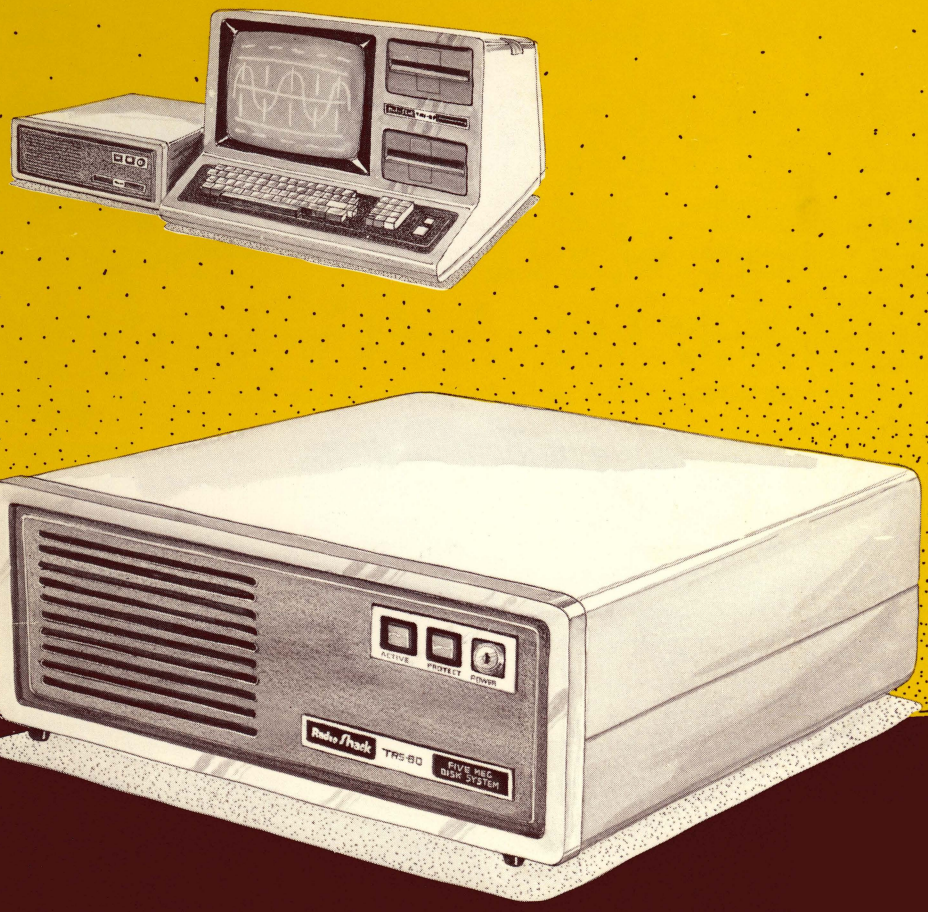
CAT. NO. 26-1133

TRS-80®
Model III

Hard Disk System
Start-up Manual



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TRS-8Ø® Model III

Hard Disk System Startup

10 9 8 7 6 5 4 3 2 1

TO OUR CUSTOMERS

By adding a hard disk to your TRS-8Ø Model III, 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 hard disks and floppy diskettes with LDOS Version 5.1.4.

ABOUT THIS MANUAL

Chapters 1 through 7 of this manual explain everything you need to know to set up and begin using your Model III hard disk system. This includes procedures for connecting the hardware, initializing the system, moving all programs and data to the hard disk, and maintaining a library of backup diskettes of all information stored on hard disk.

Chapter 8 is for reference should you change the number of floppy or hard disk drives in your system. It explains the methods for informing the system of the change.

Chapters 9 and 1Ø outline the commands, utilities, and features available with the LDOS 5.1.4 operating system. Many LDOS commands and utilities, including FORMAT and BACKUP, differ from their TRSDOS counterparts described in your other Model III manuals, so be sure to refer to Chapter 8 whenever entering a command. Details on LDOS are in Hard Disk Operating System Reference Manual.

Chapter 11 describes the problems and error messages you may encounter while using LDOS and the initialization procedures.

Appendices A, B, and C describe alternate methods of hard disk system initialization. These are included only for advanced users who cannot meet their system requirements using the normal HARDGEN procedure described in Chapter 4.

Appendices D and E describe the care of and specifications for your hard disk drives.

Notations

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

lower-case underlined
represents words, letters, or values that you supply.

[ ] (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.

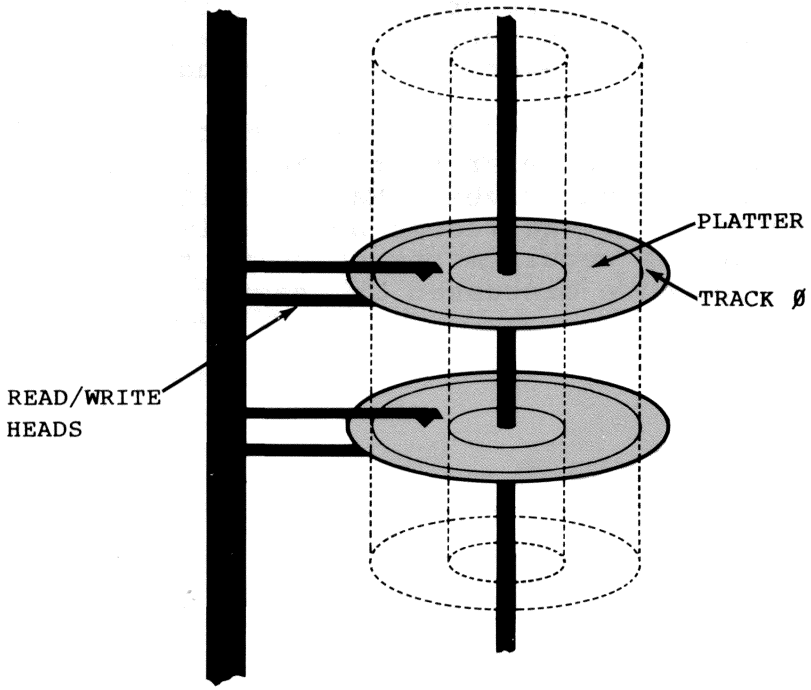

Figure 1. Internal View of Hard Disk Drive

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 Ø 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 your 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 III yet, do so now, referring to your computer owner's manual. 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 Operating System Reference Manual
- Hard Disk Expansion Cable (5Ø-pin)
- Hard Disk Operating System Diskette
- 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.

