any operating system. When you leave **fdisk**, **badtrk** is run again and you should scan the disk for further flaws.

This process continues until **badtrk** finds no flaws in the first few tracks.

23. To exit **badtrk**, enter **q** and press **<Enter>**.

24. You are next prompted for the number of tracks to allocate as replacements for those tracks that are flawed. You should allocate at least as many as the recommended number. Enter the number or just press **(Enter)** to use the recommended number that is displayed:

Enter the number of bad tracks to allocate space for
(or press Enter to use the recommended value of n):

If you press **(Enter)** and do not enter an alternate value, **badtrk** allocates the recommended number of tracks as replacements. This number is based on the number of bad tracks currently in the table, plus an allowance for tracks that may go bad in the future. If you ever exceed the number of allocated bad tracks, you must reinstall the system.

25. Next, you see a prompt from **divvy(ADM)**. The **divvy** program divides a partition into filesystems. You can create up to seven divisions on a single partition, and name them anything you like.

NOTE The maximum filesystem size is 2 gigabytes. When **divvy** is run on a logical drive that is greater than 2 gigabytes, it automatically calculates the minimum number of **divvy** partitions that can exist on this logical drive. For example, on an IDA controller that has a logical drive configured as 2.6 gigabytes, there is a minimum of two 1.3 gigabyte filesystems. You can modify the **divvy** partition so that one filesystem is 2 gigabytes and one is 600 megabytes. Remember that a block is 1024 bytes. To convert blocks to megabytes, simply divide by 1024.

26. You see the main **divvy** menu and a display that shows how your disk is divided similar to the one here:

```

+-----+-----+-----+-----+-----+-----+
| Name   | Type       | New FS | # | First Block | Last Block |
+-----+-----+-----+-----+-----+-----+
|       | NOT USED  | no     | 0 |           0 |        39011|
|       | NOT USED  | no     | 1 |        39012 |        41511|
|       | NOT USED  | no     | 2 |           - |           - |
|       | NOT USED  | no     | 3 |           - |           - |
|       | NOT USED  | no     | 4 |           - |           - |
|       | NOT USED  | no     | 5 |           - |           - |
|       | NOT USED  | no     | 6 |        41512 |        41521|
| hd1a   | WHOLE DISK| no     | 7 |           0 |        41980|
+-----+-----+-----+-----+-----+-----+

41522 blocks for divisions, 459 blocks reserved for the system

n[ame]      Name or rename a division.
c[reate]    Create a new file system on this division.
t[ype]      Select or change filesystem type on new filesystems.
p[revent]   Prevent a new file system from being created on this division.
s[start]    Start a division on a different block.
e[nd]       End a division on a different block.
r[estore]   Restore the original division table.

Enter your choice or q to quit:

```

Each row in the **divvy** table corresponds to a filesystem (also known as a division).

You can divide the partition into as many filesystems as you like. Each filesystem must have the following:

- if the division does not already exist (NOT USED appears in the Type column) it must first be created using the **c** (create) command
- a beginning block number, defined by the **s** (start) command
- an ending block number, defined by the **e** (end) command
- a filesystem name, defined by the **n** (name) command. Filesystems can have any name you choose. For example, you could name a filesystem *u* (for “user”). This name in turn creates the device name (for example, */dev/u*).

WARNING Filesystem boundaries must not overlap. For example, filesystem 0 cannot end on the block number where filesystem 1 begins.

Do not change the configuration of filesystem 7; it is reserved for internal use by the operating system.

Do not name a filesystem *usr*; this directory already exists on the *root* filesystem.

The default filesystem type is EAFS. If you wish to create filesystems of other types, you must use the **type** command.

Exit from **divvy** by entering **q**. The program prompts whether to install the new partition table, or return to the main menu. Select option **i** to install the partition table.

For more information, see the **divvy**(ADM) manual page.

27. The system now creates the filesystems on your hard disk. This takes several minutes. You see the following message:

```
Making filesystems
```

28. After creating the new filesystem(s), **mkdev hd** terminates.
29. If you installed a SCSI disk, you should now run the **scsibadblk**(ADM) utility to map any bad blocks. If your adapter supports Automatic Write Remapping (AWRE), you can use **scsibadblk** to enable this feature.

Relinking the kernel

If you responded “no” when prompted to relink the kernel after installing a SCSI disk, you must run **link_unix** to rebuild the kernel manually with the new configuration information. Enter the following commands:

```
cd /etc/conf/cf.d
./link_unix
```

Δ **sysadmsh** users select: System ⇄ Configure ⇄ **Kernel** ⇄ Rebuild

Disks larger than 1024 cylinders

Disks with more than 1024 cylinders are supported with the following restrictions:

- The disk controller must support disks with more than 1024 cylinders.
- If the disk is configured as the primary hard disk, the root filesystem for all bootable partitions must lie within the first 1024 cylinders. This is because the ROM BIOS cannot access boot or operating system information if it lies beyond the 1024th cylinder. If the root filesystem falls outside the first 1024 cylinders, an error message will be displayed by **boot**(HW) as follows:

```
Error: request outside range of BIOS (1024 cylinders)
```

You can use the rest of the disk for swap space and/or additional filesystems. If you install only a UNIX partition, you should make certain that the root filesystem falls within the first 1024 cylinders.

divvy(ADM) will display a warning message if you try to install across more than 1024 cylinders. For example, with the DPT PM3011 controller, your SCO system works with disks containing up to 2048 cylinders, 16 heads, and 63 sectors, for a total maximum disk capacity of 1 gigabyte.

Hard disk interleave

An interleave of 1:1 is preferred for disk controllers that support it. Most modern disk controllers support a 1:1 interleave, but older, single-buffered MFM controllers do not. A controller's fastest or best interleave is one of its most widely published specifications; check your documentation. (Typically, 3:1 is suggested for MS-DOS.) However, if you are unsure and unwilling to experiment, we suggest that you format your drive using a 3:1 interleave. Although, with an appropriate controller, a 1:1 disk interleave can substantially improve I/O performance, an inappropriate disk/controller combination formatted 1:1 can reduce performance by a factor of 4 or worse. (Operations that would take 15 seconds on a drive with proper interleave could take as long as a minute.)

To determine if you have an interleave problem, first perform a minimal installation, then enter:

```
dd if=/dev/root of=/dev/null bs=1k count=4096
```

If this command takes longer than 45 seconds to complete, you may have a disk interleave problem; you may want to reformat and reinstall before proceeding further. (It is also possible that your particular disk/controller combination is intrinsically slow, even when formatted at the proper interleave.)

Most new disk/controller pairs arrive already formatted at the proper interleave (3:1 for MS-DOS). If reformatting is necessary, you must perform it using the setup disk that came with your system, or a DOS formatting program.

Note that some disk/controller pairs, notably SCSI and IDE, have their own cylinder/head/sector translation logic, and will probably ignore any reformat command sent to them. Consult your disk and controller documentation before you reformat your disk to see how your disk responds to reformatting.

Standard architecture specific notes

In the case of ST506/ESDI drives, the drive must be supported by the ROM BIOS, or you must enter the drive parameters manually at installation time. Check your computer hardware reference manual for the appropriate ROM table entries for your computer. For disks using the Adaptec AHA-154x controller, the drive must be jumpered for the correct SCSI ID: 0 for the first disk (ID-0:LUN-0) and 1 for the second disk (ID-1:LUN-0).

Chapter 4

Adding tape drives and controllers

It is possible to have one QIC-02 cartridge tape drive plus a mini-cartridge, a QIC-40 drive or a QIC-80 drive configured on a system. This limit does not apply to SCSI tape devices. Up to four SCSI tape drives are supported on a SCSI bus. QIC-24 format is supported on full size cartridges. Tape support is raw (character only), no block device. A no-rewind device exists for writing multiple tape archives on a single QIC-02 or SCSI tape. A tape utility, **tape(C)**, is provided for rewinding, erasing, formatting, retensioning, and so on. Digital audio tape (DAT) and 8mm (video) tape drives are also supported as SCSI devices. Fast file search and tape partitioning are only supported on some specific drives (for example, Hewlett Packard DAT).

If you are installing a non-Adaptec adapter on your Micro Channel machine, refer to the SCO list of compatible hardware. If you are installing a second SCSI host adapter, refer to "Adding a secondary SCSI host adapter" (page 31). In addition, you can refer to Chapter 2, "Disk controllers and host adapters," for information on hardware configuration.

To configure your system for a tape unit, run **mkdev tape**.

If you do not choose specific values for the DMA channel, interrupt, and base address, the default values are used. (For more information, see the SCO list of compatible hardware.) Note that most addresses are specified in hexadecimal. Watch for possible interrupt conflicts with other installed devices.

"Typical device interrupts" (page 3) indicates which interrupts may already be in use on your system. (Do not use interrupts 0, 1, or 6; these are already in use.) Use vector 6 only with the IBM 6157; it is the only drive that shares this vector with the floppy driver.

The **mkdev tape** menu indicates the Irwin units as "Mini-Cartridge" and all other units are indicated as "Cartridge," "QIC-40," "QIC-80," and "SCSI" units. The Irwin units are not configurable.

For more information on using tape drives, see the *System Administrator's Guide* ("Operating System Services" for SCO Open Desktop / SCO Open Server).

Installing a tape drive

Read your tape drive hardware manual for physical installation instructions and general information.

To add a tape drive, log in as *root* and enter the following:

```
mkdev tape
```

Δ *sysadmsh* users select: System ⇄ Hardware ⇄ Tape

The following menu is displayed:

```
Tape Drive Configuration Program

  1. Install a Tape Drive
  2. Remove a Tape Drive
  3. Change default Tape Drive

Select an option or enter q to quit:
```

Enter **1** to add the drive. You are then asked to select the type of tape drive you have installed:

```
Tape Drive Installation Menu

  1. Install Cartridge Tape Drive
  2. Install Mini-Cartridge Tape Drive
  3. Install QIC-40 or QIC-80 Tape Drive
  4. Install SCSI Tape Drive

Select an option or enter q to return to the main menu:
```

The subsections that follow describe the configuration requirements for each drive type. Be sure and consult "Kernel relinking" (page 67) after following the instructions for your drive type.

NOTE AT-type hardware uses jumpers or switches to configure such characteristics as interrupt vector or DMA channel. EISA and Micro Channel hardware settings are configured with a Reference (setup) diskette provided with your machine. When you see instructions to set jumpers or switches, Micro Channel and EISA installers should use this information in conjunction with their reference or setup diskette.

Cartridge tape

The Cartridge Tape Driver selection refers to the QIC-02-type full-size cartridge tape drives. Follow these steps:

1. When you select the Cartridge Tape, another menu is displayed that controls the tape parameters:

```

QIC Cartridge Tape Configuration

    1. Display current tape parameters
    2. Modify current tape parameters
    3. Select previous tape parameters
    4. Select default tape parameters

Enter your choice or q to quit:
  
```

The system has default values for each supported drive. You need not modify the defaults unless you have configured your tape controller card differently. Enter **q** and press **(Enter)** if you are using the default values and skip to step 3.

2. If you have a non-default configuration, you must enter 2 to modify the default parameters. You see a display similar to the following:

```

Tape Parameters      Values      Comments
-----
1. Controller Type   0           1 = archive  3 = wangtek  4 = emerald
                   5 = mountain 6 = tecmar   7 = everex
2. DMA Channel       0           1 or 3
3. Interrupt Vector  0           logical vector number
4. Base Address      0x0        i o addresses start here

Enter a parameter to modify or 'q' to return to the main menu.
  
