Radio Shack®

HARD DISK SYSTEM STARTUP

TRS-80® Model 4/4P

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To Our Customers

By adding a hard disk to your TRS-80 Model 4 or 4P, you are greatly enhancing the capabilities of your computer system. A hard disk gives two major advantages over a floppy diskette:

- More storage space per disk.
- Higher reliability because the hard disk is far more durable.

In addition, your hard disk lets you retain a flexible operating system environment. You can use both LDOS Version 5.1.4 and TRSDOS Version 6 with your hard disk system, as well as with your floppy diskette system.

About this Manual

This manual explains everything you need to know to set up and begin using your Model 4/4P hard disk system. It includes procedures for connecting the hardware, initializing the system, and moving all programs and data to the hard disk.

Details on the TRSDOS Version 6 operating system are in *Model 4/4P Disk System Owner's Manual*.

Notations

For your convenience, the following notations are used in the command syntaxes and the text referring to the commands:

lower-case italics
represent words, letters, or values that you supply, or displayed information that may vary.

[ ] (square brackets)
indicate optional parameters. Do not include the brackets when typing the command.

(KEYBOARD CHARACTER)
indicates a key that you press.

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Chapter 1
A Look at Your Hard Disk Drive

The hard disk drive basically consists of 2 or 3 platters, or "disks," that lie parallel to one another within the drive. These disks reside in the drive permanently.

Each side of each disk has a read/write head that moves toward or away from the center of the disk as needed to store and retrieve information.

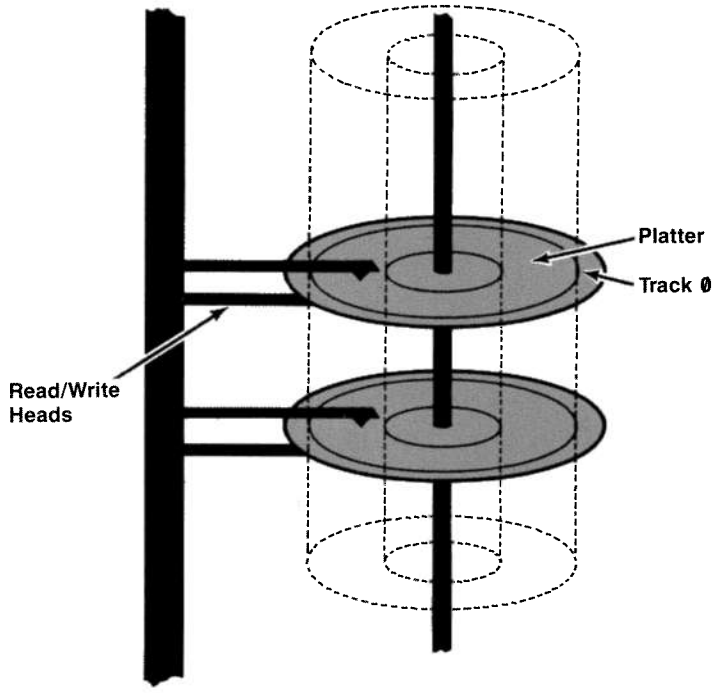

Figure 1. Internal View of Hard Disk Drive

If you have only one hard disk drive, it is the "primary" hard disk drive. A small area on this drive is used to store the operating system. You can have as many as 3 "secondary" hard disk drives for storing additional data.

The Media Error Map

When you purchase your hard disk, a few disk areas called "tracks" may be flawed because of minor defects in the media or signals from external sources. However, no hard disk is shipped with more than 3 flawed tracks per head nor more than 8 (5-meg) or 12 (15-meg) flawed tracks in all. Track 0 never contains flaws.

Before shipment, a built-in error detector determines which, if any, tracks on your hard disk are flawed. We then attach to the bottom of the disk a Media Error Map containing this information. **Keep this map!** Radio Shack service technicians may need to refer to it if your drive ever needs servicing.

In addition, if you choose to initialize your hard disk system manually, you may want to refer to the Media Error Map when formatting the hard disk drives. Manual initialization is discussed in Appendix A. We recommend it **only** for advanced users who cannot meet system requirements by using the simpler initialization procedure discussed in Chapter 4.

Chapter 2
Connecting Your Hard Disk Drives

If you haven't set up your Model 4/4P yet, do so now, referring to *Introduction to Your Disk System*, the startup manual that you received with your computer. Then connect your primary drive and any secondary drives as described in this section and the one that follows. Figure 4 shows a fully configured system.

Connecting the Primary Drive

In addition to this startup manual, your primary hard disk comes with the following:

- Hard Disk Expansion Cable (50-pin)
- Hard Disk Operating System Initialization Diskette, which is called the "Hard Disk Initialization Diskette" or "Initialization Diskette" throughout this manual
- Power Cord
- Power Key

Below is an illustration of the back of the primary hard disk drive. The purpose of each connector and jack is described in the "Procedures" sections in this chapter.

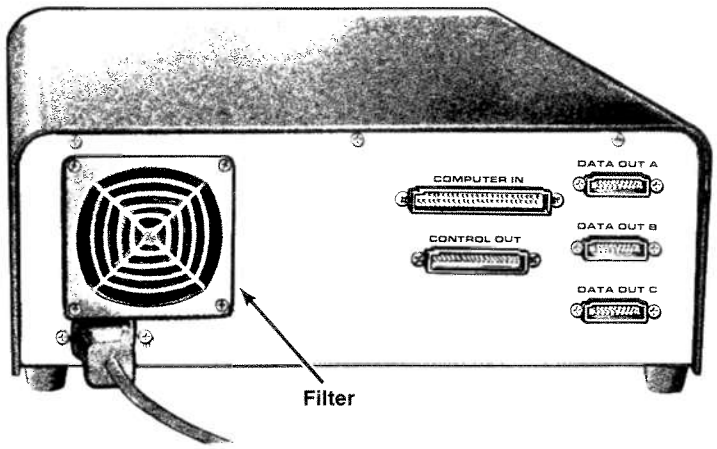

Figure 2. Back View of the Primary Hard Disk Drive

Procedure

To connect the primary hard disk drive to your computer, follow these steps:

1. Connect one end of the hard disk expansion cable to the I/O bus card edge of your computer.
2. Connect the other end to the COMPUTER IN connector (50-pin) on the back of the primary hard disk drive.
3. Connect the power cord to the primary drive. Plug the other end into a grounded AC power source of appropriate voltage.

Connecting the Secondary Drives

Each secondary hard disk drive comes with the following:

- Secondary Hard Disk Expansion Cable
- Data Cable
- Power Cord

The secondary hard disk drives connect to the computer via the primary hard disk drive.

Before you can connect the secondary drives, however, you must take all your hard disk drives—including the primary drive—to a Radio Shack computer technician to be modified. After the modification, only one drive is labeled as the terminator. This drive must be the last in the chain.

> **Warning:** If you have been using the hard disk system and are adding a secondary drive, be sure to back up all the information onto floppy diskettes before you have your hard disk drives modified. This modification could erase all the information you have previously stored on your hard disk drives. Refer to Chapter 5 for information on backing up to diskettes on your computer.

Below is an illustration of the back of a secondary hard disk drive. The purpose of each connector and jack is described in the "Procedure" section below.

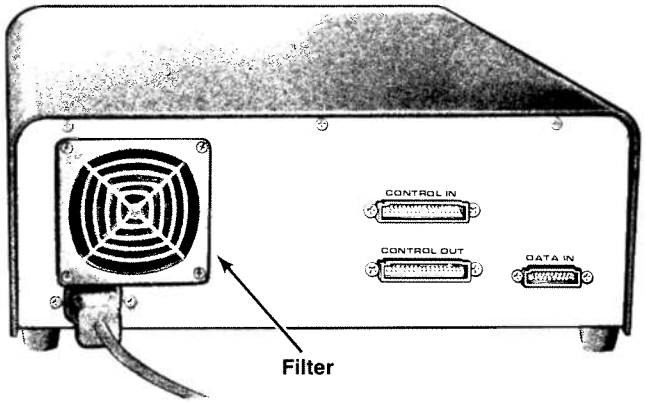

Figure 3. Back View of a Secondary Hard Disk Drive

Procedure

To connect the secondary hard disk drive(s), refer to the illustration and follow the steps below. Notice that the drives must be stacked with the primary drive on top of the secondary drives and **ending with the drive modified to be the terminator.**

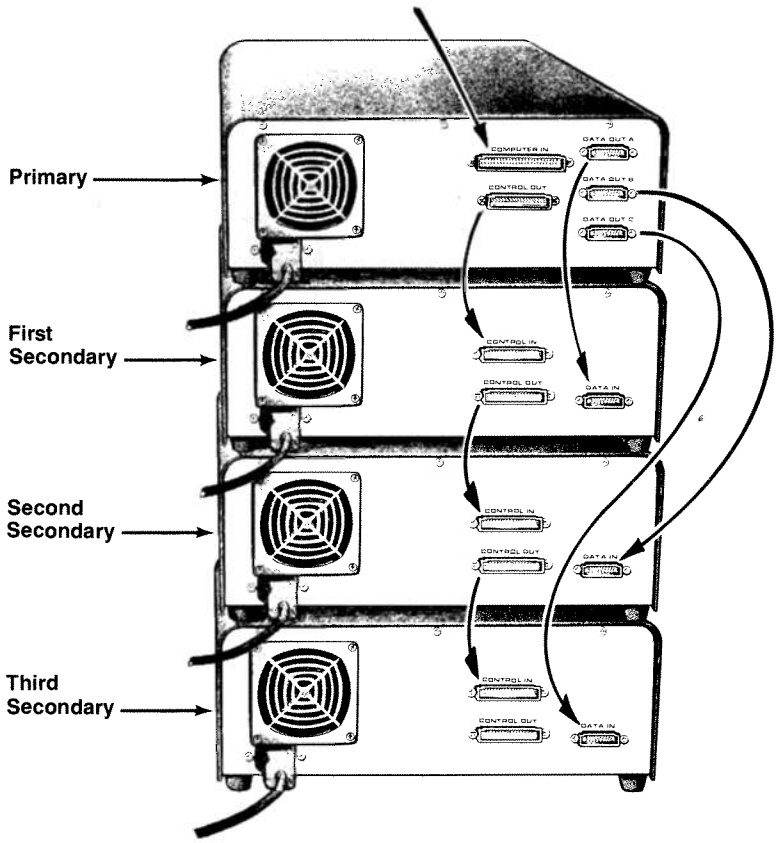

Figure 4. A Fully Configured Hard Disk System

In this procedure, the number of expansion cables and data cables you connect depends on the number of secondary hard disks you have.