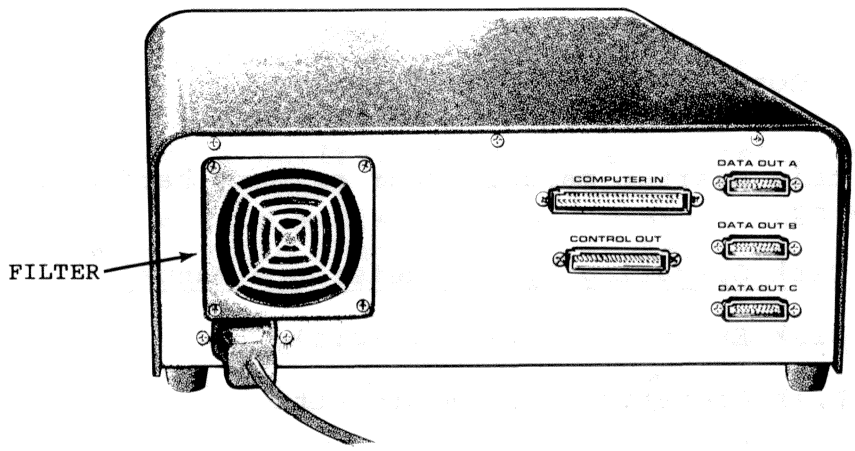

Figure 2. Back View of the Primary Hard Disk Drive

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 (5Ø-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 the appropriate voltage. (Voltage requirements are given on the label on your hard disk.)

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 6 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.

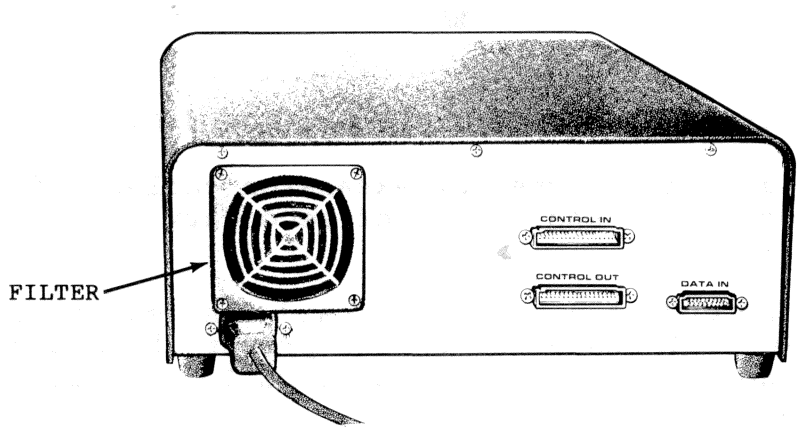

Figure 3. Back View of a Secondary Hard Disk Drive

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.**

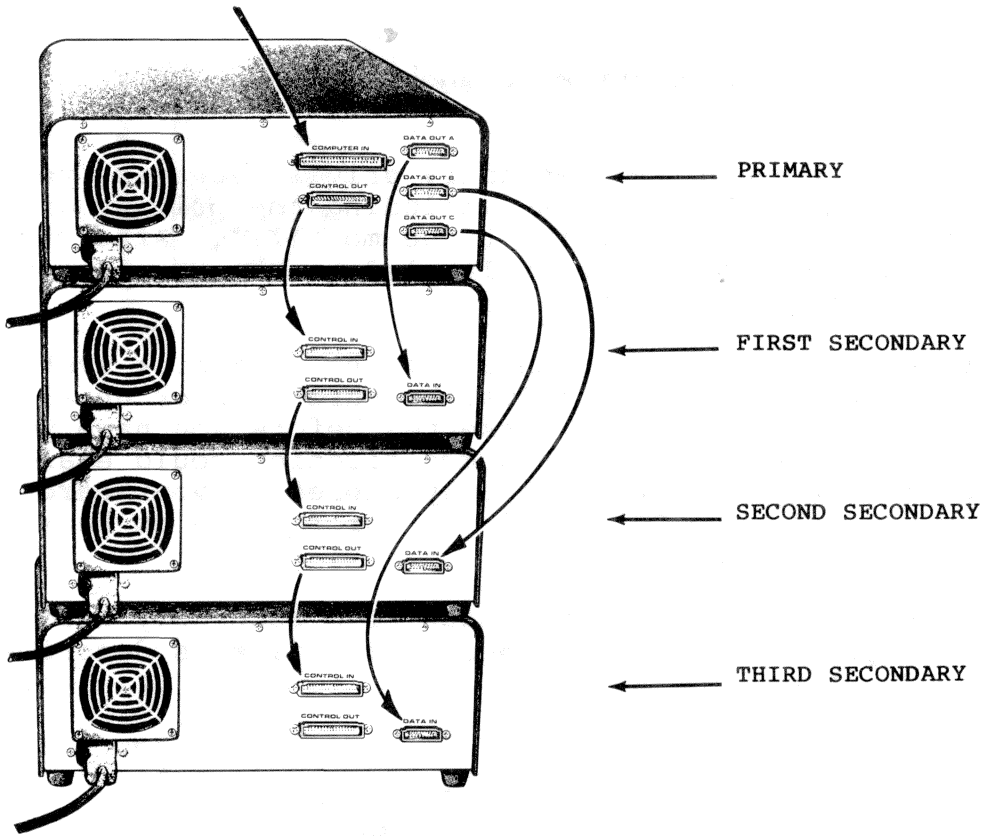

Figure 4. A Fully Configured Hard Disk System

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 (2Ø-pin connector) on the primary drive to DATA IN (2Ø-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 an appropriate grounded AC power source.

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.