```

Select each parameter you wish to change and supply a value for each of the four categories listed above. Explanations of each category follow:

Controller type This is the kind of tape drive/controller you have installed. The values and manufacturer are shown in the previous display.

NOTE Everex and Tandberg tape controllers use the same hardware settings; use "7" for a Tandberg controller.

DMA channel This is the Direct Memory Access (DMA) Channel that is being used. The choices are DMA Channel 1 or DMA Channel 3. On a typical ISA tape controller card, you have a set of jumper pins for DACK and another set for DRQ. Each of these should have three pairs of pins labeled 1, 2, and 3. The DACK and DRQ pins should each be jumpered for the appropriate value (1 or 3) as they combine to give you your DMA value. In other words, if you want a DMA value of 3, you should jumper DACK for 3 and DRQ for 3. Either DMA 1 or 3 are acceptable and neither provides any particular advantage over the other.

Interrupt vector This is the interrupt value being used. On ISA tape controller cards, there is an IRQ set of jumper pins, typically labeled 2-7. You can use any interrupt you choose, as long as it is not being used by another device on your system.

For example, if you have a COM1 serial port on your system and it is recognized on the boot screen, then interrupt 4 is not an available interrupt, unless you disable your COM1 port. On ISA machines, if a device is recognized by your SCO system on the boot screen, the interrupt it uses is taken even if you are not actively using the device. In this case, you must either use another free interrupt, or physically disable the device using the interrupt you want to use for the tape controller.

The most commonly available interrupts are 2 and 5, as most systems do not come standard with an LP2 port or a network card.

When you determine the interrupt you will be using, jumper the appropriate IRQ pins on your tape controller card and then indicate the same value.

Base address This is the I/O address that your tape controller card is configured for. An ISA tape controller card will have either jumper pins or switches for configuring the address. Check your tape hardware documentation to determine what the available address settings are. The system does not really care what address you are using, as long as it is not being used by another device on your system. This is not usually an issue, as common tape controller addresses are not often used by other devices.

Be sure and enter the address with a preceding 0x. For example, if your address is 300 (hexadecimal), you should enter 0x300.

3. When you have finished setting your parameters, you are returned to the tape parameter menu. You must then enter **q** and press **<Enter>**.
4. The system configuration is updated and the new device files are created and displayed on the screen. Table 4-2 lists the device files for each drive type and their purpose. You are also prompted whether you wish to change the bootstring. Refer to “Boot messages and /etc/default/boot” (page 69) for more information.
5. You are then returned to the tape configuration menu. You are then asked to relink the kernel; for more information, refer to “Kernel relinking” (page 67).

Mini-cartridge (Irwin)

Mini-tape drives use the floppy disk drive controller or are connected to the Irwin 4100 controller. Mini-tape drives are significantly different from standard QIC tape drives. These units are also known as “Irwin” tape units. They are not configurable and do not require parameters to be entered. In addition, use of the **tape format** command is not supported for Irwin units; preformatted tapes are required.

Make certain your drive and controller are correctly jumpered; this can vary with different brands of machines. Refer to your hardware documentation for more information.

The prompts for a mini-cartridge (Irwin) drive are as follows:

1. First you see:

```
If you have changed the unit number for the Mini-Cartridge Tape Drive
enter the new number [1-n] or press <Return> to use the default
value of 1 or enter q or return to the main menu:
```

Unless you are configuring the drive at a different unit number, enter 1 and press (Enter).

2. The system configuration is updated and the new device files are created and displayed on the screen. Table 4-2 lists the device files for each drive type and their purpose. You are also prompted for whether you wish to change the bootstring. Refer to “Boot messages and /etc/default/boot” (page 69) for more information.
3. You are then returned to the tape configuration menu. You are then asked to relink the kernel; for more information refer to “Kernel relinking” (page 67).
4. The Irwin driver also includes a configuration file `/etc/default/mcconfig` that can contain options for debugging, hardware-specific options, and other useful features. The `mcconfig` file does not exist by default, it must be created and entries added. Table 4-1 contains some commonly used `mcconfig` entries.

Table 4-1 `/etc/default/mcconfig` entries

String	Meaning
<code>iropt=F</code>	Floating drive search (Adaptec controller)
<code>iropt=I</code>	Wait-for-index before transfer of each block (MCA)
<code>4100=P:370,I:6,D:2,T:2,T:0</code>	Specifies 4100 PC Bus Controller parameters

Refer to the `mcconfig(F)` manual page for more information on these and other options.

In addition, the Irwin driver includes a daemon process `/etc/mcdaemon` that is automatically started at boot time. An Irwin drive will not function in single-user mode unless the daemon is started. To start the daemon while in single-user mode, enter the following command:

```
/etc/mcdaemon
```

QIC-40/80

These units are specialized mini-cartridge units that use a different format from the Irwin units described earlier; they follow the QIC-40/80 specifications. Refer to your tape drive documentation for instructions on how to jumper your drive properly. The prompts are as follows:

1. You are first asked to select the drive type, QIC-40 or QIC-80:

```

1. Install a QIC-40 Tape Drive
2. Install a QIC-80 Tape Drive

Select an option or enter q to return to the main menu:

```

Select the appropriate option. If you are unsure of your choice, refer to the manual for your tape drive.

2. You are asked if you wish to enable extended tape length mode:

```

1. Do not enable Extended Length Mode
2. Enable Extended Length Mode

Select an option or enter q to return to the main menu:

```

Select the appropriate option; you should not enable extended length mode if your drive does not support it. Refer to the **tape(HW)** manual page for information on extended length mode.

3. You see:

```

Enter one of the following:

  1-4      the drive select unit number for the
           QIC-40 or QIC-80 Tape Driver

  s        a Soft Select mode drive with no select
           jumpers installed. Archive and Mountain
           drives can be configured for this mode.

  c        Colorado Memory Systems tape drive

  p        Wangtek drive configured for Phantom select mode
           (with only Phantom Select jumpers installed)

  Return   the default value of n

Select an option or enter q to return to the main menu:

```

If your drive is jumpered at the default value shown, simply press (Enter). Otherwise, enter the appropriate option and press (Enter).

Refer to your hardware manual to determine your drive's current drive select option setting, or if your drive is in Soft Select mode. There are other configuration options available that control memory and buffer usage; see **tape(HW)** for details.

4. The system configuration is updated and the new device files are created and displayed on the screen. Table 4-3 lists the device files for each drive type and their purpose. You are also prompted for whether you wish to change the bootstring. Refer to "Boot messages and /etc/default/boot" (page 69) for more information.
5. You are then returned to the tape configuration menu. You are then asked to relink the kernel; For more information, refer to "Kernel relinking" (page 67).

SCSI

SCSI tape drives are attached to a SCSI adapter. You are asked to provide the device ID number (0-7), the number of the adapter the drive is attached to, and the logical unit number of the device (LUN). See Figure 4-1.

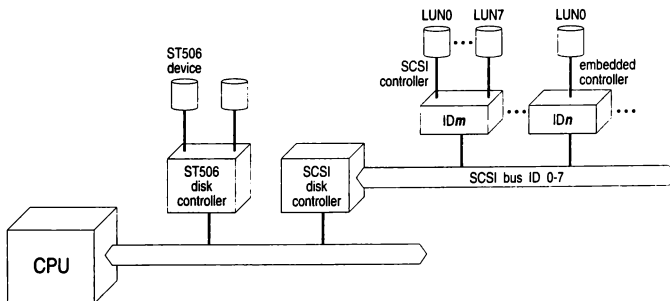


Figure 4-1 SCSI configuration schematic

As shown, a SCSI host adapter (HA) translates signals from the CPU bus to the SCSI bus. A SCSI controller is known as a "SCSI ID." A SCSI device is referenced by a logical unit number (LUN).

To configure a SCSI tape device, you must know:

- ID number of the controller (0-7) on the device (host adapter); the host adapter itself is usually ID 7, giving it the highest priority on the SCSI bus
- host adapter number (0 or 1)
- host adapter type; this code refers to the type of host adapter. Several types are supported. For example: **ad** refers to an Adaptec AHA-154x host adapter (**ad** is also the default type).

NOTE Because the tape drive and its controller are one unit (referred to as “embedded”) the LUN or logical unit number is simply 0.

The **mkdev tape** prompts for SCSI configuration are as follows:

1. You see this menu:

```
SCSI Tape Drive Configuration Menu

  1. Install SCSI Cartridge Tape Drive
  2. Install SCSI Exabyte Tape Drive
  3. Install SCSI 9-track Tape Drive
  4. Install SCSI DAT Tape Drive
  5. Install Compaq SCSI Tape Drive

Select an option or enter q to return to the main menu
```

Enter the number associated with your tape drive and press (Enter). If you are configuring a Compaq SCSI tape drive, proceed to “Compaq SCSI” (page 66).

2. You see the following message:

```
The type Tape Drive must be configured before use.
Do you wish to configure the type Tape Drive now? (y n)
```

Enter **y** and press (Enter).

3. Now you must identify the type of adapter that the drive is attached to:

```
Enter the prefix of the SCSI host adapter that supports this device
or press <Return> for the default: type
Enter h for a list of host adapters or enter q to quit:
```

Enter **h** to display a list of host adapters, and select one of them.

- Now you are prompted for the number of the adapter:

```
Which 'hatype' SCSI host adapter supports this device?  
Select 0-7 or enter q to quit:
```

Enter 0 if it is the first host adapter, 1 for the second host adapter, and so forth.

- If you are adding a device to a previously configured host adapter, or to a host adapter that is the only one of its kind installed in your system, skip to step 8. If you are configuring a second host adapter of a type already installed, you see the following:

```
hatype SCSI host adapter ha is not configured.  
Would you like to update the link-kit?
```

The kernel already recognizes one of each type of host adapter; an additional entry must be created for the new one. Respond **y** and press **<Enter>**.

- You may be prompted for one or more of the following, depending on your host adapter type (the system attempts to autoconfigure any values it can obtain from default files and other adapters installed of the same type):

```
What is the interrupt vector for this adapter?  
  
What is the start IO address (hex) for this adapter?  
  
What is the end IO address (hex) for this adapter?  
  
What is the start controller memory address (hex) for this adapter?  
  
What is the end controller memory address (hex) for this adapter?
```

(You should check for conflicts before entering values; other hardware devices may already be using the same interrupt vector, I/O address, and so forth.) Enter each value as prompted and press **<Enter>**.

- You are asked to confirm the values you supplied. Then the following prompt is displayed:

```
The following parameters will be used to configure hatype SCSI host adapter n  
  
list of parameters  
  
Update the link-kit?
```

If you need to make corrections, enter **n** and press **<Enter>**, and then press **** to exit **mkdev tape** and start again. If the values are correct, enter **y** and press **<Enter>** to add these values to the link kit.

8. Next, you see:

```
What is the Target ID for this device?
Select 0-7, or h for help, or q to quit:
```

Enter the Target ID number of the controller on the tape drive.

9. You are then prompted:

```
What is the LUN of this device? Press <Return> to use the default: 0
Select 0-7, or h for help, or q to quit:
```

Enter the Logical Unit Number of the device attached to the controller. With the tape devices that SCO supports, the controller and the device are a single unit, in which case the Logical Unit Number is 0.