1. Connect one end of a secondary hard disk expansion cable to the CONTROL OUT connector on the primary hard disk drive. Connect the other end to the CONTROL IN connector on the first secondary hard disk drive.
2. Connect any remaining expansion cables from the CONTROL OUT on one secondary drive to the CONTROL IN on the next secondary drive.

3. Connect the data cable(s) as follows:
   - One from DATA OUT A (20-pin connector) on the primary drive to DATA IN (20-pin jack) on the first secondary drive.
   - One from DATA OUT B on the primary drive to DATA IN on the second secondary drive.
   - One from DATA OUT C on the primary drive to DATA IN on the third secondary drive.
4. Connect one end of a power cord to each secondary drive and the other end to a grounded AC power source of appropriate voltage.

The drive with the terminator must be the last in the chain.

Chapter 3
Powering Up and Powering Down

To prevent information loss, always use the proper sequence to power up and power down your system. Refer to the illustration below, as well as to the procedures that follow.

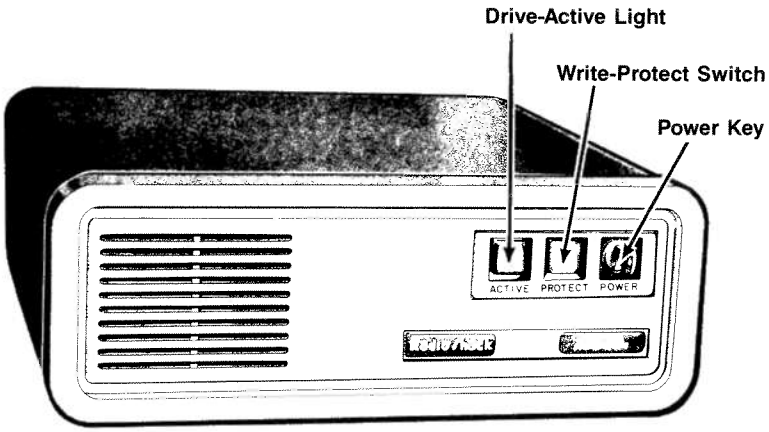

Figure 5. Front View of a Primary Hard Disk Drive

Power Key (primary drive only). This key controls the power to all the hard disk drives. Turn it clockwise to turn on the drives and counterclockwise to turn off the drives. To avoid accidentally erasing information on your hard disks, remove the key once the drives are on.

Two power keys are provided. If you lose a key, the nearest Radio Shack Computer Center can replace it.

Power Light (on all secondary drives in place of power key). When the light is on, the drive is powered up.

Drive-Active Light. When the light is on, the drive is powered up and has been selected for use. When the light is blinking, the drive is in use.

Only one drive-active light should be on at a time. If more than one light is on, turn off the system, wait a few minutes, and turn it on again. If the problem recurs, contact a Radio Shack service technician. (**Note:** When you use two drives in rapid succession, more than one light may **appear** to be on at the same time, without actually being so.)

Write-Protect Switch. When the switch is lighted, the disk drive is write protected so that you cannot write information on it.

Pressing the switch turns the write protection on and off. Press this switch only when the drive is not in use. Otherwise, you may lose or destroy data.

Warning: Never move your hard disk drive while the drive is running. Doing so may cause permanent damage to the drive or disk. Also, do not expose a hard disk to a strong magnetic field, such as that produced by a bulk eraser. You could lose valuable data or damage the unit. Remember, you cannot bulk erase a hard disk.

Power-Up Procedure

1. Be sure all floppy diskette drives are empty. Turn on all peripheral equipment (such as a printer or external floppy diskette drives).
2. Turn on all hard disk drives by turning the power key, which is located on the primary hard disk drive, clockwise. Wait for all secondary drive power lights to come on before continuing. Then remove the key.
3. Turn on the computer.

Power-Down Procedure

1. The operating system prompt should be the last line on your screen. If it is not, press (ENTER) or exit your program so that the prompt appears.
2. Remove all floppy diskettes from their drives.
3. Turn off any peripheral equipment.
4. Turn off all hard disk drives by turning the power key counterclockwise.
5. Turn off the computer.

Chapter 4
Initializing Your System with HARDGEN

Although you have set up and perhaps turned on your hard disk drives, you can, as yet, operate your computer only as a floppy disk system.

To use your hard disk drives, you must first initialize your hard disk system. This includes:

1. Formatting the hard disk drives
2. Configuring them into the computer system
3. Copying TRSDOS Version 6 onto your hard disk system

The TRSDOS Hard Disk Initialization Diskette contains an easy-to-use program called HARDGEN/BAS ("Hard Disk System Generator") that does all this for you.

> **Note:** HARDGEN sets up a system configuration using a specified pattern. Because these patterns are limited, you may want to configure your system differently, using one of the alternate methods described in Appendices A and B. Both methods are more complicated, however, and we recommend them only for advanced users who cannot meet their system requirements with the normal use of HARDGEN.

Before beginning the initialization, please read the next section carefully. It explains the difference between "physical" and "logical" drives. It is important to understand this difference before initializing your hard disk system. Once the initialization is complete, the operating system expects only logical drive numbers.

Technical information on the hard disk initialization is included in Chapter 6, but you probably will not need it if you use the HARDGEN program.

> **Caution:** If you are reinitializing your hard disk, first back up all information on the disk. Initialization erases all information you have on all your hard disk drives.

You should also make backups before moving the equipment from its present location or adding new hard disk drives to your system.

Physical Drives *v* Logical Drives

A physical drive is the actual piece of hardware. A logical drive is a division of the physical drive—according to read/write heads—that the operating system recognizes as a complete drive. It has its own directory and files, and its information can be accessed and backed up just as can the information on a physical drive.

A floppy disk drive is both one physical drive and one logical drive. A hard disk drive is one physical drive that you can separate into several logical drives. The drawing below illustrates this concept:

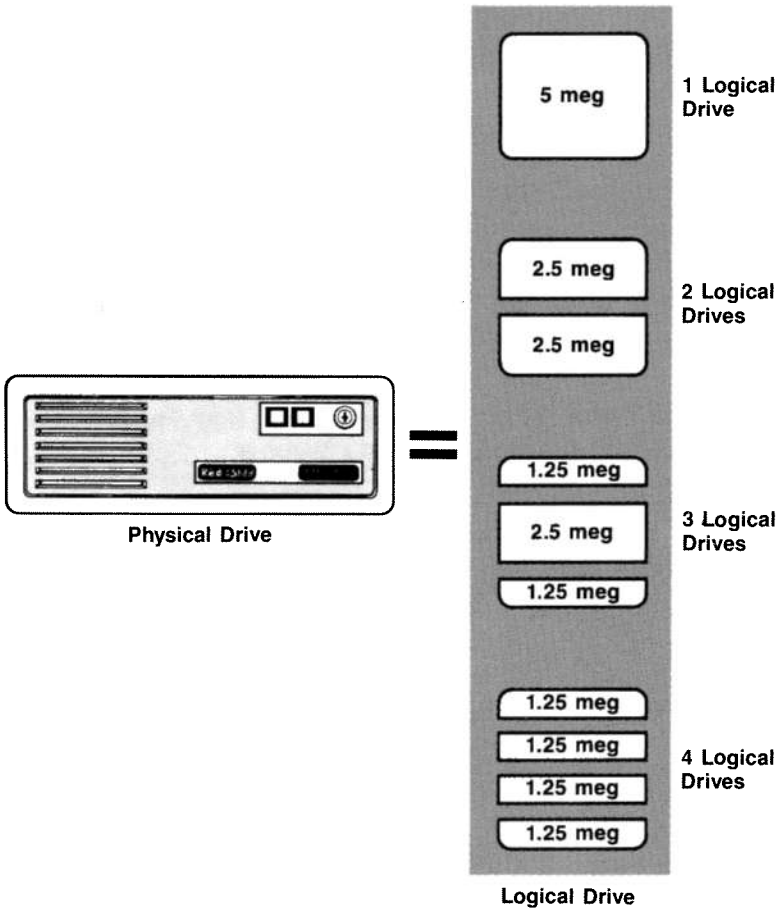

Figure 6. Physical v Logical Drives

Several factors may influence the number of logical drives you want:

- You can put similar files, such as all accounting data files, in one logical drive so that you can operate on them as a group. For example, you can back them up, without affecting the files in other logical drives.
- Some application programs require a certain number of logical drives.
- The maximum number of files any logical drive can have is 240.
- By putting a group of files in a logical drive, you can assign the files a master password that protects them from being erased or copied.