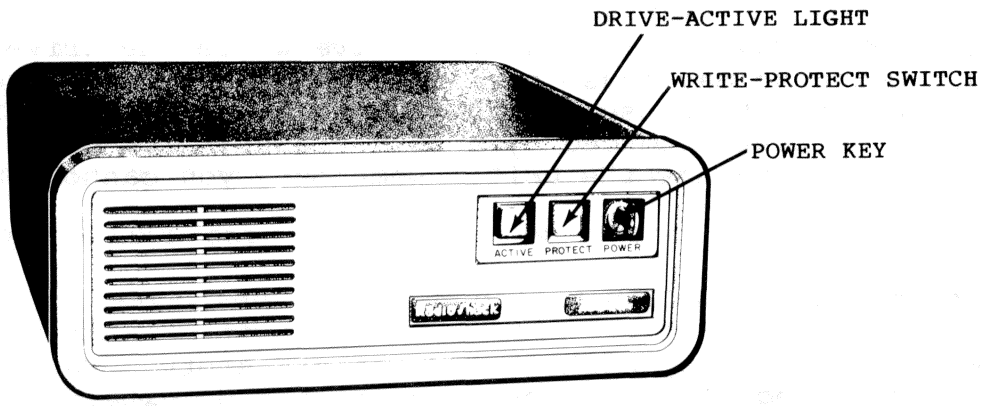

Figure 5. Front View of a Primary Hard Disk Drive

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 LDOS onto your hard disk system

LDOS HAS 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 methods described in Appendices A, B, and C. All three alternate 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 two sections carefully. They explain the difference between "physical" and "logical" drives, and outline the way in which HARDGEN configures your system. It is important to understand these concepts before initializing your hard disk system.

> **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.

How HARDGEN Configures Your System

When HARDGEN initializes your system, it stores a "configuration file" on your Initialization Diskette. This file contains your hard disk system's configuration (the number of floppy and hard disk drives it contains). It also tells the "logical" numbers HARDGEN assigns to each drive.

Logical Drive Numbers

When you operate your computer as a floppy disk system, each drive has a number that corresponds to its physical position. The numbers are as follows:

Drive Ø	=	first floppy drive
Drive 1	=	second floppy drive (optional)
Drive 2	=	third floppy drive (optional)
Drive 3	=	fourth floppy drive (optional)

When you run the HARDGEN program, it assigns "logical" numbers to all your drives--both floppy and hard disk drives. These numbers differ from the drives' positions. First, regardless of the number of physical hard disk drives you have, HARDGEN divides them into a total of 4 logical hard disk drives, and numbers these drives Ø through 3. Then it numbers the floppy disk drives, in order, starting with the number 4. Thus, the logical drive numbers are as follows:

```
Drive 4   =    first floppy drive
Drive 5   =    second floppy drive (optional)
Drive 6   =    third  floppy drive (optional)
Drive 7   =    fourth floppy drive (optional)
Drive Ø   =    first logical hard disk drive
Drive 1   =    second logical hard disk drive
Drive 2   =    third logical hard disk drive
Drive 3   =    fourth logical hard disk drive
```

Once the initialization is complete, the operating system expects you to enter only logical drive numbers.

The way in which HARDGEN assigns numbers to your hard drives depends on the number of drives and read/write heads your system has. You can have more than one logical drive per physical drive and more than one read/write head per logical drive. You cannot, however, have a logical drive that spans a physical drive. Thus, all the read/write heads assigned to a logical drive must be on the same physical drive. As a result, an even division of disk space to logical drives is not always possible.

Limitations of HARDGEN and LDOS

For most systems, HARDGEN is by far the best method of disk space allocation; it is both simple and suitable. However, there are exceptions.

Consider that the LDOS operating system imposes a limit of 1Ø megabytes on any one logical drive. With most systems, this limit is of no consequence. In some systems, however, the limit is reached with megabytes to spare. For example, suppose your system has one floppy disk drive and three 15-meg hard disks. If you use HARDGEN to initialize your system, HARDGEN divides the hard drives into 4 logical drives--2 of 1Ø megabytes each and 2 of 7.5 megabytes each. Ten megabytes aren't used. (See the chart on the following page.)

If you **need** this extra space, and you are an advanced user with some programming experience, you can initialize your system with one of the alternate methods discussed in Appendices A and C. These methods, unlike HARDGEN, do not limit you to 4 logical hard drives. Thus, you can assign the extra megabytes to fifth and sixth logical hard drives.

The following table summarizes disk space allocation by HARDGEN, according to the number of physical drives in the system. It is intended only for reference. If your system is suitable for initialization with HARDGEN, as is most likely the case, you may proceed immediately with the initialization.

PHYSICAL DRIVES	HEADS PER DRIVE	ALLOCATION OF DISK SPACE (Megabytes per Logical Drive)							
		Logical Drive Ø	Meg	Logical Drive 1	Meg	Logical Drive 2	Meg	Logical Drive 3	Meg
1 5-meg	4	Primary 1 head	1.25	Primary 1 head	1.25	Primary 1 head	1.25	Primary 1 head	1.2
2 5-megs	4	Primary 2 heads	2.5	Primary 2 heads	2.5	1st Sec. 2 heads	2.5	1st Sec. 2 heads	2.5
3 5-megs	4	Primary 4 heads	5	1st Sec. 4 heads	5	2nd Sec. 2 heads	2.5	2nd Sec. 2 heads	2.5
4 5-megs	4	Primary 4 heads	5	1st Sec. 4 heads	5	2nd Sec. 4 heads	5	3rd Sec. 4 heads	5
1 15-meg	6	Primary 2 heads	5	Primary 2 heads	5	Primary 1 head	2.5	Primary 1 head	2.5
2 15-megs	6	Primary 3 heads	7.5	Primary 3 heads	7.5	1st Sec. 3 heads	7.5	1st Sec. 3 heads	7.5
3 15-megs	6	Primary 6 heads	1Ø*	1st Sec. 6 heads	1Ø*	2nd Sec. 3 heads	7.5	2nd Sec. 3 heads	7.5
4 15-megs	6	Primary 6 heads	1Ø*	1st Sec. 6 heads	1Ø*	2nd Sec. 6 heads	1Ø*	3rd Sec. 6 heads	1Ø*

* LDOS imposes a limit of 1Ø megabytes per logical drive.

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 all punctuation. You will need the numbers during Step 4 below.