10. The information you supplied earlier for the device configuration is then displayed as in the following example. You are asked to confirm that you wish to update the configuration:

```
You are about to add the following SCSI device:
```

```
Host
Adapter          Adapter
Type   Device   Number ID   LUN
-----
ad     Stp     0     2     0
```

```
Update SCSI configuration (y n)?
```

If the information is correct, enter **y** and press (Enter).

11. The system configuration is updated and the new device files are created and displayed on the screen. Table 4-3 lists the device files for each drive type and their purpose. You are also prompted for whether you wish to change the bootstring. Refer to "Boot messages and /etc/default/boot" (page 69) for more information.
12. You are then returned to the tape configuration menu. You are then asked to relink the kernel; for more information refer to "Kernel relinking" (page 67).

Compaq SCSI

The prompts for Compaq SCSI tape installation are as follows:

1. First you see:

```
Enter the SCSI ID of the tape being added or press <Return> for default (0):
```

Enter the Target ID number of the tape drive or acknowledge the default by pressing <Enter>.

2. The following menu is displayed:

```
Compaq SCSI Host Adapter Configuration
```

1. Display current parameters
2. Modify current parameters
3. Select default parameters

```
Enter an option or 'q' to quit:
```

Select 2 or 3 and press <Enter>.

3. You see the following:

Index	Parameters	Current Value	Valid Values
1	Base Address	130	130, 330 or *120 (Hex)
2	DMA Channel	7	7 or 5
3	Interrupt Vector	0	5, 3, *10, or *11

*Not supported SCSI Tape Adapter (001379)

If you chose option 3, proceed to step 6. If you chose option 2, you also see the prompt:

```
Enter index of the parameter to modify or 'q' to return to the main menu:
```

Enter 1, 2, or 3 to alter the base address, DMA channel, and interrupt vector, as desired. The display is repeated each time a parameter is altered. Enter **q** when the values are correct.

4. When the "Compaq Host Adapter Configuration" menu is displayed, enter **q** and press <Enter> to continue.

5. The system configuration is updated and the new device files are created and displayed on the screen. Table 4-3 lists the device files for each drive type and their purpose. You are also prompted for whether you wish to change the bootstring. Refer to “Boot messages and /etc/default/boot” (page 69) for more information.
6. You are then returned to the tape configuration menu. You are then asked to relink the kernel. For more information refer to “Kernel relinking” (this page).

Kernel relinking

If it is necessary to relink the kernel, you see several prompts after exiting the tape drive installation menu. You are given the option of not relinking in case you are adding a number of devices. This way the kernel needs to be relinked only once.

1. First you see:

```
You must create a new kernel to effect the driver change you specified.
Do you wish to create a new kernel now? (y n)
```

Answer **y** to add the driver to your kernel.

2. Next, you see:

```
The UNIX operating system will now be rebuilt.
This will take a few minutes. Please wait.

Root for this system build is
```

As part of the linking process, you see the following messages:

```
The UNIX kernel has been rebuilt.

Do you want this kernel to boot by default? (y n)
```

Answer **y** if you want this kernel to be used every time you boot.

3. The following is displayed:

```
Backing up unix to unix.old.
Installing new unix.

The kernel environment includes device node files and /etc/inittab.
The new kernel may require changes to /etc/inittab or device nodes.

Do you want the kernel environment rebuilt? (y n)
```

Enter y.

4. The following is displayed:

```
The new kernel has been successfully linked and installed.
To activate it, reboot your system.

Setting up new kernel environment.
```

The tape drive unit is available for use after rebooting.

Device files

After the drive is configured, a series of device files are created to access the tape drive. Some are linked to the basic tape device file, */dev/rct0*. Others include the “no-rewind” device, which does not rewind the tape after access, and the “no-unload” device, which does not eject the tape after use.

Table 4-2 lists the prefixes used in tape device names.

Table 4-2 Tape device prefix

Prefix	Meaning	Example
e	ECC device (QIC-02 only)	/dev/erct0
rh	high density (9-track only)	/dev/rhStp0
nr	no rewind, no unload	/dev/nrStp0
nur	rewind, no unload	/dev/nurStp0
ur	rewind, unload	/dev/urStp0
r	rewind on close	/dev/rStp0, /dev/rct0
x	override/control	/dev/xStp0, /dev/xct0, /dev/xft0, /dev/xctmini
n	no rewind	/dev/nrct0, /dev/nrStp0

Table 4-3† lists the main devices created for tape drives and the default device to which they are linked.

† Some drives have additional device files that depend on brand and model. For example, certain DAT drives support tape partitioning; see **dat(HW)** and **tape(HW)**.

Table 4-3 Tape device files

Tape device	Device file	Default device
QIC-02	/dev/rct0	/dev/rct0
Mini (irwin)	/dev/rmc0	/dev/rctmini
QIC-40/80	/dev/rft0	/dev/rctmini
SCSI cartridge	/dev/rStp0	/dev/rct0
DAT/Exabyte	/dev/urStp0*	/dev/rct0
9-track	/dev/nurStp0	/dev/rct0
Compaq	/dev/rmt/cst2*	/dev/rct0

In addition, some devices are linked to equivalent standard UNIX devices in the `/dev/rmt/*` hierarchy.

Boot messages and `letc/default/boot`

When the kernel recognizes a tape drive (and when the driver is linked into the kernel) a message is always displayed at boot time indicating that the device is present. This information can also be displayed using `hwconfig(C)`. Table 4-4 contains the messages displayed, indicating the drive type.

Table 4-4 Tape drive boot messages

Type	Boot display message				
QIC-02†	%tape	0x0338-0x033C	05	1	type=wangtek
mini	%mc	-	-	-	type=mc
QIC-40	%ctmini	-	-	-	type=QIC40
QIC-80	%ctmini	-	-	-	type=QIC80
SCSI**	%tape	-	-	-	type=S ha=0 id=2 lun=0

Tape load and unload commands

The **load** and **unload** options of the `tape(C)` command are used on certain drives to load and unload the tape. Drives that support **load** and **unload** include:

- 9-track drives
- DAT drives
- Wangtek SCSI cartridges
- Exabyte 8-mm
- Archive Anaconda (Model 2750) SCSI cartridges

Most DAT, Exabyte, and SCSI cartridge tape drives perform an automatic **load** when the tape is inserted.

† The specifics of these configurations are examples.

On tape drives that do not support automatic loading and unloading of media, **tape load** and **tape unload** may need to be issued before executing tape commands or reading and writing to the tape.

Preventing SCSI DAT or Exabyte drives from ejecting cartridge

SCSI tape drives that support the **tape load** and **tape unload** commands (principally DAT and Exabyte drives) are easier to use if a “no-eject” (no unload on close) device is used:

- Use of the no-eject device prevents the tape from being automatically unloaded (ejected) after each access.
- Certain SCSI cartridge tape drives (such as the Wangtek) require a **load** command after an **unload**, but the actual **unload** is not obvious because the tape is not physically ejected as it is with DAT drives. (The **unload** is done when the tape drive is closed after a read or write sequence.) This is also true of CD-ROM devices.

You can add a no-eject device yourself with the following procedure:

1. Log in as *root*.
2. Determine the major number of the tape device by doing a long listing on */dev/rct0*:

```
l /dev/rct0
```

You see a display similar to the following:

```
crw-rw-rw  2  root  root 46,  0 Dec 7 9:40 /dev/rct0
```

In this example, *46* is the “major device number” and *0* is the “minor device number.” The major number for your device might be different, as it is dynamically allocated when the tape drive is first installed. To create a “no eject” device for your SCSI tape drive, you need to use the major number of your normal tape device and add 4 to the minor device number.

3. Use the **mknod(C)** command to create the new device. For example, using the numbers displayed in the previous step, the major device number is *46* and the minor number is *0+4*:

```
mknod /dev/noeject0 c 46 4
```

Be sure and use the numbers that match your actual configuration.

4. You can now create backups using the no-eject device. You can also make the no-eject device the default device. Do this by logging in as *root* and executing the commands:

```
mv /dev/rct0 /dev/eject
ln /dev/noeject /dev/rct0
```

Creating backups with Irwin and QIC-40 drives

For most efficient use, we recommend that you perform tape backups in system maintenance mode. If you see a cannot allocate buffer or not enough space error message while using the tape drive, you have run out of memory. If you are using an Irwin mini-cartridge tape drive, reboot your system using `sysadmsh(ADM)`, enter system maintenance (single-user) mode, and run the backup again. If you are using a QIC-40 or QIC-80 drive, see the `tape(HW)` manual page for information on `ft.alloc.switch`, `ft.minbufs`, and `ft.maxbufs`. These values give an indication of how to allocate more memory at system initialization time for QIC-40 and QIC-80 tape drivers.

NOTE When backing up files in system maintenance mode, you must explicitly mount non-*root* filesystems.

Using the dd(C) command with Exabyte tapes

Do not use the `dd` command to put individual data files onto Exabyte tapes; extracting the files may cause extraneous characters to be appended to the original data. You can, however, use the `dd` command with Exabyte tapes to store and extract `tar(C)` or `cpio(C)` images.

SCSI tape drives and ECC

Tape ECC (Error Correction Code) support is unavailable for SCSI tape drives at this time. However, many SCSI tape drives have hardware ECC.

tape format command

The `tape format` command is only supported for use with QIC-40/QIC-80 tape drives. You must bulk-erase tapes before using the `tape format` command to re-format them. This means that if a tape has been format-written before, you must erase it with a bulk eraser before you can format-write it again. (See `tape(C)` for more information.) If the `tape format` command fails, the drive light flashes rapidly. The user must reset the drive by removing the tape cartridge. The driver does not detect this condition and no error message is generated. All tape operations fail until the tape is removed and reinserted.

Configuring the tape drive at boot time

If you have a tape distribution, your tape drive is configured at install time by creating a special bootstring used at the Boot prompt. This bootstring is invoked automatically each time the system is started. For more information, see "Configuring devices at installation or boot time" (page 3).

Tape drives and controllers on ISA

This section cover the notes that apply to tape drive/controller combinations.

Archive notes

Archive drives using the SC402 controller do not use the default type A interrupt 4. Use the **mkdev tape** command to change the interrupt or restrap the controller card.

High-density 150 Mbyte drive notes

High density 150 Mbyte drives require DC6150 or DC600XTD tapes for writing.

Irwin notes

When installing the Irwin Accutrack 250 pc/mc or Accutrack 120 pc/mc drives using **mkdev tape**, select the option, "mini-cartridge."

Olivetti notes

The Olivetti tape controller's factory jumper settings do not match the type W drive default values. To use the Olivetti drive without changing the controller card's jumper settings, use the **mkdev tape** command to select all four of the following settings:

Type	DMA	Interrupt	Base address (hex)
W	1	9	0x288

QIC format tape notes

All SCO supported QIC-02 and SCSI cartridge tape drives will read the 60 Mbyte format tape install product. Tapes written on higher capacity drives (for example, 150 Mbyte) cannot be read on lower capacity tape drives (for example, 60 Mbyte drive).

SCSI tape drive notes

When using a new DAT tapes, it is recommended that a **tape erase** command be issued before the first write to a new tape. This sets up the tape for writing to it on the DAT drive.

The Hewlett-Packard 34580 incorporates DCLZ data compression in hardware.