When partitioning a hard disk drive into logical drives, you must assign at **least** one read/write head to each logical drive, and you cannot assign parts of heads. Otherwise, you can assign the heads as you like. For example, you can assign Heads 1 and 2 to Logical Drive 1, and Heads 3 and 4 to Logical Drive 2. In this case, you have 1 physical drive and 2 logical drives.

Initialization Procedure

Before you begin the initialization, **turn off** your hard disk drives and locate the serial numbers on the bottom of the drives. Copy these numbers down exactly, including any punctuation. You will need the numbers during Step 4 below.

Now make a backup of the Hard Disk Initialization Diskette and store the original in a safe place. Use only the backup during the initialization; the HARDGEN program modifies the diskette, and using the backup ensures that you still have the master Initialization Diskette intact. (Refer to *Introduction to Your Disk System* for details on backing up diskettes.)

Note: Suggested responses to prompts given by the HARDGEN program are listed immediately following the initialization procedure. You may want to look at them before continuing.

1. Insert the write-enabled backup Initialization Diskette into Floppy Drive **0**, and reset the system.

   Note: Model 4 users: To reset the system, press the reset switch. Model 4P users: To reset the system at any time you have hard disks connected, press the reset switch and [F2].

   If you are prompted to enter the date and time, do so. The HARDGEN program starts automatically.

2. A prompt appears, asking if your system is ready. If you have properly connected your hard disk system, as described in Chapter 2, type **Y** [ENTER]. If not, type **N** [ENTER]. The system returns to `TRSDOS Ready` so that you can remove all diskettes, turn off the entire system, and connect the drives properly.

3. HARDGEN now asks for the number of floppy and hard drives in your system. Enter the appropriate numbers in response.

   Hint: If you think you might purchase more floppy drives in the future, you can enter a number greater than the number of drives you currently have connected. This applies only to floppy drives. You must enter the exact number of hard disk drives you have.

4. Now HARDGEN asks you to enter the serial numbers you obtained above. It asks for the numbers one at a time, beginning with the primary drive. Enter each complete serial number, in the correct order, including hyphens if present.

5. The initialization program also asks you to enter the amount of data you can store on the hard disk. This is the size of the disk; so type **5** (ENTER) for a 5-megabyte hard disk or **15** (ENTER) for a 15-megabyte hard disk.

6. The program then asks a series of four questions about the assignment of logical drives:

```
How many logical drives do you want to
have on your system?
```

HARDGEN displays a range of *m* to *n*. *m* is the minimum number of logical drives allowed (the number of hard disks + 1), and *n* is the the maximum number allowed. Specify the number of logical drives you want within this range.

```
How many floppy drives do you want to
use on your system?
```

HARDGEN displays a range of 1 to *n*, in which *n* is the number of floppy drives you specified in Step 3. If you wish to reserve more logical drives for hard disks, you may enter a number smaller than the number of drives you own. In this case, HARDGEN disables the unused floppy drives. You must, however, specify at least 1 floppy drive. Most applications require only 1 or 2 floppy drives when running hard disk drives.

```
Do you want to reserve a logical drive
for use with Memdisk? (Replying no
does not mean you cannot use Memdisk.
However, you may have to disable
another drive while using Memdisk.)
```

Your *Model 4/4P Disk System Owner's Manual* describes Memdisk. If you want to reserve a logical drive for Memdisk, type **Y** (ENTER). If not, type **N** (ENTER). As the prompt indicates, you can use Memdisk even if you type **N** (ENTER), but you may need to disable another **logical** drive to do so.

If, at this point, the number of logical drives is too small to satisfy the requirement of at least 1 logical drive per physical drive, the system instructs you to increase the total number of logical drives (maximum of 8) or reduce the number of logical devices assigned to other devices, such as floppy disk drives or Memdisk.

```
How many logical drives do you want to
use on your hard disks?
```

HARDGEN displays a range of numbers, which varies according to the numbers entered in response to earlier prompts. Enter a number in that range.

7. Now HARDGEN asks if you want to change any of your answers. If you are satisfied with the answers, type **N** (ENTER) to indicate no changes. If you want to change an answer, type **Y** (ENTER) so that the system returns to the logical drives prompt.

8. Most likely, at least 1 of your hard disk drives will be divided into 2 or more logical drives. HARDGEN can divide the space in 1 of 4 ways. It lists the methods and asks which you prefer:

   A) `Divide up the space as evenly as possible.`

   Where possible, HARDGEN tries to allocate the same amount of space for each logical drive. If, because of physical limitations, HARDGEN cannot do this, it informs you and asks you to choose a different option.

   B) `Give more space to the higher-numbered drives.`

   You may find this option useful for systems with large data bases, such as payroll and accounting packages. These systems need more space on the data disk drives. This option does not appear if the number of logical and physical hard disk drives is equal.

   C) `Give more space to the lower-numbered drives.`

   You may prefer this option for some software development systems.

   D) `Allows you to specify which read/write heads are to be assigned to each logical drive.`

   This option is useful if TRSDOS 6 and another operating system are to share the drives, or if other special circumstances exist. Do not use this option without first referring to Appendix B.

   `Which method would you prefer?`

   Enter the letter of your selection.

   After you choose A, B, C, or D, HARDGEN displays the normal steps being taken by the automatic allocation process. If certain conditions are encountered, the screen describes them.

If, during the allocation process, HARDGEN determines that a very large logical drive assignment would exceed the size limit imposed on a logical drive by TRSDOS 6, HARDGEN warns you. It is possible to reduce the likelihood of encountering this restriction if you are able to increase the number of logical hard drives to be assigned to the system or if you choose an even distribution (Option A).

Step 12 gives you the option to change the configuration; use it as often as necessary until you either have found a configuration that does not exceed the logical hard drive size limit or until you are satisfied that the limit cannot be avoided in your particular circumstances.

9. HARDGEN now displays a picture of your system, configured according to your instructions, including the logical drive numbers and a description of the space given to each. It asks:

```
Do you want a hard disk to be the
system device? <Yes or No>
```

If you want the TRSDOS Version 6 operating system stored on the hard disk, type **Y** (ENTER). If you want it stored on a floppy disk, type **N** (ENTER).

10. HARDGEN asks:

```
Do you want the Hard Disk Drives to be
searched first when the system is
looking for a file? <Yes or No>
```

Because TRSDOS can search the hard disk drives faster than it can the floppy disk drives, you may want to type **Y** (ENTER) in response to this prompt. If, for some reason, you want the floppy drives searched first, type **N** (ENTER).

11. If you chose to reserve a logical drive for Memdisk, HARDGEN now asks if you want to change the logical drive number it assigned to Memdisk.

If you type **Y** (ENTER), HARDGEN asks you for the new number. Enter the number. If you type **N** (ENTER), HARDGEN continues.

12. The screen displays the resulting configuration one last time and asks if it is acceptable.

The configuration shown on the screen tells you which logical drives are on each hard disk drive. If you have a printer connected and ready, and you want a printed copy of the system layout, press (CTRL)(:).

If the configuration is acceptable, type **Y** (ENTER). TRSDOS 6 begins the format and setup procedure. This takes a few minutes.

If the configuration is not acceptable, type **N** (ENTER) so that HARDGEN gives you 2 options:

```
A  Keep the configuration but reassign
   the logical drive numbers

B  Change the configuration
```

Typing **A** (ENTER) returns you to Step 9. Typing **B** (ENTER) returns you to Step 2.

13. For each logical drive that it formats, TRSDOS asks for a disk pack name and a master password. You may press (ENTER) to use the default values or enter the names of your choice.

    Note: HARDGEN may ask you to turn on the drives or to write-enable them. (See Chapter 3 for details.)

    The disk pack names default to the following:

HARDA	1st logical drive
HARDB	2nd logical drive
HARDC	3rd logical drive
:	
:	

    The master password defaults to PASSWORD.

14. The program also asks:

    ```
    Are you sure you want to format the
    hard disks?
    Any data on them will be erased.
    To proceed, type 'YES' and press
    <ENTER>
    ```

    To continue, type **YES** (ENTER).

    If you answer the prompt incorrectly, the system returns to `TRSDOS Ready`. To continue the initialization process, type:

    DO HDJCL (ENTER).

    Note: Once the formatting process begins, **do not stop** the initialization procedure. If you stop the initialization for some reason, you must start the entire procedure over with a **new** backup of the master Hard Disk Initialization Diskette.

15. When the formatting is complete, press (ENTER).

    If you specified the hard disk drive as the system drive, proceed to Step 16. If you specified another as the system drive, skip to Step 17.

16. Because you chose the hard disk drive as the system drive, TRSDOS asks you insert your Model 4/4P TRSDOS Diskette into Drive 0. Remove the backup Initialization Diskette and insert the TRSDOS Diskette. Press (ENTER). TRSDOS copies

system files from that system diskette to the hard disk. Then, it asks you to reinsert the backup of the Hard Disk Initialization Diskette. When you have done so, press (ENTER).

17. HARDGEN now creates the Boot Diskette from the backup diskette. When `TRSDOS Ready` appears, reset the system to boot up the hard disks.