To initialize your hard disk you need both LDOS diskettes:

- The Initialization Diskette
- The Hard Disk Operating System Diskette

Make backups of both diskettes, and store the originals in a safe place. Use only the backups during initialization. The HARDGEN program modifies the Initialization Diskette, and using a backup ensures that you still have the master Initialization Diskette intact. (Refer to your Chapter 9 for instructions on formatting and backing up LDOS diskettes.)

1. Insert a write-enabled backup Initialization Diskette in Drive Ø, and press the reset button. 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 **LDOS 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. You must enter the exact number of hard disk drives you have.

4. Now HARDGEN asks you to enter the serial numbers 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 may also ask 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 screen then displays the software configuration that it set up according to your responses in Steps 3 and 4. If you have a printer connected and ready, and you want a printed copy of the system layout, hold down <SHIFT> and press <↓> and <*> at the same time. To continue, press the space bar.

7. HARDGEN asks:

   Do you wish to continue with this initialization. <Yes or No>

   If you wish to continue, press **Y** <ENTER> to go to Step 8. If not, press **N** <ENTER> to exit the program, and return to **LDOS Ready.** If you exit the program, no initialization takes place; you may start the program again.

8. HARDGEN now asks you to enter the master password. Enter one password you want HARDGEN to assign to all 4 logical drives. The password can have from 1 to 8 alphanumeric characters, the first of which is a letter. Or, if you wish, simply press <ENTER> to have HARDGEN assign the password PASSWORD. For hard disks, however, we recommend that you use a password other than PASSWORD. This keeps you from inadvertently reformatting the disk.

9. After assigning the password, HARDGEN writes the details of the system configuration to a disk file called INCLUDE/TBL. This file is one that HARDGEN includes in a larger JCL file, INITHD5, before execution. HARDGEN displays several informative messages, followed by this warning:

   You are preparing to re-configure your hard drive(s). All information on the hard drive will be overwritten. Be sure all data is backed up onto floppies.

   The program then pauses and asks you to press <ENTER> to continue or <BREAK> to exit. If this is the first time you are initializing the hard disk(s), then they do not contain any data to be overwritten. Press <ENTER> to continue.

   If you are reinitializing the hard disk(s) and have not backed up the data on them, press <BREAK>. The program exits, and **LDOS Ready** is displayed. Reset the computer, using your previous Boot or Startup Diskette. Before restarting the initialization, make a fresh backup of the master Initialization Diskette; then use this new backup for the reinitialization.

10. The JCL file INITHD5 reads from the table INCLUDE/TBL to provide the answers to the LDOS operating system prompts. Again, you are asked to press <ENTER> to continue or <BREAK> to exit.

11. The hard disk is formatted and verified. The amount of time this takes depends on the amount of disk storage. The rate is about 4 minutes per megabyte of space. Thus, if you are formatting a 15-megabyte hard disk drive, the entire process takes about an hour.

12. When the formatting is completed, HARDGEN displays:

```
Configuration is not complete.
To complete the configuration you MUST
type the following commands:

     SYSTEM (SYSTEM=4) <ENTER>
     SYSTEM (SYSGEN=ON) <ENTER>
     BACKUP :0 :4 (SYS,INV,MOD) <ENTER>
     BOOT <ENTER>
```

In addition, it displays **Job Done** and **LDOS Ready.** If you have a printer connected and ready, and you want a printed copy of the screen, press <SHIFT> <↓> <*>. Enter each of the commands, as shown above. (Note: The screen displays a period before each line that you are required to type. Do **not** type the period on the command line.)

On successful completion of the above commands, the diskette in the floppy drive is modified to become a Boot, or "Startup," Diskette. During the backup of the new system invisible files from Drive 0 to Drive 4, you can see that CONFIG/SYS is the only file copied. This file contains the information about your hard disk system. The BOOT command should have given your disk its first test in booting your system as a hard disk system.

13. To complete the initialization, you must transfer the contents of the Hard Disk Operating System Diskette to the hard disk drive. LDOS asks you to insert the Hard Disk Operating System Diskette. Remove the Boot Diskette, and label it as such. Then insert the Operating System Diskette, and press <ENTER>.

When the backup is finished, **LDOS Ready** reappears. LDOS is now stored on your primary hard disk drive, and the initialization is complete.

14. With the Hard Disk Operating System Diskette still in the floppy drive, press the reset button. Since this diskette does **not** contain the configuration file CONFIG/SYS, the system is now booted under floppy disk control.

    At **LDOS Ready,** remove the Operating System Diskette, and insert the Boot Diskette that you just labeled. Type:

    AUTO <ENTER>

    This command removes the automatic process by which you went from Step 12 to Step 13.

15. Press the reset button to boot your system as a hard disk system.

Backing Up the Boot Diskette

Because your Boot Diskette is so important, make several backups of it now, following the appropriate instructions below:

Users with 1 Floppy Drive

Remove the Boot Diskette, and insert a blank or unformatted diskette into Floppy Drive Ø. To your operating system, this is now Logical Drive 4. Type:

FORMAT :4 (Q=N) <ENTER>

When the formatting is complete, remove the formatted diskette, and reinsert the Boot Diskette. Type:

BACKUP :4 :4 <ENTER>

LDOS instructs you to alternately insert the source diskette (the Boot Diskette) and the destination diskette (the formatted diskette) several times. Follow the prompts, pressing <ENTER> after each diskette swap.

LDOS may tell you that the pack IDs of the two diskettes differ, and ask if you want to stop the backup. This is a warning message only. Type **N** <ENTER> to continue.

Users with 2 or More Floppy Drives

With the Boot Diskette still in Logical Drive 4, insert a blank or unformatted diskette in Logical Drive 5 (Floppy Drive 1). Type:

FORMAT :5 (Q=N) <ENTER>

When the formatting is complete, type:

BACKUP :4 :5 <ENTER>

LDOS may tell you that the pack IDs of the two diskettes differ, and ask if you want to stop the backup. This is a warning message only. Type **N** <ENTER> to continue.

The Boot Diskette, which is in Floppy Drive Ø, is necessary to start or reset your hard disk system. After the system starts up or resets, you can remove the diskette.