The following notes apply to DAT drives only:

- You should wait for the drive to finish its initialization sequence before attempting to access the device. This is usually very swift on a non-DAT device but may take 30 seconds or more for a DAT or Exabyte tape drive.
- When using the Wangtek DAT tape drives with the DPT SCSI host adaptor, the OP2 switch located on the DAT drive must be set to the "ON" position in order for the drive to work.

Chapter 5

Installing CD-ROM drives

CD-ROM drives are supported using the ISO9660/High Sierra CD-ROM filesystem. A CD-ROM filesystem can be configured and mounted as a read-only filesystem. The filesystem allows access to files which are described by the primary volume descriptor on the CD-ROM. Access to files described by secondary volume descriptors is not supported. At this time the system provides a level of support similar to that provided by the Microsoft CD-ROM Extensions for MS-DOS.

When installing a SCSI CD-ROM drive, you must use an SCO supported host adapter.

Configuring the drive

CD-ROM drives are added to the system as SCSI devices. You must specify the SCSI host adapter number, the host adapter type, Target ID, and logical unit number (LUN) as described in Figure 5-1 earlier in this guide.

To add your CD-ROM drive to the system, follow these steps:

1. Bring the system down to maintenance mode. You can do this with the **su** option of the **shutdown(ADM)** command:

shutdown su

2. Enter the following command:

mkdev cdrom

3. You see:

```
CD-ROM Configuration Program

1. Install a CD-ROM Drive
2. Remove a CD-ROM Drive
3. Install a CD-ROM TAPE Driver
4. Remove a CD-ROM TAPE Driver

Select an option or enter q to quit:
```

Enter 1 and press <Enter>. The following messages are displayed:

```
Updating system configuration
System files have been successfully updated
```

4. If the CD-ROM driver is not installed, you see:

```
The CD-ROM Driver must be configured before use.
Do you wish to configure the CD-ROM Driver now? (y n)
```

Enter y and press <Enter>.

5. You are prompted for the SCSI configuration data as follows:

```
Enter the prefix of the SCSI host adapter that supports this device
or press <Return> for the default: type
Enter h for a list of host adapters

Which type SCSI host adapter supports this device?
Select 0-n or enter q to quit:
```

Enter the data requested, followed by <Enter>.

6. If you are adding a CD-ROM drive connected to a previously configured host adapter, skip to step 9.

If you are configuring a secondary host adapter of a type already installed, you see the following:

```
hatype SCSI host adapter n is not configured.
Would you like to update the link-kit?
```

The kernel already recognizes one of each type of host adapter; an additional entry must be created for the new one. Respond y and press <Enter>.

7. You may be prompted for one or more of the following, depending on your host adapter type (the system attempts to autoconfigure any values it can obtain from default files and other adapters installed of the same type):

```
What is the interrupt vector for this adapter?
What is the start IO address (hex) for this adapter?
What is the end IO address (hex) for this adapter?
```

Check for conflicts before entering values; other hardware devices may already be using the same interrupt vector, I/O address, and so forth.

Enter each value as prompted and press (Enter).

8. You are asked to confirm the values you supplied. Then the following prompt is displayed:

```
The following parameters will be used to configure hatype SCSI host adapter n
list of parameters
Update the link-kit?
```

If you need to make corrections, enter **n** and press (Enter), then press (Del) to exit **mkdev cdrom** and start over. If the values are correct, enter **y** and press (Enter) to add these values to the link kit.

9. Next, you see:

```
What is the Target ID for this device?
Select 0-7, or h for help, or q to quit:

What is the LUN of this device? Press <Return> to use the default: 0
Select 0-7, or h for help, or q to quit:
```

Enter the information according to the configuration of your CD-ROM drive. Because the CD-ROM drive and its controller are one unit (referred to as "embedded") the LUN or logical unit number is simply 0.

- The information you supplied earlier for the device configuration is then displayed as in the following example. You are asked to confirm that you wish to update the configuration:

```
You are about to add the following SCSI device:

Host
Adapter
Type Device Number ID LUN
-----
ad Srom 0 1 0

Update SCSI configuration (y n)?
```

If the information is correct, enter **y** and press **(Enter)**. The system responds with the message: The SCSI configuration file has been updated.

- If this is the first CD-ROM device you have installed, you see the following:

```
Do you want to configure a CD-ROM TAPE installation device? (y n)
```

This enables support for the SCO CD-ROM distribution. You do not have to configure this option to access the drive.

- If this is the first CD-ROM device you have installed, you see the following additional prompt:

```
Do you want to add configure the high-sierra file system? (y n)
```

This enables support for the High-Sierra filesystem. Enter **y** and press **(Enter)**.

- Now that the data is entered, the program acknowledges prompts for relinking of the kernel:

```
A new kernel must be built, to reflect the changes
to the SCSI configuration. Do you want to do this now? (y n)
```

After rebooting the system, the CD-ROM drive is ready for use.

CD-ROM device names

The CD-ROM driver supports both block and raw device access to the CD-ROM drive.

The device names for CD-ROM drive 0 are `/dev/cd0` (block device) and `/dev/rcd0` (raw device).

The manual page for `cdrom`(HW) contains more information.

In addition, the devices needed to install and access SCO Distribution CD-ROM are: `/dev/rcdt0`, `/dev/mrcdt0` and `/dev/xcdt0`. These devices may be transparent to the user.

Accessing CD-ROM filesystems

CD-ROM filesystems are mounted with the `mount`(ADM) command. All utilities behave as expected. You can traverse the filesystem with the `cd` command, and so forth, including copying files from the CD-ROM filesystem to other filesystems with such utilities as `cp`(C) and `tar`(C).

All files on the CD-ROM appear to have access permissions of 555 (that is, files are readable and executable by all users and are not writable). Filesystems containing extended attribute records are supported, but the record format information and the file access permissions in the extended attribute record are not used.

NOTE To bring the CD-ROM drive online, you must insert a disk. If you attempt to bring up the drive without inserting a disk, the message `cannot open` is displayed.

CD-ROM and the WD7000 SCSI host adapter

CD-ROM devices do not work with the WD7000 SCSI host adapter.

Chapter 6

Graphics adapters

Any graphics adapter that is register-level compatible with the chip sets of the supported video adapters should run under your SCO system. For a list of supported video adapters, see the SCO list of compatible hardware.

You can configure as many video adapters as can reside in the system without memory address or interrupt vector conflicts. However, only one VGA adapter can be installed.

In general, adapters bundled with supported computers work with your SCO system.

NOTE If video is integral to the motherboard of the computer, additional graphics adapters may not function with it.

Console display problems when booting

When booting up, if the console screen blanks, the cursor is gone, or the display is garbled, you may have an incompatible video card. Check the SCO list of supported hardware. If your video card is not listed, but is identical to (compatible with) one that is listed, it should work. If the card does not work, check the card hardware documentation. See if there are ways to configure the switch settings so the card is in an IBM-compatible emulation mode, and that it is addressing the kind of monitor attached. In particular, disable “autoswitch” modes. If changing the switch settings fails, then your monitor card is incompatible and must be replaced with a compatible card.

NOTE Due to firmware problems with some older 16-bit VGA cards, it is necessary to place such cards into an 8-bit slot.

Video adapters on ISA and EISA architecture

This section concerns graphics adapters supported under your SCO system for Industry Standard Architecture and Extended Industry Standard Architecture machines.

Graphics adapter and network card conflicts

Many video adapters have “vertical graphics retrace” which is tied into IRQ2. If your network board is also configured for IRQ2, this causes a problem when attempting to send or receive data from the network card. To work around this, review the documentation for your video adapter to determine if the “vertical graphics retrace” can be disabled. If it cannot, the network board must be configured for another IRQ that does not conflict with any other configured devices on the system. This has been known to occur with a WD8003 network card and the Genoa SVGA and Orchid Prodesigner VGA cards.

In addition, some video adapters and network cards might attempt to share the same shared memory segment. This has been known to occur with the WD8003 network card using D0000 and the Paradise and Video 7 1024i video adapters, and it might occur with others as well. Changing the memory I/O address on one of the devices or setting the network card to use C0000 might help.

8514/a graphics adapters

If you have a 8514/a-based graphics adapter that is exactly register-compatible with the IBM 8514/a and is listed as a supported graphics adapter in the SCO list of compatible hardware, then you can use one of the IBM 8514/a modes. For example, all 8514/a clone video adapters support a non-interlaced 1024x768 resolution. If you have an interlaced monitor and your graphics adapter supports that mode, then select the IBM 8514/a 1024x768 interlaced mode.

Paradise graphics adapters

The Paradise VGA Plus/16, VGA Professional, and other 16-bit VGA adapters based on the Paradise or Western Digital chip set must be installed in an 8-bit bus slot. Call your hardware vendor to find out if your 16-bit adapter uses the Paradise or Western Digital chipset and ask for a hardware fix. A design flaw affects memory addressing and DMA transfers over 1 Mbyte.

You may experience intermittent problems with floppy disk, tape, or hard disk writes. One way of identifying this problem is by reading a hexadecimal dump of a file. A normal file looks like this:

```
$ cat > testfile
this is test!
only a test.
$ hd testfile

0000 74 68 69 73 20 69 73 20 61 20 74 65 73 74 21 this is a test!.
0010 6f 6e 6c 79 20 61 20 74 65 73 74 2e 0a      only a test..
```

If your VGA adapter has this problem, every other character in the file is replaced with a hexadecimal 0xff. It looks like this:

```
0000 74 ff 69 ff 20 ff 73 ff 61 ff 74 ff 73 ff 21 t.i. .s.a.t.s.!.
0010 6f ff 6c ff 20 ff 20 ff 65 ff 74 ff 0a      o.l. . .e.t..
```

Because the problem is intermittent, not all files are affected. All data written to floppies, tapes, or SCSI devices is potentially damaged. Examine hexadecimal dumps of floppy or tape backups if you suspect this problem.

Texas Instruments 34010 and 34020-type graphics adapters

The Texas Instruments 34010 and 34020-type graphics adapters are not supported at this time.

EGA adapters

EGA adapters are not supported.

Trident graphics adapters

The Trident Impact III is shipped in at least two versions:

- The older version has 8 memory sockets and 2 additional sockets with one jumperblock. This jumperblock together with the jumper J3 are used to configure the memory for 512K (4 DRAM) or 1 Mbyte (8 DRAM). For more information, refer to your owner's manual. This board has to be configured for 8 DRAM.
- The later version of the Impact III does not have the memory configuration jumpers.

In case the Impact board can not be uniquely identified as a II or III and the server shows a fuzzy image in 256 color mode, try to configure the software with the alternative adapter type using `mkdev graphics`.

Trident boards need to be equipped with 1 Mbyte of memory for proper functioning of the 256 color modes.

Video cards and monitors on Micro Channel Architecture

Some Micro Channel Architecture machines have the VGA built into the motherboard. Adapters that come as the default adapter in supported computers (monochrome or color monitor) work with your SCO system.

8514/a graphics adapters

If you have a 8514/a-based graphics adapter that is exactly register-compatible with the IBM 8514/a and is listed as a supported graphics adapter in the *SCO Hardware Compatibility Handbook*, then you can use one of the IBM 8514/a modes. For example, all 8514/a clone video adapters support a non-interlaced 1024x768 resolution. If you have an interlaced monitor and your graphics adapter supports that mode, then select the IBM 8514/a 1024x768 interlaced mode.