    Note: If you did not make a hard disk the system drive, you are currently using an incomplete system disk (the Boot Diskette). After resetting your system to boot up the hard disks, replace the Boot Diskette with a complete TRSDOS System Diskette.

Before using your hard disk system, make several backups of your Boot Diskette and label them.

Suggested Responses

The following chart lists responses that you can enter at the prompts during initialization. These responses set your hard disk system to a configuration that most applications can use.

HARDGEN Prompt	Number of Drives on Your System			
	1 floppy 1 hard	2 floppy 1 hard	1 floppy 2 hard	2 floppy 2 hard
How many floppy drives are connected to your system? <1 to 4>	1	2	1	2
How many hard disks are connected to your system? <1 to 4>	1	1	2	2
What is the serial number of the Primary hard disk? (The Primary drive has the keyswitch on the front) >	*serial number*	*serial number*	*serial number*	*serial number*
What is the serial number of the first secondary hard disk? (If you have more than one secondary drive, look on the back of the primary drive and follow the cable that is connected to the ''Data Out A'' jack) >	—	—	*serial number*	*serial number*
How many logical drives do you want to have on your system? <*m* to *n*>	8	8	8	8
How many floppy drives do you want to use on your system? <1 to *n*>	1	2	1	2
Do you want to reserve a logical drive for use with the Memdisk? (Replying no does not mean you cannot use Memdisk. However, you may have to disable another drive while using Memdisk.) <Yes or No>	N	N	N	N
How many logical drives do you want to use on your hard disks? <*m* to *n*>	4	4	4	4
Do you want to change any value? <Yes or No>	N	N	N	N
Which method would you prefer?	A	A	A	A
Do you want a hard disk to be the system device? <Yes or No>	Y	Y	Y	Y
Do you want the Hard Disk Drives to be searched first when the system is looking for a file? <Yes or No>	Y	Y	Y	Y
Is the configuration acceptable? <Yes or No>	Y	Y	Y	Y

Operating Your Computer as a Hard Disk System

Start up or reset the computer with the Boot Diskette in Floppy Drive Ø. When TRSDOS Ready appears, type this command:

DIR :4 (ENTER)

TRSDOS shows a directory of the files contained on your Boot Diskette (assuming that your first floppy drive is Logical Drive 4, as determined in your configuration). Type:

DIR :Ø (ENTER)

TRSDOS shows a directory of the hard disk system's Drive Ø (assuming that your primary hard disk is assigned as logical Drive Ø).

This is what happens:

1. When you first turn on or reset the computer, it knows only about Floppy Drive Ø. It goes to Floppy Drive Ø to find an operating system.

2. In Floppy Drive Ø, it finds your Boot Diskette. This diskette contained a logical drive configuration file.

   The configuration file tells the computer the number of hard disk drives and floppy drives on your system. It also tells it the location of the logical drives and the amount of storage space each logical drive contains.

3. The computer searches the primary hard disk drive for an operating system. If the hard disk is turned off or disconnected, an H appears in the upper right corner of the screen. If the hard disk is on but not yet ready to perform an operation, a blinking H appears. When the drive is ready, the H disappears and the system begins using the hard disk.

4. There the system finds TRSDOS, displays the TRSDOS Ready prompt, and executes your commands.

   With your system configured as a hard disk system, you can now remove your Boot Diskette. The computer continues to use the hard disk system's drive numbers until you turn it off or reset it. You can use the DEVICE command to display the configuration of your system. (See *Model 4/4P Disk System Owner's Manual.*)

Operating Your Computer as a Floppy Disk System

The computer operates as a hard disk system only because the configuration file tells it to do so. To operate it as a floppy disk system, do either of the following:

- Remove the Boot diskette from Floppy Drive Ø and insert any other operating system diskette. Reset the system. (Only the Boot Diskette contains the hard disk configuration file.)

- Leave the Boot Diskette in Floppy Drive Ø but tell the computer to ignore its configuration file. To do this press (CLEAR) and hold it down while resetting the system and waiting for TRSDOS Ready to appear. (If you are starting up the computer, hold down (CLEAR) after you enter the date.) If you didn't do this correctly, try it again.

  Remember: The Boot Diskette does not contain a complete operating system.

  See the BOOT and SYSGEN library commands in the *Model 4/4P Disk System Owner's Manual* for more information.

To see that your system is now a floppy disk system, type (at TRSDOS Ready):

DEVICE (ENTER)

TRSDOS displays the physical devices and their assigned logical device numbers. Type:

DIR :Ø (ENTER)

TRSDOS displays a directory of the diskette in Floppy Drive Ø.

Note: If your system is still responding as a hard disk system, you probably did not press (CLEAR) long enough. Try again.

Chapter 5
Using Application Programs

If you wish, you can use your Model 4/4P application programs just as you always have. Simply start up your system with the application program diskette, rather than the Boot Diskette. Follow the steps outlined in the application manual.

Moving Your Programs to Hard Disk

A much better option is to move your Model 4 application programs to the hard disk. You can do this using the COPY command or BACKUP command. (For more information on the parameters available with these commands, see your *Model 4/4P Disk System Owner's Manual.*)

The COPY Command

The syntax for the COPY command is:

COPY *source* [TO] *destination* [(*parameters*)]

Use the COPY command only if you know the names of the files you want to copy to the hard disk. For example, to copy a file called MYACCTS/BAS to the hard disk, the command might be:

COPY MYACCTS/BAS:4 :0 (ENTER)

This example assumes that Logical Drive 4 is a floppy drive and Logical Drive **Ø** is a hard disk drive. Use drive numbers that correspond to your system.

The BACKUP Command

The syntax for the BACKUP command is:

BACKUP [*partspec*] [:*source drive*] [TO]
[:*destination drive*] [(*parameters*)]

Use the BACKUP command to copy all the files from one disk to another. For example, to move all the user files that do not already exist on the hard disk, the command might look like this:

BACKUP :4 :Ø (NEW,INV) (ENTER)

This example assumes that Logical Drive 4 is a floppy drive and Logical Drive **Ø** is a hard disk drive. Use drive numbers that correspond to your system.

To run the application program, follow the instructions in your *Model 4/4P Disk System Owner's Manual.*

Backing Up a Hard Disk

To safeguard the information stored on hard disk, you should periodically make a backup copy on floppy diskettes. To do so, follow these steps:

1. Start up or reset the computer with the Boot Diskette.

2. Look at the directory of the hard disk to determine the total amount of space taken by the files on that disk. To do this, type the DIR command followed by the hard disk drive number and then (I,S). This command, for example, displays the total space consumed by the files on Logical Hard Disk Drive 1:

   DIR :1 (I,S) (ENTER)

   At the bottom of the display is the message Space = followed by the space taken by the files (in kilobytes, or "kbytes").

   Note: Look at the File Size column on the display. If any individual file exceeds 174K bytes, you need to use HDCOPY4, instead of BACKUP, to copy that file. When backing up the other files, use the QUERY option of BACKUP to skip that file. (See Chapter 6 of this manual for information on HDCOPY4. See your *Model 4/4P Disk System Owner's Manual* for information on QUERY.)

3. Calculate the number of TRSDOS-formatted floppy diskettes you need. To do this, divide the "total space consumed" figure by 174. (A newly formatted floppy diskette can hold about 174K or 178,176 bytes.) Round the result to the next higher whole number.

   For example, if the Space = message shows the total space to be 435K, you need 3 floppy diskettes:

   435 / 174 = 2.5 (rounded off = 3)

4. Format the number of floppy diskettes you need and one extra in case of a problem. Then place one of the write-enabled, formatted diskettes in a floppy drive. Enter the BACKUP command. The following command copies each file on *source drive* to the floppy diskette in *destination drive*:

   BACKUP *source drive destination drive* (ENTER)

The message `Backup - reconstruct invoked` appears on the screen. The screen shows the name of each file as it is being copied.

5. When the floppy diskette becomes full, TRSDOS asks you to insert a newly formatted diskette. Remove the diskette currently in the destination drive, insert a blank formatted diskette, and press (ENTER).

   When `TRSDOS Ready` appears, the BACKUP is complete.

   Note: It is not unusual for a file to use less space on a floppy diskette than on a hard disk.

Chapter 6
Copying and Restoring Large Files

Sometimes a hard disk file is too large to fit on one floppy diskette. For this reason, TRSDOS has a utility called HDCOPY4/BAS that transfers a large hard disk file onto several floppy diskettes.

Copying a File with HDCOPY4

Before copying a hard disk file, be sure that you have enough write-enabled, TRSDOS-formatted diskettes to receive the file. (It is a good idea to have one extra, in case one is flawed.) See Chapter 5 for information on calculating the number of diskettes you need.

After formatting the diskettes, you can run the HDCOPY4 utility, which is actually a BASIC program:

1. Type:

   BASIC HDCOPY4/BAS (ENTER)

   HDCOPY4 displays its main menu:

   ```
   HARDCOPY-Disk file Backup Utility -
   for TRSDOS 6.1.1 or later - mmddyy
   Copyright (C) 1983 by
   Logical Systems, Inc.

      <C> Create Backup copy
      <R> Read in Backup copy
      <@> to Exit

      Your Selection ?
   ```

   Type **C** (ENTER).