Be sure to make several backups of the Boot Diskette. Without it, you cannot use your computer as a hard disk system. The computer needs the information on this diskette to configure the hard drives into the system.

If an error occurs during initialization, refer to Chapter 11 for an explanation of that error.

> **Note:** If you make a mistake in initializing your system, restart the process from Step 1. Be sure, however, to do so with a fresh backup of the master Hard Disk Initialization Diskette.

If, for any reason, you need to reinitialize your hard disk system, follow the same steps as in the first initialization. Be sure, however, to use a fresh backup of the master Hard Disk Initialization Diskette. Do not use any previous Boot Diskettes.

If you wish to change the number of floppy or hard disk drives in your system, follow the instructions in Chapter 8.

Operating Your Computer as a Hard Disk System

Once you initialize your hard disk system, running it under hard disk control is an easy task. Start up or reset the computer with the Boot Diskette in Logical Drive 4 (Floppy Drive Ø). When **LDOS Ready** appears, type this command:

DIR :4 <ENTER>

LDOS shows a directory of the files contained on your Boot Diskette. Type:

DIR :Ø <ENTER>

LDOS shows a directory of Logical Drive Ø (your primary hard disk drive).

Here is a summary of the steps the computer takes to start up under hard disk control:

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 contains a logical drive configuration file that tells the computer to assign hard disk drive numbers to your drives. Thus, the primary hard disk becomes Logical Drive Ø.

3. The computer searches the primary hard disk drive for an operating system. There it finds LDOS, displays the **LDOS 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.

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 **LDOS 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.

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

DIR :4 <ENTER>

The screen shows an error message. LDOS is using floppy disk system drive numbers; so Logical Drive 4 does not exist. Type

DIR :Ø <ENTER>

LDOS shows a directory for 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 still use most of your application programs with TRSDOS, the same as always. 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 application programs to the hard disk so that you can then run them under LDOS. The following are general steps for transferring application programs to hard disk. If you are transferring Radio Shack programs, you may have to make changes to them before doing so. Please refer to the addendum "Converting Radio Shack Software for Use with Hard Disk."

1. Make a backup of your application program diskette under TRSDOS. (Use the instructions in your application manual.)

2. Start up or reset the hard disk system (with the Boot Diskette in Floppy Drive Ø). The computer assigns your drives logical numbers so that Floppy Drive Ø is now Logical Drive 4. When **LDOS Ready** appears, you can remove the Boot Diskette.

3. Place the application program diskette in Logical Drive 4. Then type the convert command, using this format:

   CONV :4 :d (VIS,Q=N) <ENTER>

   d is the number of the drive the diskette is usually in when the computer is operating as a floppy disk system.

   For example, if the diskette is labeled PROGRAM or DRIVE Ø, type:

   CONV :4 :Ø (VIS,Q=N) <ENTER>

   If the diskette is labeled DATA or DRIVE 1, type:

   CONV :4 :1 (VIS,Q=N) <ENTER>

If the diskette is labeled DRIVE 2, type:

CONV :4 :2 (VIS,Q=N) <ENTER>

The VIS option tells LDOS to move the visible files only. (All application files are visible.) Q=N tells LDOS to move all files without asking whether you want to move each one.

The convert utility begins moving the disk files from Floppy Drive 4 to the hard disk drive you specified, displaying each filename.

When the convert utility is finished, **LDOS Ready** reappears. Your hard disk drive now contains the application program. Remove the application program diskette and store it in a safe place.

Repeat these steps for all your application program diskettes and data files.

Note: If you are transferring a program written in the COBOL language, you need to also transfer the RUNCOBOL/CMD program to the hard disk. Insert the **program** or **Drive Ø** application diskette--the diskette most likely to contain RUNCOBOL--in Drive 4, and type:

CONV RUNCOBOL/CMD:4 :Ø (SYS) <ENTER>

If RUNCOBOL is on the program diskette, the convert utility asks you:

Convert file RUNCOBOL/CMD?

Type **Y** <ENTER>.

If the **Convert file RUNCOBOL/CMD?** prompt does not appear, RUNCOBOL is on a data diskette, instead of on the program diskette. Try the command again--with each of the application program's data diskettes in Logical Drive 4 (Floppy Drive Ø)--until the prompt does appear.

Important: The above instructions are general. For detailed instructions on converting specific Radio Shack programs, see the addendum to your Hard Disk Operating System Reference Manual and any addenda your application program manual may have.

Loading BASIC Programs

If you have an application program written in the BASIC language, you need to load it differently under LDOS than under TRSDOS.

Most application program manuals tell you to load the program by loading BASIC, answering the **How Many Files ?** and **Memory Size ?** prompts, and then entering the RUN command. When running the program under TRSDOS, you need to do that.

When running the same program under LDOS, however, you can specify the number of files and the memory size as part of the command to load BASIC. For example, to load and run a BASIC program called PAYROLL/BAS, you might type these commands:

At **LDOS Ready:**

BASIC (FILES=4,MEM=6144Ø) <ENTER>

At BASIC's **Ready >** prompt:

RUN "PAYROLL/BAS" <ENTER>

If the application manual instructs you to press <ENTER> in response to the **How Many Files ?** and **Memory Size ?** prompts, do either of the following:

- Type **BASIC** <ENTER> to load BASIC, and then enter the RUN command, using this format: **RUN "PAYROLL/BAS"** <ENTER>
- Load BASIC and run the program in one step, using this format: **BASIC RUN "PAYROLL/BAS"** <ENTER>

If the application program asks that you answer the **Files ?** prompt with a number followed by a **V**, omit the V. For example, if the manual asks you to specify the Files as 4V, simply specify it as 4.

To return to LDOS from your BASIC program, type:

CMD "S" <ENTER>

Note: LDOS BASIC is called LBASIC rather than BASIC. Unlike TRSDOS BASIC, LBASIC automatically adds a default /BAS extension to BASIC filenames.

So that your BASIC programs load properly with LBASIC, LDOS has a BASIC command file that:

- Lets you load BASIC programs by entering the RUN BASIC command rather than the LBASIC command
- Prevents LBASIC from adding the default /BAS extension to your BASIC filenames

A complete description of LBASIC is in the Hard Disk Operating System Reference Manual.