Supported monitors

A monitor is supported if it can handle the signal generated by the graphics adapter. In order to determine this, you should know a little bit about how video works.

There are a lot of parameters to the video signal, but the most important is the horizontal sync frequency, followed by the vertical sync frequency. The horizontal sync frequency corresponds to how many scan lines are drawn per second, and is usually expressed in kilohertz (KHz), or thousands of times per second. The vertical sync frequency corresponds to how often an entire screen is drawn, and is also known as the refresh rate. Vertical sync is expressed in hertz (Hz), or times per second. The higher the refresh rate, the less "flashy" a screen is and the easier it is on the eyes. The most-used vertical sync frequency is 60 Hz, but 70 Hz and above is better. There are also "interlaced" modes in which the odd scan lines are refreshed with one vertical scan and the even scan lines are refreshed with the next scan, so that the whole screen is refreshed with two scans. For example, an interlaced mode might have a vertical scan frequency of 90 Hz, but a particular scan line is only getting refreshed at the rate of 45 Hz. This kind of video mode is inferior to non interlaced mode.

How does the video mode resolution correlate with the horizontal and vertical sync? A given video mode has a particular resolution and refresh rate — for example, 1024x768 at 60Hz. The horizontal sync is proportional to both of these. More precisely, the horizontal sync is proportional to the number of scan lines and to the vertical sync, or refresh rate. In our example, the monitor has to draw 768 scan lines 60 times a second, or 46080 scan lines a second. The actual rate of scanning is actually about 48000 lines/second, because there is some time required for the monitor's beams to go back up to the top of the screen when it has finished a scan.

A monitor has to be able to work with the sync rates produced by the graphics adapter, or else you will get problems such as a very small screen image, multiple overlapping images, or a completely scrambled screen, because the monitor hardware can not deal with the sync rates. If the monitor is a fixed-frequency monitor, it can only deal with one combination of horizontal and vertical sync frequency. Multisync monitors can deal with a certain range of vertical and horizontal frequencies—for them, the limiting factor is usually the horizontal frequency, since they can usually deal with a wide range of vertical sync frequencies. The following table shows the approximate horizontal sync frequencies needed for some typical video modes, along with some of the monitors that are rated at those frequencies.

Horizontal sync frequency (KHz)	Typical monitors supporting this frequency	Video resolution	Refresh rate (Hz)
31.5	Basic VGA	640x480	60 Hz
38	Super VGA (NEC 3D, Sony 1302, Seiko 1440, IBM 8514, many other multisyncs)	640x480 800x600 1024x768	70 Hz 60 Hz 43 Hz interlaced
48	NEC 4D, NEC XL, Sony 1304 Seiko 1450 (note: as higher resolution monitors are becoming more popular, more models are supporting 1024x768 noninterlaced)	800x600 1024x768	70 Hz 60 Hz
64	NEC 5D	1280x1024	60 Hz

The horizontal sync frequency of a monitor is usually mentioned in the user's manual. Usually, the higher the horizontal sync frequency a monitor can handle, the more expensive it is.

Chapter 7

Adding mice and other graphic input devices

This chapter explains how to attach mice and other graphic input devices (such as bitpads) to your system.

Installing the hardware

Consult your hardware manufacturer's documentation for specific instructions on hardware configuration. Note the brand and type of your input device and whether it is attached to a serial port or directly to the system bus. (Keyboard mice attach to a special port found on certain systems.)

Bus mice

Bus mice come with controller cards that are plugged into a slot in the computer. They have jumpers or switches that must be set to allow the computer to talk to the mouse correctly.

The manuals that come with your bus mouse should contain information about the jumpers and what the correct jumper settings should be. Although some of the jumper settings depend on the type of hardware you have, and should be set according to the manual instructions, some bus mice require specific jumper settings to work properly.

It is important to set the jumpers before you run **mkdev mouse** because resetting jumpers usually requires a software removal and reinstallation of the mouse. If you are unfamiliar with bus cards, refer to "Installing bus cards" (page 11) for more information.

Check your system to see which interrupts are being used by other devices, so you will know the interrupts you cannot use. See “Typical device interrupts” (page 3) for a list of standard interrupts. You should select which interrupt you want to use for your mouse and be prepared to set the jumpers to that interrupt. You can use the **hwconfig(C)** command to display your current system configuration. The interrupts in use will be under the “vec” column; be sure to avoid using an interrupt belonging to another device.

The following sections describe correct hardware setup for specific bus mice.

Logitech bus mouse

Set the jumpers as follows:

- Set JMP1 to any interrupt that is not being used.
- Set JMP2 to jumper 1 for 30 Hz, as 60 Hz is used for DOS.

Microsoft bus mouse

Set the jumpers as follows:

- Set JMP2 and JMP3 to the proper settings listed in your manual.
- Set JMP4 to either interrupt 3, 4, or 5. Do not use the setting for interrupt 2.

Olivetti bus mouse

Set the jumper settings according to your manual.

NOTE In all cases, except for the Microsoft bus mouse, use interrupt 25 in the software if you have set the interrupt jumper to interrupt 2.

Serial mice

Serial mice are connected to either the COM1 or COM2 port, or to a port in a multiport board. They usually require either 9-pin or 25-pin RS-232 connections.

If you have a COM1 or COM2 port, plug the mouse into one of those ports. If you have a non-intelligent multiport card, plug the mouse into the appropriate port on the card.

It is important that you know the name of the port on which the mouse is to be installed. COM1 uses *tty1a*, and COM2 uses *tty2a*. Multiports that are connected to COM ports have similar names but have different letters for each port. For example, a four-port multiport board in COM1 would typically have device names *tty1a*, *tty1b*, *tty1c*, and *tty1d* to correspond with its four ports. Multiport cards provided with special drivers (so-called “smart cards”) have their own device names; check your multiport manual to find them.

Keyboard mice

Keyboard mice simply connect to the back of your computer. They usually use 6-pin or 9-pin mini-DIN connectors. Check your manual to find the port to which your mouse should be connected.

When installing a mouse using **mkdev mouse**, choose the keyboard mouse option only if you have a machine and mouse capable of using this port. On some AT-type machines that do not have a keyboard mouse port, installing a keyboard mouse driver causes the keyboard to lock up after booting. If this happens, boot the previous kernel (*unix.old*) and remove the keyboard mouse driver from the system using the `remove` option of **mkdev mouse**. This problem does not occur on systems with keyboard mouse ports.

Configuring a mouse

To install a mouse on your system, you must perform the following steps:

1. Install the mouse in the computer according to the manufacturer's instructions.
2. Make sure your link kit is installed and functioning correctly. The mouse drivers cannot be installed without the link kit. (The link kit is installed using **custom(ADM)**.)
3. Log in as *root* and input the following command:

mkdev mouse

△ **sysadmsh** users select: System ⇄ Configure ⇄ Hardware ⇄ Mouse

You see the Mouse Initialization menu:

```
Mouse Initialization Program

1. Display current configuration
2. Add a mouse to the system
3. Remove a mouse from the system
4. Associate a terminal with an existing mouse
5. Disassociate a terminal from an existing mouse
6. Remove the mouse drivers from the kernel

Select an option or enter q to quit:
```

To install a mouse, select option 2 and press (Enter). The other options allow you to change your mouse configuration at any time. For example, you can add or remove additional mice on your system or change the terminals that are allowed to receive input from an existing mouse.

4. Next, specify the type of mouse you will use. You see the menu:

```
Reading device entries...

The following mouse device types are supported:

1. Serial mouse
2. Bus mouse
3. Keyboard mouse

Select an option or enter q to return to the previous menu:
```

Enter the number corresponding to the type of mouse you wish to install and press (Enter). If you selected 2, proceed to step 7. If you selected 3, proceed to step 9.

5. You see the following menu:

```
The following serial mouse devices are supported:

1. Logitech serial mouse
2. Logitech MouseMan: Serial or cordless version
2. Microsoft Serial Mouse
3. Mouse Systems PC II Serial Mouse
4. Mouse Systems PC Mouse

Select an option or enter q to return to the top level menu:
```

Enter the number corresponding to the mouse you wish to install and press (Enter).

6. You see:

```

mouse_type is currently configured
to attach to the system on dev ttyxx

Do you want to install this mouse on a different port? (y n)

```

mouse_type refers to the brand or type of mouse you have chosen from the previous menu(s).

Enter **n** and press (Enter) if you do not need to change the default port. Enter **y** followed by (Enter) if you wish to change the default and enter a port when prompted. Proceed to step 10.

7. The bus mouse menu is displayed:

```

The following Bus mouse devices are supported:

1. Microsoft Bus Mouse
2. Olivetti Bus Mouse
3. Logitech Bus Mouse

Select an option or enter q to return to the top level menu:

```

Enter the number corresponding to the mouse you wish to install and press (Enter).

8. You are asked to select the configuration for the bus mouse card:

```

Busmouse Configuration

1. Display current busmouse parameters
2. Modify current busmouse parameters
3. Select previous busmouse parameters
4. Select default busmouse parameters

Enter an option or q to quit:

```

If you wish to use the default bus mouse parameters, select 4. The current parameters are displayed, and you can press **q** to quit this menu. The default bus mouse selection auto-configures your bus mouse. If you wish to change the default parameters, special care should be taken when changing the interrupt vector for the mouse. Interrupt vector 5 is often used by the cartridge tape or the secondary parallel port; interrupt vector 3 is used by COM2; and interrupt vector 2 may be used by the network card or video adapter. Be sure to select an unused interrupt vector for the mouse. Proceed to step 10.

9. You see the following menu:

```
The following Keyboard mouse devices are supported:
1. Low Resolution Keyboard Mouse
2. High Resolution Keyboard Mouse

Select an option or enter q to return to the top level:
```

Enter the number corresponding to the mouse you wish to install and press **(Enter)**. (Refer to “Changing the keyboard mouse resolution setting” (page 96) and “Solving slow or no mouse response” (page 97) for further details on high resolution mice.)

10. Next, you are asked to specify the terminals and multiscreens that are allowed to accept input from the mouse. Do not specify any tty ports where mice are actually connected or you will receive an error message. You may choose to allow any or all other terminals and console multiscreens to use the mouse. Simply pressing **(Enter)** associates all of the console multiscreens.

If you install more than one mouse, make sure the terminal specifications for each mouse do not overlap. Note that only one mouse can be allowed for input on a given tty.

Refer to “Using the mouse” (page 97) for more information on sharing the mouse between several terminals or multiscreens. You see:

```
This mouse may be configured for use on any of the system's
terminals and multiscreens. The multiscreens and terminals
that will be associated with this mouse need to be specified.

Specify them by entering, at the following prompt, all the
ttyps to be associated with this mouse. Entering the word
"multiscreen" will associate all of the console multiscreens.

Enter a list of terminals (e.g. tty1a tty2a multiscreen)
or enter q to quit. The default is multiscreen

Press return when finished:
```

If only the multiscreens are to be associated with the mouse, just press **(Enter)**. If you need to associate other devices, enter them and press **(Enter)**.

Now you see:

```
Do you want to use the mouse_type on
any other terminals? (y n)
```

Note that in this example *mouse_type* is replaced with the brand or type of mouse you specified earlier in the procedure. Respond **n** if no other terminals are allowed to receive mouse input. If you answer **y**, you are returned to the screen prompting for a list of terminals.