2. HDCOPY4 asks you to enter the source drive. Enter the number. If, for example, the disk file you want to copy is on Hard Disk Drive 1, type:

   1 (ENTER)

3. HDCOPY4 then asks you to enter the destination drive. Place a write-enabled, TRSDOS-formatted diskette in Floppy Drive 4 and type:

   4 (ENTER)

4. HDCOPY4 asks for the filespec of the file to be copied. Enter the name, including its extension and password, if any, but excluding the drive number. For a file called TEST/BAS, for example, type:

   TEST/BAS (ENTER)

   HDCOPY4 copies the file, displaying the number of records it copies.

5. When the floppy diskette is full, HDCOPY4 displays:

   ```
   DESTINATION disk is FULL - insert new
   disk and hit <ENTER>
   ### SOURCE errors detected and marked
   ```

   (The second line appears only when a source error has occurred.)

   Remove the floppy diskette, insert a new one, and press (ENTER). HDCOPY4 continues until all records are copied.

   Each time you insert a floppy diskette, HDCOPY4 checks the diskette and displays an error message if any problem exists.

When finished, HDCOPY4 lets you know if it found any defective records. It then returns you to the main menu. Press (@) to return to `TRSDOS Ready.`

You now have a backup of your hard disk file. Number and label each floppy diskette with the date and the name of the file.

The backup file cannot be used while it is on floppy diskettes. It must be restored to hard disk. Because the file is on more than one diskette, you cannot restore it in the normal way. Instead, use the READ option of HDCOPY4. This option is discussed in the next section.

Restoring a File With HDCOPY4

To restore a multiple-diskette file to its original state on the hard disk, use the Read in Backup option of HDCOPY4 as follows:

1. Load the HDCOPY4 utility. At the main menu, type **R** (ENTER).

2. HDCOPY4 asks you to enter the source drive. Insert the first diskette of the backup file into a floppy drive and enter that drive's number.

3. HDCOPY4 asks you to enter the destination drive. Enter the number of the hard disk drive to which you want to restore the file.

4. When asked for the filespec, enter the backup file's name exactly as you entered it to create the backup. HDCOPY4 begins moving each record in the file, checking each record as it moves it.

5. After copying each diskette, HDCOPY4 asks you to insert the next. You can copy the diskettes in any order. HDCOPY4 places all the records in their proper location. Press (ENTER) after inserting each diskette.

When finished, HDCOPY4 returns to the main menu. Press (@) to return to `TRSDOS Ready`.

HDCOPY4 Errors

Below are error messages you might see while using HDCOPY4:

`DESTINATION disk I/O error.` The record indicated by the number displayed contains an error. You can continue the copy by pressing (ENTER). However, HDCOPY4 does not copy any record that contains an error. To stop the copy, press (@).

`DESTINATION disk is flawed - Copy suspended.` HDCOPY4 cannot use the destination diskette. Remove the diskette and insert another. Press (ENTER); the copy restarts at the current block of records. To stop the copy, press (@).

`File not on SOURCE drive - <ENTER> to continue.` The source drive does not contain the file you specified. Perhaps the file has a password or extension that you didn't enter. To return to the main menu, press (ENTER).

`SOURCE disk I/O error.` The record indicated by the number displayed contains an error. You can continue the copy by pressing (ENTER). However, HDCOPY4 does not copy any record that contains an error, but marks it as not copied in the destination file. To stop the copy, press (@).

`SOURCE file is empty - <ENTER> to continue?` The file exists but contains no records. Press (ENTER) to return to the main menu.

`Unacceptable File Name.` You entered a filename that included a drive number. HDCOPY4 asks you to enter the filespec again, without the drive number.

If a source or destination I/O error occurs during HDCOPY4, the record in which the error occurred is not copied. HDCOPY4 marks it as noncopied in the header record of the destination diskette and the copy may be continued.

An experienced programmer can reconstruct this data. The information below gives the layout of the header record that should be used for this purpose. This information should be sufficient for an experienced programmer.

Header Block

The first record of every destination disk contains a block of information arranged as described below:

	Bytes	Description
*	1 - 2	disk number in the copy set
	3 - 14	filename/ext
	15 - 31	time and date of copy, BASIC TIME$ format
*	32 - 33	ending record number (original source file)
*	34 - 35	first source record (destination diskette)
*	36 - 37	last source record (destination diskette)
*	38 - 39	end of file offset (original source file)
	40 - 45	ASCII representation of a random number
*	46 - 47	Logical Record Length (source file)
	48 - 128	currently unused
*	129 - 256	defective source file record numbers

* These fields are stored as compressed integers with the BASIC MKI$ function.

Description

If any records are bad, TRSDOS stores their numbers as integers (2-byte fields) starting at Byte 129 in the header block. The corresponding record of the destination file is marked with the message HDCOPY4-BAD SECTOR.

To locate the bad record, determine the offset into the file by subtracting the starting record number (fifth field) from the bad record number. Add 1 because the first record always contains the header information. For example, if Record 140 is bad, and the diskette contains the block of Records 100 to 300, the bad record is the 41st record in the file:

140 − 100 = 40 + 1 (header) = 41st record

To repair the record, determine the original contents of the defective source file record; then write this information to the proper record on the destination disk.

After the record is repaired, write zeroes over the bad record indication in the header (Bytes 129-256). Follow this procedure again for each bad record.

If you do not correct all the records, the remaining 2-byte record numbers should be moved to the front of the field, starting at Byte 129.

Chapter 7
Problems and Error Messages

If you try to remove a diskette while the drive-access light is on, your computer system might "hang up." If this happens, and you want to continue the operation, reinsert the diskette and close the drive door. Then press (SHIFT) and (BREAK) at the same time. If this doesn't work, reset the system.

Boot Errors

Listed below are error messages the system might display upon startup. If you see an error message that is not on this list, it is one of the following:

- A message from your application program. See your application program manual.
- A message from the individual TRSDOS command, utility, or feature you are using. If the message is not self-explanatory, see the individual command listing in the *Model 4/4P Disk System Owner's Manual*.
- A message that is unique to the Model 4P. See Appendix B of *Introduction to Your Model 4P Disk System*.

`Boot Error.` The disk from which you tried to boot is blank or inserted incorrectly. Also check to see that the power is turned on to all parts of the system and that the drive door is closed.

`Cannot boot, DATA DISK!` You are trying to boot your system with a data disk instead of a system disk.

`Disk Error.` An error occurred during the loading of the operating system. Try again. If the problem recurs, try a different diskette.

`Error` *nn*`.` Part of the operating system could not be loaded during boot. Try using a different diskette.

`H.` There is a problem with the hard disk. If the H is not flashing, the hard disk drive is turned off or disconnected. If the H is flashing, the drive has not yet reached its operating speed. When the drive is ready, the H disappears.

`No System.` You are trying to boot your system with a data disk instead of a system disk.

`Not a system disk.` You are trying to boot your system with a data disk instead of a system disk.

If no message appears and the system does not load, check to be sure that there is a system or boot disk in Drive Ø. Also see that the disk is inserted correctly and that the drive door is closed.

Appendix A
Initializing Your System Manually

As stated in Chapter 4, the HARDGEN program sets up a system configuration using specific patterns. Because these patterns are limited, you may want to manually initialize from `TRSDOS Ready`. Before attempting to use this procedure, read this appendix and Appendix B completely. Appendix B describes an alternate initialization procedure, the head-by-head assignment option of HARDGEN, which you may find simpler and better suited to your purposes. Also, be sure you have backups of your TRSDOS diskette, Hard Disk Initialization Diskette, and any information on your hard disk drives.

Before beginning the manual initialization, **turn off all equipment,** and obtain the Media Error Map from the bottom of each hard disk drive. You will need this information when you run the formatting program.

For more information on some of the commands used in this appendix, refer to your *Model 4/4P Disk System Owner's Manual*.

Overview

Using manual initialization, you can separate each physical hard disk drive into logical drives, or *partitions*.

In addition, you can determine the size of each logical drive by selecting the number of read/write heads to assign to it. On a 5-megabyte hard disk, each head adds 1.25 megabytes to the size of the drive. On a 15-megabyte hard disk, each head adds 2.50 megabytes. You can assign as many as 4 heads to each logical drive.

For example, a 15-megabyte hard disk user might allocate Heads 1 through 4 to Logical Drive 1, making it a 10-megabyte drive, and Heads 5 and 6 to Logical Drive 2, making it a 5-megabyte drive.

To configure your hard disk manually, you must do the following:

1. Set up the logical drives. (Specify their numbers and sizes.)
2. Format the drives.
3. Move the operating system to the hard disk.
4. Make the hard disk the system device.
5. Store the configuration on the Boot Diskette.

Procedure

The entire initialization procedure is covered step-by-step in the sections that follow. Notice that if you do not want to use a hard disk as the system disk, you will perform only the first two operations and a SYSGEN command. This is explained in detail in "Using Hard Disks as Data Drives."

Setting Up the Logical Drives

Using a backup copy of the Hard Disk Initialization Diskette, reset your system while holding down (ENTER). Then, for each logical drive that you wish to set up, enter the SYSTEM library command and answer the questions presented. The syntax for SYSTEM is:

SYSTEM (DRIVE=*n*,DISABLE,DRIVER="TRSHD6")

n specifies the **logical drive to set up.** It is a number in the range 1 to 7.

SYSTEM displays the following prompts, one at a time. Answer each according to your configuration needs.

Note: Pressing (BREAK) in response to any question causes the SYSTEM command to exit, and returns you to `TRSDOS Ready`.

1. `Enter drive select address <1-4>`

   Enter the number of the physical hard disk drive that is to contain the logical drive specified in the command line. Addresses 1 through 4 correspond to the primary hard disk drive through the third secondary hard disk drive, respectively.