Chapter 6: BACKING UP YOUR HARD DISK SYSTEM

To safeguard the information stored on hard disk, keep periodic backups of all the information and daily backups of selective information. This chapter outlines the procedures needed to do this.

Formatting a Diskette

To store information on floppy diskettes, LDOS requires only that the diskettes be in the LDOS format. To get a diskette into this format, follow these steps:

1. Start up or reset your hard disk system with the Boot Diskette in Floppy Drive Ø. The configuration file reassigns drive numbers so that Floppy Drive Ø becomes Logical Drive 4.

2. When **LDOS Ready** appears, remove the Boot Diskette, and replace it with a blank or old diskette. First, be sure the replacement diskette's write-protect notch is **not** covered.

3. Type:

   FORMAT :4 (Q=N) <ENTER>

When finished formatting the diskette in Drive 4, LDOS displays:

```
Formatting Complete
Note: Real time clock no longer accurate
LDOS Ready
```

You can now use this diskette to store information in the same way you use your hard disk drives.

Making Periodic Backups

To periodically make backups of all hard disk information, follow these steps:

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

2. Look at the directory of each hard disk, in turn, to see if that disk contains any very large files. To do this, type the DIR command followed by the hard disk drive number and then (I,S), as shown in this example:

   DIR :1 (I,S) <ENTER>

   The column labeled **Space** indicates the amount of space that each file uses on that disk. If an **individual** file exceeds 174K bytes, you need to use HARDCOPY, instead of BACKUP, to copy that file. (See Chapter 7 of this manual for more information on HARDCOPY.)

3. Next, determine the number of LDOS-formatted floppy diskettes you need. (A newly formatted floppy diskette can hold about 174K or 178,176 bytes. Thus, you may need as many as 7 diskettes to store 1 megabyte of information.) Type:

   FREE <ENTER>

   The last column of the display shows the amount of free space on the disk. For example, the figures 245Ø/4986K indicate that approximately 2.4 megabytes were used for the files on that drive, and that the backup of the drive requires 15 diskettes.

4. Format the number of floppy diskettes you need. (It is a good idea to format extra diskettes in case of a problem.) Place one of the formatted diskettes in Logical Drive 4. Then type the BACKUP command. The following command, for example, copies each file on Logical Hard Disk Drive 1 to the floppy diskette in Logical Drive 4:

   BACKUP :1 :4 <ENTER>

   The message **Backup Reconstruct Invoked** appears on the screen. The screen shows the name of each file as it is copied.

   When the floppy diskette becomes full, LDOS asks you to insert a newly formatted diskette. Remove the diskette in Logical Drive 4, insert a newly formatted diskette, and press <ENTER>.

   When **LDOS Ready** appears, the BACKUP is complete.

Repeat the backup procedure for each hard disk drive in the system.

Making Daily Backups

To make daily backups of the most important information on your system, follow one of the procedures listed in your Hard Disk Operating System Reference Manual.

> **Note:** If you have the disk storage space, and if your application programs are not adversely affected by the existence of 2 files of the same name, you may back up one logical hard drive to another logical hard drive. For example, this command copies from Logical Drive 1 to Logical Drive 3 all Drive 1 files that have not been backed up since their last modification:
>
> **BACKUP :1 :3 (MOD)** <ENTER>
>
> Use such backups to supplement, not to replace, regular backups to floppy.
>
> To keep track of which files have not been backed up since last modified, LDOS puts a plus sign (+) by the appropriate filenames in the directory.

Chapter 7: COPYING AND RESTORING LARGE FILES

In some cases, a file on the hard disk is too large to fit on a single floppy diskette. For this reason, LDOS has a utility called HARDCOPY/BAS that transfers a large hard disk file onto several floppy diskettes. This chapter discusses the use of HARDCOPY/BAS.

Copying a File with HARDCOPY/BAS

Before copying a hard disk file, be sure you have enough write-enabled, LDOS-formatted floppy diskettes to receive the file. (It is a good idea to have one extra, in case one is flawed.)

A newly formatted diskette can hold about 174K (178,176) bytes. To find out the number of bytes in your hard disk file, look at the directory "allocation table." To do this, type the DIR command followed by the hard disk drive number, as shown here:

DIR :1 <ENTER>

The column labeled **Space** indicates the amount of space that the given file uses on the disk. Locate the figure for the file you want to copy.

Next divide the file space number by 174. Round the result to the next higher whole number.

For example, if the directory allocation table shows a file to be 435K, you need 3 floppy diskettes:

435 / 174 = 2.5 (rounded off = 3)

After gathering enough diskettes, you can run the HARDCOPY utility, which is an LBASIC program. To do so, follow these steps:

1. Type:

LBASIC (F=2,B=N) RUN"HARDCOPY/BAS" <ENTER>

HARDCOPY displays its main menu:

```
HARDCOPY - Disk file Backup Utility
for LDOS 5.1.4 - mm/dd/yy
Copyright (C) 1982 by Logical Systems, Inc.

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

                Your Selection ?
```

Type **C** <ENTER>.

2. HARDCOPY 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. HARDCOPY then asks you to enter the destination drive. Place a write-enabled, LDOS-formatted diskette in Logical Drive 4, and type:

   4 <ENTER>

4. HARDCOPY 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 EXAMPLE/BAS, for example, type:

   EXAMPLE/BAS <ENTER>

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

5. When the floppy diskette is full, HARDCOPY 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>. HARDCOPY continues until all the records are copied.

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

When finished, HARDCOPY lets you know if it found any defective records. It then returns you to the main menu. Press <@> to return to **LDOS 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 HARDCOPY. This option is discussed in the next section.

Restoring a File With HARDCOPY/BAS

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

1. Load the HARDCOPY utility. At the main menu, type **R** <ENTER>.

2. HARDCOPY 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. HARDCOPY 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. HARDCOPY begins moving each record in the file, checking each record as it moves it.

5. After copying each diskette, HARDCOPY asks you to insert the next. You can copy the diskettes in any order. HARDCOPY places all the records in their proper locations. Press <ENTER> after inserting each diskette.