11. You see the following messages, which may take a few minutes to appear on your screen:

```
You must create a new kernel to effect the driver change you specified.
Do you wish to create a new kernel now? (y n)
```

Answer **y** to add the mouse device driver to your kernel.

12. Next, you see:

```
The UNIX operating system will now be rebuilt.
This will take a few minutes. Please wait.
```

```
Root for this system build is
```

As part of the linking process, you see the following messages:

```
The UNIX kernel has been rebuilt.
```

```
Do you want this kernel to boot by default? (y n)
```

Answer **y** if you want this kernel to be used every time you boot the system.

13. The following is displayed:

```
Backing up unix to unix.old.
Installing new unix.
```

```
The kernel environment includes device node files and etc inittab.
The new kernel may require changes to etc inittab or device nodes.
```

```
Do you want the kernel environment rebuilt? (y n)
```

Enter **y**.

14. The following is displayed:

```
The new kernel has been successfully linked and installed.  
To activate it, reboot your system.  
  
Setting up new kernel environment.
```

You have now installed the mouse drivers in your kernel.

15. Finally, you are returned to the main mouse menu again. If you have no changes to make to your mouse configuration at this time, enter **q** to quit and press (Enter).
16. Use the **shutdown(ADM)** command (or **haltsys(ADM)** if you are in single-user mode) to shut down the system and reboot.

You can invoke **mkdev mouse** at any time to allow or prevent input on different terminals, remove mice, or check your current configuration.

NOTE Many system utilities (for example, **usemouse(C)**) and applications (for example, Office Portfolio) which use a mouse require pseudo ttys to be installed on the system. If you wish to use such an application or use **usemouse(C)** to test your mouse as described below. If necessary, use the **mkdev pty** command to create more than the 32 pseudo ttys that are generated by default when your SCO system is installed.

Changing mouse ports

If you change your mouse's port after installing your SCO system, use **mkdev mouse** to change the port.

Testing a mouse

Use the following procedure to test your mouse.

NOTE Pseudo-ttys must be installed on the system in order to use **usemouse(C)**.

1. Log in as *root* in multiuser mode.
2. Enter the following at the system prompt:
usemouse -t vi -c "view /etc/termcap"

3. Observe the cursor as you move the mouse. The cursor should move as the mouse moves.

Pressing each mouse button should result in the following actions:

- Left button moves the cursor to the beginning of the file.
- Middle button deletes the current character.
- Right button moves the cursor to the last line of the file.

NOTE If you are using a two button mouse, pressing both buttons at once emulates the middle button. (This is called chording.)

4. To stop the **usemouse** utility, press `<Return>` to flush the character buffer and enter **quit**.

NOTE Because **usemouse** starts a new shell when executed, it is important to exit this shell before starting a graphical application.

If invoking **usemouse** does not produce the cursor behavior described here, or you see the following error messages:

```
Open event driver failed:: No such file or directory
Open event driver failed:: Not enough space...giving up
```

Your mouse is not installed incorrectly. Check the following:

- First, verify that your mouse is supported.
- Make certain the hardware is seated properly and the cable is attached securely.
- If you are using a bus mouse, verify that the bus mouse card is recognized during boot up of your system and that there is no conflict with the interrupt vector or base address. Check the hardware configuration information using the **hwconfig(C)** command.
- If you are using a serial mouse, verify that the serial card to which your mouse is attached is recognized during boot up of your system (by running **hwconfig**). If the mouse is on a multiport board that uses its own drivers, make certain the board works. Try the mouse on a COM port to eliminate the possibility of a third-party driver being the problem.

Removing a mouse

To remove a mouse or mouse drivers on your system, select **3** (for a mouse) or **6** (for mouse drivers) from the main menu. Then select the appropriate currently installed mouse to remove. After you have removed the mouse or mouse drivers, the kernel must be relinked for the change to take effect.

Changing the keyboard mouse resolution setting

The file `/etc/conf/pack.d/kbmouse/space.c` contains two parameters that affect the performance of the high resolution keyboard mouse, **kbm_resolution** and **kbm_poll**. You can use a text editor to edit the `/etc/conf/pack.d/kbmouse/space.c` file and change the **kbm_resolution** parameter to adjust the resolution setting. The **kbm_poll** parameter, however, is automatically set by the **mkdev mouse** utility. Normally, **kbm_poll** should not be manipulated by hand. Refer to “Solving slow or no mouse response” (page 97) for more information about **kbm_poll**.

The **kbm_resolution** parameter determines how many reports, or counts, are made from the mouse to the mouse driver each time that you move the mouse one millimeter. Increasing the number of counts per millimeter increases the sensitivity of mouse performance. The allowable values for **kbm_resolution** are:

Table 7-1 High-resolution keyboard mouse

Parameter	Counts/millimeter
<code>kbm_resolution=0</code>	1
<code>kbm_resolution=1</code>	3
<code>kbm_resolution=2</code>	6
<code>kbm_resolution=3</code>	12

The default **kbm_resolution** value for a high resolution keyboard mouse is 1, specifying 3 counts/millimeter. **kbm_resolution** is set in the file `/etc/conf/pack.d/kbmouse/space.c`.

The parameters for a regular keyboard mouse do not correspond to the same counts/millimeter parameters as for a high-resolution keyboard mouse. The allowable values for a regular keyboard mouse are:

Table 7-2 Regular keyboard mouse

Parameter	Counts/millimeter
<code>kbm_resolution=0</code>	1
<code>kbm_resolution=1</code>	2
<code>kbm_resolution=2</code>	4
<code>kbm_resolution=3</code>	8

The default **kbm_resolution** value for a regular keyboard mouse is 3, specifying 8 counts/millimeter. The same value specifies 12 counts/millimeter for a high-resolution keyboard mouse, which causes the high-resolution keyboard mouse to behave too sensitively. Therefore, you must use the **mkdev mouse**

utility when you add or remove a high-resolution mouse. **mkdev mouse** changes the default parameters in `/etc/conf/pack.d/kbmouse/space.c` to the appropriate values for the mouse that you are configuring. You must answer **y** when **mkdev mouse** prompts you if you want to relink the kernel if you want to effect the new parameter values.

Solving slow or no mouse response

If your mouse responds too slowly or not at all, you should use a text editor to edit the file `/etc/conf/pack.d/kbmouse/space.c`. Lower the **kbm_poll** value to improve mouse response. For example, if the value `0xb0` produces very slow mouse response, try `0xa0`, `0x90`, `0x80`, and so on in turn until you have satisfactory mouse performance. A recommended starting value is `0x400`.

NOTE Some **kbm_poll** values lower than `0xb0` may cause your system to freeze. If this occurs, raise the **kbm_poll** value.

After modifying parameters in `/etc/conf/pack.d/kbmouse/space.c`, you must relink the kernel. To do this, enter the following commands:

```
# cd /etc/conf/cf.d
# ./link_unix
```

Linking can take a while. When the process is complete, use the **shutdown(ADM)** command to reboot the system. When the system boots, the new keyboard mouse parameters take effect.

Using the mouse

Use of a mouse is automatic. If a program or utility accepts mouse input and the terminal is allowed to use the mouse, you simply invoke the program and the mouse works. If the terminal or multiscreen is not allowed to use the mouse, or the program is not configured to accept mouse input, using the mouse has no effect.

Using the mouse with multiscreens

Multiscreens (on monitors attached to video cards in the bus) provide the most convenient method for using the mouse. If a mouse is associated with the multiscreens on your main system console (typically, a monitor attached to a video card in the system bus), the mouse input is associated with the current active multiscreen. For example, if your system has four multiscreens enabled on the main system console and all those screens are allowed to use the mouse, the input from the mouse goes to the program running on the active multiscreen.

Changing the keyboard mouse resolution setting

The file `/etc/conf/pack.d/kbmouse/space.c` contains two parameters that affect the performance of the high resolution keyboard mouse, **kbm_resolution** and **kbm_poll**. You can use a text editor to edit the `/etc/conf/pack.d/kbmouse/space.c` file and change the **kbm_resolution** parameter to adjust the resolution setting. The **kbm_poll** parameter, however, is automatically set by the **mkdev mouse** utility. Normally, **kbm_poll** should not be manipulated by hand. Refer to “Solving slow or no mouse response” (page 97) for more information about **kbm_poll**.

The **kbm_resolution** parameter determines how many reports, or counts, are made from the mouse to the mouse driver each time that you move the mouse one millimeter. Increasing the number of counts per millimeter increases the sensitivity of mouse performance. The allowable values for **kbm_resolution** are:

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Parameter	Counts/millimeter
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utility when you add or remove a high-resolution mouse. **mkdev mouse** changes the default parameters in `/etc/conf/pack.d/kbmouse/space.c` to the appropriate values for the mouse that you are configuring. You must answer **y** when **mkdev mouse** prompts you if you want to relink the kernel if you want to effect the new parameter values.

Solving slow or no mouse response

If your mouse responds too slowly or not at all, you should use a text editor to edit the file `/etc/conf/pack.d/kbmouse/space.c`. Lower the **kbm_poll** value to improve mouse response. For example, if the value `0xb0` produces very slow mouse response, try `0xa0`, `0x90`, `0x80`, and so on in turn until you have satisfactory mouse performance. A recommended starting value is `0x400`.

NOTE Some **kbm_poll** values lower than `0xb0` may cause your system to freeze. If this occurs, raise the **kbm_poll** value.

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```
# cd /etc/conf/cf.d
# ./link_unix
```

Linking can take a while. When the process is complete, use the **shutdown(ADM)** command to reboot the system. When the system boots, the new keyboard mouse parameters take effect.

Using the mouse

Use of a mouse is automatic. If a program or utility accepts mouse input and the terminal is allowed to use the mouse, you simply invoke the program and the mouse works. If the terminal or multiscreen is not allowed to use the mouse, or the program is not configured to accept mouse input, using the mouse has no effect.

Using the mouse with multiscreens

Multiscreens (on monitors attached to video cards in the bus) provide the most convenient method for using the mouse. If a mouse is associated with the multiscreens on your main system console (typically, a monitor attached to a video card in the system bus), the mouse input is associated with the current active multiscreen. For example, if your system has four multiscreens enabled on the main system console and all those screens are allowed to use the mouse, the input from the mouse goes to the program running on the active multiscreen.

Remember that programs that do not accept mouse input are unaffected by moving the mouse, even on a mouse-allowed multiscreen.

Serial (terminal) multiscreens and serial consoles can also be configured to use the mouse.

Using the mouse on serial terminals

When you install the mouse, you are prompted to list the ttys that are allowed to use mouse input. You can allow terminals on serial lines to use the mouse just as you allow multiscreens. You must not specify any ttys where mice are physically connected.

Sharing a mouse with several terminals

When the mouse is shared among several terminals, the mouse is associated with a tty on a “first-come, first-served” basis. The first user to invoke a mouse-enabled program has the mouse for the duration of that program. For another user to use the mouse, the first user must quit the program. (This closes the input queue from the mouse.) Then, the next user for the mouse can invoke the program and open the line for input from the mouse.

Note that other users on ttys allowed to use a mouse can use programs that accept mouse input while the mouse is busy. If the mouse is busy, the programs are unable to receive input from the mouse but should otherwise function normally.

Using a mouse with keyboard-based programs

The `usemouse(C)` utility maps mouse movements and operations to key strokes used by keyboard-based programs. Refer to the `usemouse(C)` manual page for complete information.

WARNING Do not use the `usemouse` utility while in single-user (maintenance) mode.

Using the pseudo-mouse driver

A pseudo-mouse is configured automatically during installation when you run `mkdev mouse`. This allows you to use applications that expect mouse input within a `scoterm` window.

To demonstrate the use of the pseudo-mouse, run `usemouse` in a `scoterm` window, then press `(Ctrl)\Alt\Bksp)`. Notice your pointer disappears, but the cursor in the window now moves with the mouse. Press the same keys again to get the pointer back.

Configuring a bitpad

To install a bitpad on your system, you must perform the following steps:

NOTE Bitpads are not supported by the X server. They cannot be used in place of mice.

1. Install the bitpad according to the manufacturer's instructions.
2. Make sure your link kit is installed and functioning correctly. The bitpad drivers cannot be installed without the link kit. (The link kit is installed using `custom(ADM)`.)
3. Log in as `root` and input the following command:
mkdev bitpad
4. You see the Bitpad Initialization menu:

```
Bitpad Initialization Program
1. Display current configuration
2. Add a bitpad to the system
3. Remove a bitpad from the system
4. Associate a terminal with an existing bitpad
5. Disassociate a terminal from an existing bitpad
6. Remove the bitpad drivers from the kernel

Select an option or enter q to quit:
```

To install a bitpad, select option **2** and press (Enter). The other options allow you to change your bitpad configuration at any time. For example, you can add or remove additional bitpads on your system or change the terminals that are allowed to receive input from an existing bitpad.

5. Next, specify the type of bitpad you will use. You see the menu:

```
Reading device entries...
The following bitpad device types are supported:
1. Serial bitpad
Select an option or enter q to return to the previous menu:
```

Enter **1** and press **<Enter>**.

6. You see the following menu:

```
The following serial bitpad devices are supported:
1. Summagraphics bitpad, 4 buttons, MM mode
Select an option or enter q to return to the top level menu:
```

Enter the number corresponding to the bitpad you wish to install and press **<Enter>**.

7. You see:

```
bitpad_type is currently configured
to attach to the system on dev ttyxx
Do you want to install this bitpad on a different port? (y n)
```

Enter **n** and press **<Enter>** if you do not need to change the default port. Enter **y** followed by **<Enter>** if you wish to change the default and enter a port when prompted.

8. Next, you are asked to specify the terminals and multiscreens that are allowed to accept input from the bitpad. Do not attempt to allow bitpad input on any tty where any bitpads are physically connected or you receive an error message. You may choose to allow any or all other terminals and console multiscreens to use the bitpad. Simply pressing **<Enter>** associates all of the console multiscreens.

Note that only one bitpad can provide input on a given terminal or multi-screen.

Refer to “Using the mouse” (page 97) for more information on sharing these devices between several terminals or multiscreens. You see:

```
This bitpad may be configured for use on any of the system's
terminals and multiscreens. The multiscreens and terminals
that will be associated with this bitpad need to be specified.
```

```
Specify them by entering, at the following prompt, all the
ttys to be associated with this bitpad. Entering the word
"multiscreen" associates all of the console multiscreens.
```

```
Enter a list of terminals (e.g. tty1a tty2a multiscreen)
or enter q to quit. The default is multiscreen
```

```
Press return when finished:
```

If only the multiscreens are to be associated with the bitpad, just press **(Enter)**. If you need to associate other devices, enter them and press **(Enter)**. Now you see:

```
Do you want to use the bitpad_type or any other terminals?
(y n)
```

Note that in this example *bitpad_type* is replaced with the brand or type of bitpad you specified earlier in the procedure. Enter **n** if no other terminals are allowed to receive bitpad input. If you enter **y**, you are returned to the screen prompting for a list of terminals.

9. You see the following messages, which may take a few minutes to appear on your screen:

```
You must create a new kernel to effect the driver change you specified.
Do you wish to create a new kernel now? (y n)
```

Answer **y** to add the bitpad device driver to your kernel.

10. Next, you see:

```
The UNIX operating system will now be rebuilt.
This will take a few minutes. Please wait.
```

```
Root for this system build is .
```

As part of the linking process, you see the following messages:

```
The UNIX kernel has been rebuilt.  
Do you want this kernel to boot by default? (y n)
```

Answer **y** if you want this kernel to be used every time you boot the system.

11. The following is displayed:

```
Backing up unix to unix.old.  
Installing new unix.  
  
The kernel environment includes device node files and etc inittab.  
The new kernel may require changes to etc inittab or device nodes.  
  
Do you want the kernel environment rebuilt? (y n)
```

Enter **y**.

12. The following is displayed:

```
The new kernel has been successfully linked and installed.  
To activate it, reboot your system.  
  