2. `Enter total number of heads on drive <1-8>`

   If the physical drive to be used is a 5-meg, type **4** (ENTER). If it is a 15-meg, type **6** (ENTER). (Note: If you have run SYSTEM before, and have already assigned some of the heads on this hard disk, this prompt is skipped.)

3. `Enter physical tracks per surface:`

   5-meg users, type **153** (ENTER). 15-meg users, type **306** (ENTER). (Note: If you have run SYSTEM before, and set up a logical drive on this disk, this prompt is skipped.)

4. `Enter step rate for drive:`

   SYSTEM asks this question only for the first logical drive assignment on a hard disk system. Type **.01** (ENTER).

5. `Heads already in use <.-.-.-.-.-.>`
   `Enter number of heads for partition <1-n>`
   `Enter starting head:`

   If you have already set up any logical drives on the physical drive being partitioned, SYSTEM displays the heads already allocated. You can now enter the heads to allocate to the logical drive currently being set up. Keep in mind that a logical drive cannot span 2 physical drives.

   In addition, enter the head at which to start the logical drive. We recommend that you start with 1 and work up to the higher-numbered heads. For example, if you have assigned Heads 3 and 4, SYSTEM displays:

   ```
   Heads already in use <.-.-3-4>
   Enter number of heads for partition
   <1-2>
   Enter starting head:
   ```

   If you are assigning 1 head, you can specify either Head 1 or 2. However, if you are assigning 2 heads, you must specify Head 1.

   Specifying heads that are in use or specifying a starting head that causes an overlap of existing assigned heads is not allowed. Doing so causes the following message to appear:

   ```
   Heads requested conflict with heads
   in-use!
   ```

   In the event of such an error, SYSTEM asks you for the correct head number. If you specify 4 heads and the drive has only 4 heads available, SYSTEM does not ask for a starting head.

Repeat the SYSTEM command as necessary until you have assigned all read/write heads.

Formatting the Hard Disk Drive

Your Hard Disk Initialization Diskette contains a program called TRSFORM6/CMD that formats a logical drive set up with the SYSTEM command. You must run TRSFORM6 once for each logical drive you created.

To run the program, type:

TRSFORM6 (ENTER)

TRSFORM6 asks the following questions:

Note: Pressing (BREAK) as a response to any of the prompts causes program to exit, and returns you to `TRSDOS Ready`.

1. `Which drive is to be used ?`

   Enter the logical drive number (1-7) you assigned with the SYSTEM command.

2. `Disk Pack name?`

   Enter a disk pack name for the logical drive. The name can have from 1 to 8 alphanumeric characters, the first of which is a letter.

3. `Master Password?`

   Enter the master password you want assigned to the logical drive. The password can have from 1 to 8 alphanumeric characters, the first of which is a letter. For hard disks, we recommend you use a password other than PASSWORD. This keeps you from inadvertently reformatting the disk.

   If you have previously formatted the hard drive, TRSFORM6 displays this message:

   ```
   Disk contains data -
   Name=diskname Date=mm/dd/yy
   Enter its Master Password or
   <BREAK> to abort:
   ```

   This is the last point at which you can stop the formatting. The system asks for the master password, even if it is PASSWORD. Answer the prompt accordingly. To stop the process, press (BREAK).

4. `Lock out track manually <Y/N>?`

   If you wish to lock out flawed tracks so that the operating system never tries to write to them, type **Y** (ENTER). If you do not wish to do so, type **N** (ENTER), and TRSFORM6 proceeds to Step 5.

   If you type **Y** (ENTER), TRSFORM6 displays these prompts:

   ```
   Enter physical head number <m-n>
   Enter physical track number <1-n>
   ```

Refer to the Media Error Map that contains the information for the logical drive specified in Step 1. Enter information for one track at a time. Enter the head number in the range *m* to *n*, in which *m* is the starting head of the logical drive, and *n* is the ending head. Enter the track number in the range 1 to *n*, in which *n* is the ending track of the logical drive.

After you respond to the prompts, TRSFORM6 asks if you want to lock out more tracks. If you do, type **Y** (ENTER). If not, type **N** (ENTER).

5. TRSFORM6 now formats and verifies the logical drive. The verification takes longer than it does on a floppy diskette, because the hard disk has more storage to check.

   When finished formatting, TRSFORM6 puts the directory information on the logical drive.

Using Hard Disks as Data Drives. Most likely, you will want to put TRSDOS on a hard disk to make that disk the system drive. If, however, you do **not** want to put TRSDOS on hard disk (you want to use all hard disks as data disks), type the following command now:

SYSGEN (ENTER)

This command stores the system's drive configuration on the Initialization Diskette in Drive **0**.

To access the data on the hard disk, you must boot the system with this Initialization Diskette. Therefore, make several backups of the diskette immediately. If you lose all copies of the diskette, perform the initialization again, but omit the formatting.

If you are using the hard disks as data drives, you are finished with the initialization. Do **not** do the steps that follow.

Moving TRSDOS Version 6 To Your Hard Disk

If you want the hard disk to be the system drive, you must perform the rest of the initialization. This includes moving TRSDOS to hard disk, making the hard disk the system device, and storing the configuration on the boot diskette.

To move TRSDOS to your hard disk, follow these steps:

1. Insert a **backup** of the **master** Hard Disk Initialization Diskette into Floppy Drive **0**.

2. Use BACKUP to move the TRSDOS system files from that diskette to your hard disk. Type:

   BACKUP :Ø :*hd* (S,I) (ENTER)

   hd is the logical drive number associated with the first head of the primary hard disk drive.

3. Remove the Initialization Diskette from Floppy Drive Ø, and insert the TRSDOS 6.2 System Diskette. Close the drive door, and type:

   BACKUP :Ø :*hd* (S,I,NEW) (ENTER)

   hd is the same as in Step 2. This command moves those files not present on the Initialization Diskette to the primary hard disk drive, making the hard disk system a complete TRSDOS 6 system.

When the backup is complete, remove the TRSDOS diskette and reinsert the write-enabled backup of the Initialization Diskette. Proceed to "Making the Hard Disk the System Device."

Making the Hard Disk the System Device

With the backup Initialization Diskette in Floppy Drive Ø, tell TRSDOS to look for the operating system on Hard Disk Drive *hd*. To do so, enter this command:

SYSTEM (SYSTEM=*hd*) (ENTER).

Again, *hd* is the logical drive number associated with the first head of the primary hard disk drive. From now on, TRSDOS accesses the first hard disk—rather than the floppy disk drive—as Logical Drive Ø.

Storing the Configuration on the Boot Diskette

Now store the configuration file on the Boot Diskette. To do this, enter this command:

SYSGEN (DRIVE=*fd*) (ENTER)

fd is the new logical drive number of the first floppy drive (the one that contains the Hard Disk Initialization Diskette). Because you swapped system drives in the previous section, *fd* is the same number you gave as *hd* earlier.

This command tells TRSDOS to write the configuration file on the floppy diskette in Drive *fd*. The Initialization Diskette now becomes your Boot Diskette.

Using the TRSDOS JCL for Hard Disk Drive Setup

At the beginning of the initialization procedure, you set up the logical drives by responding to prompts one at a time. If you wish, you can instead create a JCL file that contains responses to the setup prompts. We recommend you use the file only once—the first time you set up a logical disk drive. This is because some prompts may be skipped later, and the JCL responses must correspond to the prompts for which they are intended.

Here is an example JCL file:

```
SYSTEM (DRIVE=4,DISABLE,DRIVER="TRSHD6")
1
4
153
.01
2
1
```

This file specifies that Logical Drive 4 is to be set up on Physical Drive 1. That physical drive contains 4 read/write heads and 153 tracks per surface. It has a step rate of .01 milliseconds. The file allocates 2 heads to Logical Drive 4, starting with the first head (Head 1).

Note: If you make a mistake in your JCL file, you may have to reset the computer and begin again.

Appendix B
Initializing with HARDGEN's Option D (Head-by-Head Assignment)

This appendix describes the way to use Option D of the allocation menu of the HARDGEN program. Before attempting to use this option, you should be familiar with the TRSDOS 6 operating system and its initialization procedures. You should also have analyzed your system requirements.

The major purpose of Option D is to allow programmers to configure a TRSDOS 6 hard disk system to their requirements when no other HARDGEN option enables them to do so.

Option D produces a JCL file that performs the initialization. It also produces a small file that provides an audit trail of the system configuration on initialization.

Option D does **not** check on the suitability of every data item that you enter. It is up to you to determine that everything is in order before going on to the initialization.

Two sample uses of Option D are given at the end of the appendix.

Procedure

Follow Steps 1 through 8 of the HARDGEN program. At Step 8, choose Option D; then follow the steps below:

9. HARDGEN prompts you with a warning, to prevent the accidental use of Option D, followed by the question:

   ```
   Are you sure you wish to continue
   <Yes or No>
   ```

   If you are prepared to continue, type **Y** (ENTER) and continue to Step 10 below. If not, type **N** (ENTER), and HARDGEN returns to Step 8.

10. HARDGEN displays another warning. Press the space bar to continue. The program asks you to define the type of physical device to which each of the 8 possible logical drives is to be assigned.

Answers must be in the range Ø to 3. Give answers that reflect the way you want your system set up:

Ø for drive slots to remain unassigned
1 for logical drives to be assigned to floppy
2 for logical drives to be assigned to hard disk
3 to reserve a logical drive number for Memdisk use

If responses are not in the correct range, HARDGEN displays the word `What.` This prompt gives you the chance to correct the error.