When finished, HARDCOPY returns to the main menu. Press <@> to return to **LDOS Ready.**

HARDCOPY Error Messages

Below are error messages you might see while using HARDCOPY:

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

DESTINATION disk is flawed - Copy suspended. HARDCOPY 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, HARDCOPY 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. HARDCOPY asks you to enter the filespec again, without the drive number.

Technical Information

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

An **experienced** programmer should be able to 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, LBASIC 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)
	4Ø - 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 LBASIC MKI$ function.

Description

If any records are bad, LDOS 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 14Ø is bad, and the diskette contains the block of Records 1ØØ to 3ØØ, the bad record is the 41st record in the file:

14Ø - 1ØØ = 4Ø + 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 8: CHANGING THE NUMBER OF DRIVES

If you change the number of floppy or hard disk drives in your system, you must inform the system of the change. This chapter describes the procedures for doing this.

Adding or Removing Hard Disk Drives

If you add or remove hard drives to your system, you must reinitialize the system. Back up all hard disk files onto floppy diskettes, and then follow all steps in the initialization procedure as described in Chapter 4.

Adding or Removing Floppy Disk Drives

Changing the number of floppy disk drives requires the use of the DO INITHD5 command with the OLD, FLOPPY, and HARD options. (Do **not** change the number of hard drives with the HARD option. You must specify the number of hard drives specified during initialization.) Follow these steps:

1. Start up or reset your computer under hard disk control

2. Remove the Boot Diskette from the floppy drive, and replace it with a newly made backup of your Hard Disk Initialization Diskette. Do **not** reset the system.

3. At **LDOS Ready,** enter the DO INITHD5 command with the OLD, HARD, and FLOPPY options, as shown in this example:

   DO INITHD5 (OLD,HARD1,FLOPPY3) <ENTER>

   This command lets you configure a system that has 3 floppy drives enabled. (The number of physical hard disk drives is the same both before and after execution of the command.)

4. LDOS reassigns the drives. When it is finished, **LDOS Ready** appears.

5. LDOS warns you that the configuration is not complete, and instructs you to type the following commands:

   SYSTEM (SYSGEN=ON) <ENTER>
   BACKUP :Ø :4 (SYS,INV,MOD) <ENTER>
   BOOT <ENTER>

   When entering the last command, hold down <ENTER>, and press <CLEAR> at the same time. This command defeats the newly created configuration file and the automatic file that would take you to Step 13 of the initialization procedure in Chapter 4.

6. You are now booted on the floppy disk. To remove the automatic execution file, type:

   AUTO <ENTER>

From now on, whenever you press the reset button, your system should start up under hard disk control with the new number of floppy disk drives enabled.

Chapter 9: LDOS COMMANDS AND UTILITIES

This is a summary of the commands and utilities discussed in this manual, as well as some additional ones you might find helpful. For more details, see the Hard Disk Operating System Reference Manual.

Remember that the **LDOS Ready** prompt must appear as the last line on your screen before you can enter any command or utility. If it is not on your screen, press <ENTER> or exit your program.

BACKUP (Utility). Makes a copy of any floppy or hard disk onto another hard or floppy disk.

The destination disk must be in the LDOS format, and must have its write-protect notch uncovered. (See FORMAT for instructions on how to get a floppy diskette into the LDOS format.)

The source disk must also be in the LDOS format. If you want to back up a TRSDOS-formatted disk (such as most application program diskettes), you must be running under TRSDOS. See BACKUP in either the Model III Disk System Owner's Manual or the manual that comes with the program.

If the pack IDs are different, LDOS asks if you want to stop the backup. Type **N** <ENTER>.

If the source disk contains a password other than PASSWORD, LDOS asks for the master password.

If you are backing up to or from a hard disk drive, LDOS displays the name of each file as it copies it.

Examples:

BACKUP :1 :3 <ENTER>

copies all the information on Drive 1 to Drive 3.

BACKUP :4 :2 <ENTER>

copies all the information from Drive 4 to Drive 2.

BACKUP :4 :4 <ENTER>

asks you to insert the source diskette and the destination diskette several times, while it makes the backup. Use this command if you have only 1 floppy drive.

BACKUP :4 :5 <ENTER>

copies all the information on Drive 4 to Drive 5.

BACKUP :4 :5 (SYS) <ENTER>

copies the system files from the Drive 4 to Drive 5.

BACKUP :4 :5 (INV) <ENTER>

copies only the invisible files from the source diskette to the destination diskette.

BACKUP :4 :5 (VIS) <ENTER>

copies only the visible files from the source diskette to the destination diskette.

COPY (Command). Copies one file from one disk to another.

The most common form of this command is:

COPY filename**:**d1 **:**d2 <ENTER>

filename is the name of the file to be moved. d1 is the source drive and d2 is the destination drive.

> **Caution:** Never copy an LDOS system file. To get system files onto another diskette, use the BACKUP utility. (System files all have the extension /SYS. You can view a system file only with the DIR (S) command.)

Example:

COPY MYDATA:Ø :1 <ENTER>

copies a file named MYDATA from Drive Ø to Drive 1, so that the file now exists in both Drive Ø and 1:

DIR (Command). Displays the disk's directory.

Examples:

DIR :Ø <ENTER>

displays information about any "user" files in Drive Ø. (User files are data or programs that you have created.) You can see the amount of space allocated for each file, along with the date on which the file was last modified. If Drive Ø has no user files, only the heading appears, showing the disk's name and creation date and the free space.

DIR :Ø (S) <ENTER>

displays information about LDOS "system" files and user files.

The display of files pauses every 15 lines. Press <ENTER> to continue.

To view a shorter form of the directory, use this command:

DIR :Ø (A=NO) <ENTER>

FORMAT (Utility). Organizes a floppy diskette into the LDOS format. The diskette must have the write-protect notch uncovered.

Example:

FORMAT :4 (Q=N) <ENTER>

formats the diskette in Drive 4, giving it the disk name LDOSDISK and the password PASSWORD.

FORMAT :5 (Q=N) <ENTER>

formats the diskette in Drive 5.