Setting up new kernel environment.
```

You have now installed the bitpad drivers in your kernel.

13. Finally, you are returned to the main bitpad menu again. If you have no changes to make to your bitpad configuration at this time, enter **q** to quit and press (Enter).

14. Use the **shutdown(ADM)** command (or **haltsys(ADM)** if you are in single-user mode) to shut down the system and reboot.

You can invoke **mkdev bitpad** at any time to allow or prevent input on different terminals, remove a bitpad, or check your current configuration.

Chapter 8

Network cards

The following sections give guidelines for network cards for both Industry Standard and Micro Channel architecture.

Standard and Micro Channel architecture notes

The driver installation software for the network cards allows you to install up to four boards of the same type. During installation the software device drivers are configured for various parameters for each card, such as the interrupt vector and base I/O address. These parameters must be chosen with care, so they do not conflict with other hardware in your system. Be aware of potential conflicts before setting jumpers on the cards.

The default manufacturer's interrupt vector setting for the WD8003E and 3C501 cards is 3 (IRQ3). This conflicts with the interrupt vector for the second serial port (tty2a/COM2). We recommend configuring your network card to use interrupt vector 2 before installing your SCO system. Refer to the documentation accompanying your network card for information on how to configure the interrupt vector. If you need to use IRQ3, you must disable the second serial port.

If you have already configured a network card for interrupt vector 3, do not later run `mkdev serial` to enable COM2.

SMC Ethernet cards

You may be aware that Standard Microsystems Corporation (SMC) has replaced the Western Digital Ethernet cards with their own interchangeable cards. The SCO LLI Drivers Package provides support for both the older Western Digital 8003 and 8013 cards as well as their SMC replacements.

NFS and network cards

When using NFS with a 3C501 card and mounting a remote filesystem, you must include the **rsize=1024** and **wsize=1024** options on the **mount** command line. If you use **mnt(C)**, these options should be added to the filesystem entry in */etc/default/filesys*. The value of 1024 must be used because of a known hardware problem with this card.

When mounting remote filesystems from a machine using a WD8003E card to a machine using a 3C503 card, the **mount** command must include the **rsize=4096**, **wsize=4096**, **soft**, and **intr** options.

Graphics adapter and network card conflicts

Many video adapters have “vertical graphics retrace” which is tied into IRQ2. If your network board is also configured for IRQ2, this causes a problem when attempting to send or receive data from the network card. To work around this, review the documentation for your video adapter to determine if the “vertical graphics retrace” can be disabled. If it cannot, the network board must be configured for another IRQ that does not conflict with any other configured devices on the system. This has been known to occur with a WD8003 network card and the Genoa SVGA and Orchid Prodesigner VGA cards.

Some video adapters and network cards might attempt to share the same shared memory segment. This has been known to occur with the WD8003 network card using D0000 and the Paradise and Video 7 1024i video adapters, and it might occur with others as well. Changing the memory I/O address on one of the devices or setting the network card to use C0000 might help.

Racal Datacomm NI6510 and Microsoft LAN Manager

The Racal Datacomm NI6510 does not work with a remote *nbstatus* on Microsoft LAN Manager for UNIX. If a machine tries to *nbstatus* the machine with the NI6510, the *nbstatus* will fail and all of the LAN Manager sessions using the NI6510 will drop.

Selecting an interrupt vector for the 3C523

The e3C (3C523) network card configuration script does not allow you to select IRQ12 as your interrupt vector. Normally this is a valid value. This is a known bug and will be fixed in a future release.

The 3Com 3C523 driver sometimes causes spontaneous rebooting under heavy load conditions.

In addition, if you are having problems with your 3C523, you may need revision b of the card. Contact your hardware vendor for more information.

WD8003ETIA and WD8013EBT network cards

The default manufacturer's interrupt vector setting for this card is 3 (IRQ3). It is recommended that this card be installed using an interrupt vector of 2, 4, 5, 7, 9, 10, 11 or 15. If you use an interrupt vector other than 3, you need to reconfigure the card using the reference disk.

The 16-bit Ethernet card (WD8013EBT) panics the kernel if it is configured to operate in 0 wait state mode.

Modem support

Any 100% Hayes-compatible 1200 or 2400 modem should work with **uucp(C)** and **cu(C)**. The default autodialer is for the Hayes Smartmodem 1200. Support is limited to external modems only. Autodial programs are also supplied for the following:

- Dowty/Telebit Trailblazer
- Hayes Smartmodem 1200, 2400 and V-Series 9600
- MultiTech MultiModem 224EM
- Racal Vadic 9600VP, 3451, 212

Other autodialing modems can be supported by writing a dialer program, or modifying an existing one in */usr/lib/uucp*. The table-driven **atdialer** program enables you to create a customized binary dialer without a compiler.

In addition, the Honey DanBer UUCP package includes a large number of dialers in the *Dialers* file. However, dialer binaries are preferred for greater reliability.

Supported high-speed (9600 bps) modems are:

- Hayes Ultra 96-2000
- MICC 9610
- MultiTech MultiModem V.32 (MT932EA)
- Telebit T2500
- US Robotics Courier V.32
- US Robotics World Port 9600

NOTE Only external modems using COM1 and COM2 are supported by SCO.

A

- Adaptec host adapters, 26, 28
- Adding
 - CD-ROM drive, 75
 - hard disk, 36
 - memory, 13-14
 - parallel port, 137
 - printer, 109-114
 - secondary SCSI host adapter, 31
 - serial port, 125
 - tape drive, 56, 62-63
- Address, serial board, 126
- Archive, tape drives, 69
- Autodialing, 107
- Automatic Write Remapping (AWRE), 52
- Autoswitch mode, 81

B

- Backups, Irwin and QIC-40 tape drives, 71
- Bad block handling, 52
- badtrk(ADM), 48-50
- Banner page, 114
- Baud rate
 - 19.2 K baud, 117
 - 38.4 K baud, 117
 - adding serial terminal, 117
 - modem, 128
- Bitpad, installing, 99-102
- Boot, screen,tape drives, 69
- Boot device configuration, 3
- Bootable floppy disk, setup program, 13
- Bootstring
 - disable, 9
 - hard disk, 8
 - host adapter, 7
 - tape, 7
 - using, 4
- Buffers, boot display, 13
- Bus, 11
- Bus card, 11-12

- Bus mouse
 - card, 95
 - installing, 91

C

- Cabling
 - printer, 110-111
 - terminals, 118
- CD-ROM drive
 - adding, 75
 - defined, 75
 - device names, 79
 - using, 79
 - WD7000 host adapter incompatibility, 79
- Circuit boards, 11
- COM ports
 - COM3 and COM4, 126
 - interrupts, 126
 - modem use, 107
 - printer, 111
- Compatibility, determining hardware, 2
- Computer bus, 11
- Configuring
 - hard disk, 36-40
 - parallel port, 137
 - print service, 114-115
 - printer, 113-114
 - SCSI tape drive, 65-66
 - serial port, 125
 - tape drive, 56
- Controller
 - Adaptec, 26
 - IDE, 33
 - incompatibilities, 27
 - SCSI disk, 38, 40, 47
 - SCSI tape, 65-66
 - ST506, 38, 42
- Creating a filesystem, 51-52
- ct bootstring, 6
- CTS (Clear to Send), 114-115
- Cylinder
 - disk, 47
 - greater than 1024, 52

D

Daemons, Irwin drive (mcdaemon), 60
 DAT, tape drives, 69
 Data bits, 117
 Data Communications Equipment (DCE),
 printing configuration, 114-115
 Data Terminal Equipment (DTE), printing con-
 figuration, 114-115
 Data Terminal Ready (DTR), serial printer,
 109
 DB-25 connector, 119
 DB-9 connector, 119
 DEFB00TSTR, 4
 Defective tracks, 49
 Destructive scan, 48
 /dev/cd0, CD-ROM device, 79
 Device
 filesystem, 51
 host adapter, 26, 39, 64
 serial card file, 126
 Diagnostic programs disk writes, 47
 DIP switches, 11
 disable(C), port, 118
 Disabling, port, 109
 Disabling drivers, 9
 Disk
 bad tracks, 48-50
 configuring, 36-40
 controllers, 19
 cylinder, 47
 ESDI, 20
 installing, 37, 41-50
 parameters, 45
 partitions, 46
 size, 45
 divvy(ADM), 50-52
 dkinit(ADM), 44
 DOS partition, 46
 DPT 2011, DPT 2012, SCSI host adapter notes,
 25
 Driver, vendor-supplied, 126
 DTE, See Data Terminal Equipment
 DTR, See Data Terminal Ready
 Duplex, 117

E

EAFS (Extended Acer Fast Filesystem), 51
 8250 chip problems, 130
 EISA
 configuration diskette, 12
 host adapter cards, 20
 host adapters, 25, 28
 installing, 21
 enable(C), port, 119
 Error correction, SCSI tape drives, 71
 ESDI
 disk, 20, 43
 root disk, 37
 /etc/conf/init.d/sio, 118, 121
 /etc/default/boot, 69
 /etc/default/mcconfig, 60
 /etc/inittab(F), setting up scancode mode,
 121
 /etc/inittab(F), terminal lines, 118
 Exabyte, tape drives, 69
 Expansion board, 125, 137
 Expansion slots, 12
 Extended length mode, 61

F

fdisk(ADM), installing a hard disk, 46
 Filesystem
 creating, 50-52
 filesystem 7, 51
 Floppy disk, intermittent write problems, 83
 Future Domain
 TMC-1800 IC-based host adapters, 30
 TMC-7000EX host adapters, 30
 TMC-7000-FASST2 host adapters, 30
 TMC-950 IC-based host adapters, 29

G

gettydefs file, baud rates above 9600, 118
 getty(M), process, 119
 Graphics adapters
 network card conflicts, 82, 104
 notes, 81
 Ground, 118
 Grounding yourself, 11

H

Hard disk

- adding, installing, 36
- bad tracks, 48-50
- configuring, 37
- controllers, 19
- driver configuration, 8
- ESDI, 20
- greater than 1024 cylinders, 52
- installing, 37, 41-50
- interleave, 53
- intermittent write problems, 83
- nonstandard, 45
- parameters, 45
- partially formatted, 2
- partition, 46
- size, 45
- standard architecture notes, 53
- switch settings, 37

Hard drive, IDE, 33

High memory, Corollary, 14

Host adapter, 19-31, 38, 39, 64

- SCSI configuration, 7

- SCSI disk, 44

Host adapters, 30

hwconfig(C), 69, 95, 111-112

I

IDA/Intelligent Array Expansion controller, 42

IDE hard drives and disk controllers, 33

inittab file, 118

Installation, configuring devices during, 3

Installing

- bitpad, 99-102
- bus card, 11-12, 125-127, 137
- cable connections, 118
- COM ports, 127
- hard disk, 37, 41-50, 52
- memory, 13
- modem, 118, 128
- monochrome card, 137
- mouse, 87-93
- multiport card, 125-127
- on EISA systems, 21
- printer, 109-114
- tape drive, 56, 62-63
- terminals, 117-119

Integrated Drive Electronics (IDE), 33

Intelligent serial board, 111

Interleave for hard disks, 53

Internal memory, adding, 13

Interrupt vector

- 3C523 network card, 104
- COM ports, 126
- graphics and network card conflicts, 82, 104
- mouse, 22, 91
- parallel port, 110
- printer, 112
- tape device, 58
- typical settings, 3
- Western Digital network card, 105

Irwin

mcconfig file, 60

mcd daemon, 60

tape drive backups, 71

ISA, host adapters, 25-26

J

Jumper settings, bus card, 12

K

Kernel

bitpad driver, 102

mouse driver, 93

relinking, 21, 52, 97

Keyboard

installing mouse, 89

substituting mouse, 98

L

link_unix program, 22, 52, 97

load(C), 69

lp0, 110

LUN (logical unit number), SCSI, 20, 38, 40, 65-66

M

mcconfig file (Irwin tape), 60

mcd daemon process, 60

Memory

Memory

- Corollary high memory, 14
- installing, 13-14
- messages file, 111
- mkdev(ADM), adding device, 31
- mkdev(ADM), bitpad, 99-102
- mkdev(ADM)
 - fs, 51-52
 - hd, 38, 40-50
- mkdev(ADM), mouse, 89, 91-93, 95
- mkdev(ADM)
 - parallel, 137
 - serial, 126
- mkdev(ADM), tape, 63
- Modem
 - autodial support, 107
 - baud rate, 128
 - tty identification, 127
- Monochrome card, 110
- Motherboard, 11, 27, 126
- Mouse
 - bus, 87
 - bus mouse, 91
 - changing ports, 94
 - changing resolution, 96
 - installing, 87-93, 97
 - interrupt vector, 22
 - keyboard, 89
 - notes, 87
 - problems, 95
 - removing, 95
 - serial, 88
 - sharing, 98
 - slow response, 97
 - testing, 94-95
 - tty, 98
 - using, 97-98
- Multiport card, 111, 125
- MultiScreen
 - bitpad, 100
 - mouse, 92, 97

N

- NBUF parameter, 13
- NDISK parameter, 42
- Network cards
 - link level interfaces, 103
 - standard architecture notes, 103

- NFS with 3C501 network cards, 104
- 19.2 K baud, 118
- Nonstandard disk, 45
- Notice: Stp: Error on SCSI tape, error message, 7
- Null modem, 118

O

- Open event driver failed, error message, 95

P

- PANIC memory parity, error message, 13
- Paradise, graphics adapter notes, 82
- Parallel port
 - adding, 137
 - configuring, 110
 - printer, 109-111
- Parity, 117
- Parity error, 14
- Partition
 - DOS, 46
 - hard disk, 46, 50-51
- Performance, tuning SCSI disk, 32
- Pin connections
 - serial printer, 110
 - serial terminal, 118
- Port
 - changing for mouse, 94
 - parallel, 110, 137
 - printer, 109-111
 - serial, 125
- Port card, installation, 127
- Printer
 - accepting, 114
 - adding, 109-114
 - configuring, 113-114
 - enabling, 114
 - serial, 114-115
- Printing, configuring, 114-115
- Pseudo-mouse driver, 98

Q

- QIC-02, boot time configuration, 5

- QIC-02 tape drive
 - base address, 59
 - controller type, 57
 - DMA channel, 58
 - interrupt vector, 58
- QIC-40, tape drive backups, 71
- QIC-40/80 tape drive, described, 61

R

- Receive data, 118
- Reference Diskette (MCA), 12
- Removing, mouse, 95
- Root hard disk, 37, 38, 52
- RS-232, printer connection, 114-115
- RTS (Ready to Send), 114-115

S

- Safe to Power Off message, 13
- Scan, destructive, 48
- SCSI
 - adding secondary host adapter, 31
 - bad block handling, 52
 - configuring disk, 38, 40, 41
 - devices, 26
 - disk controller, 47
 - host adapter, 44
 - host adapters, 19-21, 26, 28
 - root disk, 37-38, 40, 43
 - tape drive, 62-63, 65, 70, 71
 - tuning performance, 32
- SCSI hard disks, formatting, 2
- SCSI host adapter configuration, 7
- SCSI peripherals, 6
- Serial board
 - addresses for dumb boards, 136
 - installing, 126
 - installing a printer, 111
 - problems with 8250 chips, 130
- Serial card, standard, 126
- Serial line
 - adding terminals, 117
 - modem connection, 107
- Serial port
 - access error, 130
 - adding, 125
- Serial printer, 109-110, 114
- serial(HW), 126

- Settings, switch, 126
- Setup disk, 13
- Signal ground, 118
- sio file, 118
- Slots, 12
- Smart card, 126
- ST506
 - controller, 19, 42, 44
 - disk, 43
 - root disk, 37-38, 42
- Standard Architecture, network cards, 103
- Standard architecture, tape drive notes, 72
- Static electricity, 11
- Stop bits, 117
- Storage Plus, host adapter notes, 31
- SUMO, host adapter notes, 31
- Switch settings
 - hard disk, 37
 - motherboard, 126
- sysadmsh(ADM)
 - HardDisk options, 41-51
 - Kernel options, 52
- sysadmsh(ADM), utility, Printer options, 109, 113-114
- System board, 126

T

- Tape
 - QIC-02, 57
 - sysadmsh(ADM) options, 56
- Tape drive
 - accessing delay, 21
 - boot screen messages, 69
 - boot string, 59, 60, 62, 65, 67
 - configuring, 56
 - extended length mode, 61
 - installing, 56, 62-63
 - load(C) and unload(C) commands, 69
 - mcconfig file (Irwin), 60
 - mcdaemon (Irwin), 60
 - mini-cartridge (Irwin), 59
 - notes, 55
 - QIC-02, 57
 - QIC-40/80, 61
 - SCSI, 62-63
 - standard architecture notes, 72

Terminal

- adding, 117
- bitpad use, 100
- cabling, 118
- mouse use, 92, 98
- serial, 98
- terminals(HW), 117
- Texas Instruments, graphics adapter notes, 83
- 38.4 K baud, 118
- 34010, graphics adapter notes, 83
- 3Com
 - 3C523 IRQ conflict, 104
 - network cards with NFS, 104
- Transmit data, 118
- ttys
 - bitpad, 100
 - identification, 127
 - mouse, 92

U

- UNIX, partition, 49
- Unload device, 70
- unload(C), 69
- usemouse(C), 94, 98
- /usr/adm/messages file, 111

V

- Video adapters
 - compatibility, 1
 - notes, 81

W

- Wangtek, tape drives, 69
- Warning! message, 47
- Western Digital
 - network card interrupt vectors, 105
 - WD7000 compatibility, 23
 - WD7000 host adapter and CD-ROM, 79
 - WD7000 SCSI host adapter notes, 21
 - WD7000EX host adapter notes, 24

X

- XON/XOFF, handshaking, 117
- XON/XOFF, printer, 109



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