From Step 6, HARDGEN already knows the number of logical drives that you intend to have for each purpose. Therefore, if you try to assign more drives to a type than previously indicated, it displays the message `Too many.`

11. HARDGEN asks you for the head-by-head assignment of each logical hard drive. For each drive, it asks for the physical drive number, the number of the head on which the logical drive starts, and the number of heads to be used:

    `Which Physical drive?`

    Enter the number of the physical drive to contain the logical drive. The number must be in the range 1 to *n*, where *n* is the number of physical hard drives. Numbers 1 through 4 correspond to the primary hard disk drive through the third secondary hard disk drive, respectively.

    `Which Starting head?`

    Enter the number of the head at which to start the logical drive. The number must be in the range 1 through *n*, where *n* is the number of heads on the hard drive.

    `How many heads to use?`

    Enter the number of heads to allocate to the logical drive. You cannot allocate more than 4 heads to the drive. Other than that, you can allocate as many heads as you want, from the starting head to the ending head of the logical drive. For example, if the starting head is Head 2, you can use as many as 3 heads, which are Heads 2, 3, and 4.

    If you have a 15-megabyte hard disk, the disk has 6 read/write heads per physical drive. Since you can allocate only 4 heads to each logical drive, allocate the 2 extra heads to second logical drive.

Note: If, in Step 10, you assigned Logical Drive 0 as a hard drive, use the primary hard disk drive and the first head on it as responses to the first two prompts in Step 11. Any other assignment produces an error, and HARDGEN gives you the opportunity to reassign. If you specify a head assignment that appears to be in conflict, HARDGEN displays an `Overlap` message. This means that either a previous assignment or the current assignment is incorrect.

Be sure the data you enter is appropriate for your circumstances. The program does not check your entries. If you enter bad data, you may get a program error, such as `Subscript out of range`, or you may see a strange screen in Step 12.

12. HARDGEN asks you to press any key to continue. Press the space bar. HARDGEN now displays a picture of the system as you have defined it.

    Check to be sure the system meets your requirements. At this point, you have the option of correcting any discernable errors or of continuing to the initialization. You can also try any other system configuration for comparison, if you think there is more than one way to configure the system to suit your needs.

    Only when you are satisfied that the system is workable and acceptable to you should you type **Y** (ENTER) in response to the question `Is the configuration acceptable?` If you are not satisfied, type **N** (ENTER) to return to Step 2.

13. Option D now rejoins the main HARDGEN program at its Step 13. It displays a screen that reminds you that you used Option D, and it produces the audit trail file README/PCM. Otherwise, the screens and instructions from here on out are identical to those in the main program. The JCL instructions that are appropriate for your particular configuration are generated and should execute without error.

Example #1

Note: The examples in this appendix are not intended to be either exhaustive or accurate in every respect. They are intended only as a general guide for programmers with special configuration needs. It is fully expected that those using Option D will adhere to good data processing practice and use extreme caution until satisfied that the system will run satisfactorily.

Assume that you have two 5-megabyte hard disk drives on which to store an application program's data. You analyze the storage requirements, and find that 4 logical hard drives need to be available under TRSDOS 6, and the first and second logical drives must be at least 3 megabytes each.

If you use Option C at Step 8 of the HARDGEN program, it allocates all the primary hard disk's space to Logical Drive **Ø**. Thus, it **does** produce a Logical Drive **Ø** that has the necessary 3 megabytes. However, it allocates the secondary disk's space to 3 logical drives: Logical Drive 1 (2 heads), Logical Drive 2 (1 head), and Logical Drive 3 (1 head). Thus, Drive 1 has 2.5 megabytes, **not** the necessary 3 megabytes. Under the given circumstances, the system produced is not acceptable.

In fact, the only way to produce an acceptable system is to use Option D as described below:

Follow HARDGEN Steps 1 through 5 as usual.

6. Respond to the prompts as indicated:

Prompt	Response
`How many logical drives do you want to have on your system?`	**6** (ENTER)
`How many floppy drives do you want to use on your system?`	**2** (ENTER)
`Do you want to reserve a logical drive for use with Memdisk?`	**N** (ENTER)
`How many logical drives do you you want to use on your hard disks?`	**4** (ENTER)

7. If you have entered the information correctly, type **N** (ENTER) to indicate that you don't want to make any changes.

8. Choose Option D, and type **Y** (ENTER) to continue.

9. Press the space bar to continue to the prompts for drive use. When prompted for the type of device to which to assign each of the 8 possible logical drives, type:

   2 (ENTER)
   2 (ENTER)
   2 (ENTER)
   2 (ENTER)
   1 (ENTER)
   1 (ENTER)
   0 (ENTER)
   0 (ENTER)

   These answers assign Logical Drives 0 through 3 as hard drives, Logical Drives 4 and 5 as floppy drives.

   Logical Drives 6 and 7 are unassigned and are available for any future use except hard disk use. Therefore, if you later wish to use one of them for Memdisk, you can do so.

10. When asked for the head-by-head assignment, respond to the prompts as indicated:

Prompt	Response
Which Physical drive?	**1** (ENTER)
Which Starting head?	**1** (ENTER)
How many heads to use?	**3** (ENTER)
Which Physical drive?	**2** (ENTER)
Which Starting head?	**1** (ENTER)
How many heads to use?	**3** (ENTER)
Which Physical drive?	**1** (ENTER)
Which Starting head?	**4** (ENTER)
How many heads to use?	**1** (ENTER)
Which Physical drive?	**2** (ENTER)
Which Starting head?	**4** (ENTER)
How many heads to use?	**1** (ENTER)

These responses make:

- Logical Drive 0 (3.75 megabytes) the first 3 heads on the primary hard drive.
- Logical Drive 1 (3.75 megabytes) the first 3 heads on the secondary hard drive.

- Logical Drive 2 (1.25 megabytes) the last head on the primary drive.

- Logical Drive 3 (1.25 megabytes) the last head on the secondary drive.

Study the display to be sure you entered the correct data. Then press the space bar to continue.

11. Type **Y** (ENTER) if the configuration is acceptable.

To complete the initialization, follow Steps 13 through 16 of the main HARDGEN program.

Example #2

Assume that TRSDOS and CP/M* are to share a system that has two 5-megabyte hard drives and one 15-megabyte hard drive that is terminated as the last physical hard drive.

Three restrictions are imposed by both TRSDOS and CP/M:

- The two systems cannot be on the same physical hard drive.

- TRSDOS 6 must occupy the primary drive so that you can boot TRSDOS as the system hard drive.

- A hard drive for CP/M must be previously formatted under LDOS† or TRSDOS 6 because CP/M does not have a format routine for the hard drive.

Suppose you analyze the storage requirements under TRSDOS and CP/M and decide that you need the following:

- At least 15 megabytes of storage under TRSDOS, on 2 physical drives, in 7 logical drives with a distribution that is as even as possible.

- At least 5 megabytes of storage under CP/M, on 1 logical hard drive.

These storage requirements imply that the second of the 3 drives will be the one to contain CP/M.

* CP/M is a registered trademark of Digital Research.

† LDOS is a trademark of Logical Systems, Inc.

If TRSDOS needed only 6 logical hard drives, and if an even spread were not critical, you could do the following:

1. Use normal HARDGEN procedures to set up the system as a TRSDOS-only system.

2. Use SYSTEM (DRIVE=*n*,DISABLE) to disable the logical drive(s) associated with the second physical hard drive.

3. Use SYSGEN (DRIVE=*fd*) to reconfigure the boot disk.

This, however, is not the case, so you must use Option D. Details follow for first the CP/M part of the system and then the TRSDOS part of the system.

CP/M Initialization

Follow Steps 1 and 2 of the main HARDGEN routine.

3. Enter 1 for the number of floppy drives and 3 for the number of hard drives. (General rule: Answer the hard drive question with the true number.)

4. Enter the appropriate serial numbers.

5. Enter the drive size, if asked for it.

6. HARDGEN requires that you reserve as many logical drives for hard drive use as there are physical drives in the system. Therefore, respond to the prompts as indicated:

Prompt	Response
`How many logical drives do you want to have on your system?`	**5** (ENTER)
`How many floppy drives do you want to use on your system?`	**1** (ENTER)
`Do you want to reserve a logical drive for use with Memdisk?`	**N** (ENTER)
`How many logical drives do you want to use on your hard disks?`	**4** (ENTER)

(General rule: You need to have at least as many logical hard drives as there are physical drives, but no more than the number of heads to be formatted by TRSDOS 6 for CP/M use. For example, with 3 physical hard drives, the attempted assignment of only 1 logical hard drive is not allowed, and, because this example uses one 5-megabyte drive for CP/M, you do not want to format 5 heads, so the assignment of 5 logical drives would be a waste of time.)

7. If you have entered the information correctly, type **N** (ENTER) to indicate that you don't want to make any changes.

8. Choose Option D, and type **Y** (ENTER) to continue.

9. Press the space bar to continue to the prompts for drive use. When prompted for the type of device to which to assign each of the 8 possible logical drives, type:

   1 (ENTER)
   2 (ENTER)
   2 (ENTER)
   2 (ENTER)
   2 (ENTER)
   0 (ENTER)
   0 (ENTER)
   0 (ENTER)

   These answers assign Logical Drive **0** as the system floppy drive and Logical Drives 1 through 4 as hard drives. Logical Drives 5 through 7 remain unassigned.

10. When asked for the head-by-head assignment, respond to the prompts as indicated:

Prompt	Response
Which Physical drive?	**2** (ENTER)
Which Starting head?	**1** (ENTER)
How many heads to use?	**1** (ENTER)
Which Physical drive?	**2** (ENTER)
Which Starting head?	**2** (ENTER)
How many heads to use?	**1** (ENTER)
Which Physical drive?	**2** (ENTER)
Which Starting head?	**3** (ENTER)
How many heads to use?	**1** (ENTER)
Which Physical drive?	**2** (ENTER)
Which Starting head?	**4** (ENTER)
How many heads to use?	**1** (ENTER)

These responses assign all 4 logical hard drives to the second physical hard drive, with each logical drive using 1 head.

(General rule: At this point, you must ensure that all logical hard drives have been given physical allocation and that the allocation covers every head of each drive that is to be used under CP/M.)

Study the display to be sure you entered the correct data. Then press the space bar to continue.

11. Type **Y** (ENTER) if the configuration is acceptable.

You return to the main program, and TRSDOS should format the drives without any problem.

To use the second physical drive under CP/M, you must follow the steps below:

1. To be sure the system is as you expect it, type:

   DIR :0 (ENTER)

   This should access only the system floppy drive. Now type:

   DIR (ENTER)

   This should access the system floppy drive, and then give the names you assigned to the 4 logical hard drives without filenames (blank disks).

2. To restore the TRSDOS 6 Initialization Diskette for later use, type:

   AUTO BASIC HARDGEN/BAS (ENTER)
   SYSGEN (NO) (ENTER)

3. If you have a printer, print the audit trail file by typing:

   LIST README/PCM (P) (ENTER)

   Examine the printout and replace each occurrence of the word TRSDOS with the word CP/M to remind you of the configuration details.

To complete the initialization of the CP/M hard drive, do the following:

1. Remove the TRSDOS Initialization Diskette from Floppy Drive Ø and replace it with either CP/M Disk 1 (for 64K Model 4 or 4P) or CP/M Disk 2 (for 128K Model 4 or 4P).

2. Reset the system to boot under CP/M; then answer the date and time prompts.

3. Place CP/M Disk 5 in Floppy Drive B, and give CP/M information about your hard disks by typing the following lines:

   B: (ENTER)
   SETUP (ENTER)
   2
   3
   Y
   2
   E
   T

   You are telling CP/M that you are about to use hard drives and, because the one you wish to initialize is the second physical drive, you are telling it that 2 drives exist. The last line tells CP/M to test the updated configuration and return to the system.

4. Type these lines to initialize the CP/M directory and to return to the system:

   CPMINIT (ENTER)
   1
   5
   2
   Y
   E

5. Type these lines to copy files from Drive A to Drive F and to return to the system:

A: (ENTER)	(change default drive)
PIP (ENTER)	(peripheral interchange program)
F:=A:*.* (ENTER)	(copy non-system files from A to F)
(ENTER)	(return to the system prompt)

6. PIP displays the names of the files being transferred from Floppy Drive A to Hard Drive F. To be sure the files are transferred, type these two commands, and compare the filenames displayed:

   DIR (ENTER)
   DIR F: (ENTER)

   The same filename should appear in both cases.

7. To transfer the contents of other CP/M disks of your choice to the hard drive, type:

   PIP (ENTER)

   Place the source disk in Floppy Drive B and type:

   F:=B:*.* (ENTER)

   Insert, one by one, each disk to be transferred, and repeat the command for each.

8. When you have finished transferring disks, press (ENTER) to return to the system prompt.

   Note: Each of the utility or program files is transferred, and should run effectively from Hard Disk F. However, the operating system itself needs to be resident on Floppy Drive A. Application programs with hard coded drive specifications may require modification to run correctly.

The CP/M hard disk system is now available for normal use.

TRSDOS Initialization

Reboot under TRSDOS 6, and follow Steps 1 through 5 of the main HARDGEN routine, answering each prompt truthfully. At Step 3, say that you have 1 floppy drive and 3 physical hard drives.

6. Define the system you want set up under TRSDOS by responding to the prompts as indicated:

Prompt	Response
How many logical drives do you want to have on your system?	**8** (ENTER)
How many floppy drives do you want to use on your system?	**1** (ENTER)
Do you want to reserve a logical dirve for use with Memdisk?	**N** (ENTER)
How many logical drives do you want to use on your hard disks?	**7** (ENTER)

7. If you have entered the information correctly, type **N** (ENTER) to indicate that you don't want to make any changes.

8. Choose Option D, and type **Y** (ENTER) to continue.

9. Press the space bar to continue to the prompts for drive use. When prompted for the type of device to which to assign each of the 8 possible logical drives, type:

   2 (ENTER)
   2 (ENTER)
   2 (ENTER)
   2 (ENTER)
   2 (ENTER)
   2 (ENTER)
   2 (ENTER)
   1 (ENTER)

   These responses assign Logical Drives 0 through 6 as hard drives and Logical Drive 7 as the only floppy drive.

10. When asked for the head-by-head assignment, respond to the prompts as indicated:

Prompt	Response
Which Physical drive?	**1** (ENTER)
Which Starting head?	**1** (ENTER)
How many heads to use?	**4** (ENTER)
Which Physical drive?	**3** (ENTER)
Which Starting head?	**1** (ENTER)
How many heads to use?	**1** (ENTER)

Prompt	Response
Which Physical drive?	**3** (ENTER)
Which Starting head?	**2** (ENTER)
How many heads to use?	**1** (ENTER)
Which Physical drive?	**3** (ENTER)
Which Starting head?	**3** (ENTER)
How many heads to use?	**1** (ENTER)
Which Physical drive?	**3** (ENTER)
Which Starting head?	**4** (ENTER)
How many heads to use?	**1** (ENTER)
Which Physical drive?	**3** (ENTER)
Which Starting head?	**5** (ENTER)
How many heads to use?	**1** (ENTER)
Which Physical drive?	**3** (ENTER)
Which Starting head?	**6** (ENTER)
How many heads to use?	**1** (ENTER)

These responses make Logical Drive **Ø** (5 megabytes) the system drive, using all 4 primary heads, Logical Drives 1 through 6 (2.5 megabytes each), each using 1 head of the secondary B or third physical hard drive.

Study the display to be sure you entered the correct data. Then press the space bar to continue.

11. Studying the screen reveals that no attempted assignment to the second physical drive (secondary A) is made. Any attempt to format Secondary A removes the CP/M directory structure, effectively destroying files on the CP/M Hard Drive F.

    If everything is in order, type **Y** (ENTER) to continue with the main HARDGEN program. The new system hard drive is installed on the primary hard disk drive.

12. Make a backup of the boot disk just made by HARDGEN, and check to be sure TRSDOS is functioning normally. The split hard disk system is now available for use by TRSDOS or CP/M, depending on which boot disk is in the first floppy drive upon power-up or reset.

Appendix C
Care of Your Hard Disk Drive

Because the disks are permanently encased within your hard disk drive, away from dust and other harmful particles, the drive requires little maintenance.

Occasionally, you may want to dust the case. To do so, use any general-purpose, nonabrasive household cleanser and a soft cloth.

Clean the filter whenever it becomes filled with dust and particles. First, turn off your hard disk drive. Then carefully remove the outer grill. **Do not remove the screws.** Remove the filter and rinse with tap water. When the filter is dry, put it back in the drive.

Appendix D
Hard Disk Specifications

General Specifications	5-Meg	15-Meg
Disks (Platters)	2	3
Heads (Recording surfaces)	4	6
Cylinders	153	306
Tracks	612	1836

Disk Capacity	5-Meg	15-Meg
Bytes per sector	256	256
Sectors per granule	16	16
Sectors per track	32	32
Granules per track	2	2
Tracks per cylinder	4	6
Tracks per inch	254	345
Total bytes per drive	5,013,504 (4896K)	15,040,512 (14,688K)

Technical Specifications	5-Meg	15-Meg
Disk RPM	3600	3600
Recording capacity unformatted:		
per drive (megabytes)	6.38	19.14
per surface (megabytes)	1.59	3.19
per track (kilobyptes)	10.40	10.40
Recording density (BPI)	7690	9090
Step rate (milliseconds)	.01	.01
Access time (milliseconds)		
Maximum	175	175
track-to-track	3	3
average	99	85
head settling time	15	15
Disk mechanical dimensions (inches)		
height	3.25	3.25
width	5.75	5.75
length	8.00	8.00
Hard disk drive case dimensions (inches)		
height	14.00	14.00
width	5.50	5.50
length	15.00	15.00
Backwall clearance requirement (inches)	3	3
Hard disk drive system power	120 VAC, 60 HZ, .90 amps	120 VAC, 60 HZ, .90 amps
Disk power		
+12V dc +/− 10%	1.5 amps typical, 5 amps typical motor start.	1.5 amps, typical, 5 amps typical motor start.
+5V dc +/− 5%	1.5 amps typical.	1.5 amps typical.
Environmental ambient temperature		
operating	12.8°C to 29.4°C (55°F to 85°F)	12.8°C to 29.4°C (55°F to 85°F)
nonoperating	−40°C to 60°C (−40°F to 140°F)	−40°C to 60°C (−40°F to 140°F)
Relative humidity	8% to 80%	8 % to 80%
Max. wet bulb temperature	26°C without condensation	26°C without condensation

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