FORMAT <ENTER>

asks these questions and then formats the disk:

WHICH DRIVE IS TO BE USED ?
DISKETTE NAME ?
MASTER PASSWORD ?
SINGLE OR DOUBLE DENSITY <S,D> ?
ENTER NUMBER OF SIDES <1,2> ?
NUMBER OF CYLINDERS ?
BOOT STRAP STEPPING RATE <6, 12, 2Ø, 3Ø MSECS>?

The Hard Disk Operating System Reference Manual explains these questions. To use the defaults, press <ENTER> in response to each.

FREE (Command). Shows the amount of free space available on your disks.

Examples:

FREE <ENTER>

displays the number of files and the remaining amount of free space in each drive. The remaining free space is in "K" notation. (There are 1Ø24 characters per K.)

A newly formatted Model III data disk has room for 112 files and 174K of free space. A newly formatted hard disk has room for 224 files and about 1,2Ø4K of free space (when initialized with one hard disk drive).

FREE :Ø <ENTER>

shows a "free map" of Drive Ø. The map includes the used and available space, the directory area, and any "flawed" areas.

KILL (Command). Removes the specified file from a disk, freeing the space used by the file. The form for this command is:

KILL filename:d <ENTER>

filename is the name of the file (viewed with the DIR command. d is the number of the drive containing the file.

Example:

KILL MYPROG:Ø <ENTER>

deletes the file named MYPROG from Drive Ø.

LIB (Command). Lists all LDOS library commands.

Example:

LIB <ENTER>

lists the commands in two sections, Library A and Library B.

PURGE (Command). Removes a group of files from a disk. You can specify a group of files with a common filename, a common extension, the S (system file) option, or the I (invisible file) option.

After you enter the PURGE command, LDOS displays each filename. Type **Y** <ENTER> to delete the file; type **N** <ENTER> to keep it.

Examples:

PURGE /PAY:Ø <ENTER>

lets you remove all the visible files in Drive Ø that have the extension /PAY.

PURGE :1 <ENTER>

lets you remove all the visible files in Drive 1.

PURGE :1 (I) <ENTER>

lets you remove all the visible and invisible files from Drive 1.

Chapter 1Ø: LDOS FEATURES

LDOS provides many additional features that enhance the operation of your computer. This sections lists a few that might interest you. To find out how to use them, see your Hard Disk Operating System Reference Manual.

Before trying any of these features with an application program, be sure to make a backup of it. Your application program was probably not designed to run with these LDOS features, so there is no guarantee it will work with them.

SPOOL (Command). Lets you use your computer while you are printing data on the printer. This command may not work with a program that generates reports and does its own page counting.

PR/FLT (Driver/Filter). Lets you format your printer. This command is similar to the FORMS command in other operating systems. If your application program does its own page formatting and counting, the PR/FLT command may not work.

ROUTE (Command). Lets you run, without the printing feature, a program that prints reports. Thus, you can run the program, even if you don't have a printer. Then, after storing the data in a disk file that normally goes to the printer, you can print the file from a computer that **is** connected to a printer.

SYSTEM (SLOW) Command. LDOS 5.1.4, although designed for use with the Model III, now also runs successfully on the Model 4 or 4P in Model III mode. LDOS has an advanced feature that senses the faster processor in the Model 4 and uses the faster clock speed. Both your application program and the internal "time of day" clock run faster. Thus, if an application program relies on the "time of day" clock, that program must be run at the Model III clock speed; hence, the new command SYSTEM (SLOW). SYSTEM (FAST) restores the Model 4 clock speed.

Using the LDOS Features With BASIC

If you are using a BASIC program that requires setting a memory size, your program might erase these features since both the program and the features use high memory. In most cases, you can prevent this by following these steps:

1. Use the LDOS MEMORY command to set memory **one byte less** than that specified in the instructions. For example, if the instructions say to answer the **Memory Size** question with 6144Ø, type this LDOS command:

   MEMORY (HIGH=61439) <ENTER>

2. Set up the special LDOS features you want.

3. Enter BASIC, without specifying memory size.

Chapter 11: PROBLEMS AND ERROR MESSAGES

This chapter explains the error messages you might receive while using LDOS or the initialization procedures.

If Your System Hangs Up...

If you try to use a disk drive while it is empty or while the door is open--or if you try to remove a diskette while the red access light is on--your computer system might "hang up." If this happens, correct the problem, and then press <SHIFT> and <BREAK> at the same time to regain control. If this doesn't work, press the reset button.

LDOS Error Messages

Listed below are LDOS error messages the system might display. 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 LDOS command, utility, or feature you are using. If the message is not self-explanatory, see the individual command listing in the Hard Disk Operating System Reference Manual.

User-Caused Error Messages

DISK SPACE FULL. The disk you are storing information on is full. Use another disk or use the KILL command to make more room.

FILE ACCESS DENIED. You are trying to access a password-protected file without using the password.

FULL OR WRITE PROTECTED DISK. The disk you are trying to use is full or write-protected. If you are using a floppy diskette, the diskette may not be in the drive or may be in the drive backward.

ILLEGAL ACCESS ATTEMPTED TO PROTECTED FILE. You are using an incorrect password for a protected file.

ILLEGAL DRIVE NUMBER. You are trying to use a nonexistent or empty drive.

ILLEGAL FILE NAME. The filename you are using is not in the correct format.

LOAD FILE FORMAT ERROR. You are trying to load and run a data file instead of a program.

PARAMETER ERROR. The parameter (option) specified is either misspelled or not valid. Enter the command again, being sure to spell it correctly and include the correct number of blank spaces.

PROGRAM NOT FOUND. None of your disks contains the specified program. Either you mistyped the program name or you are not using the correct disk.

SYS ERROR. You are trying to access an LDOS /SYS file that is not on the disk or that is defective. Try using a different LDOS system diskette.

WRITE PROTECTED DISK. You are trying to alter the contents of a write-protected disk. Either remove the write-protect tab (on a floppy diskette) or press the PROTECT button (on a hard disk).

Computer-Caused Error Messages

DIRECTORY READ ERROR
GAT READ ERROR
HIT READ ERROR

All these errors indicate that the computer cannot read the disk's directory and, thus, cannot find a disk file. The problem is either with the disk or the disk drive. If you're using a floppy diskette, try using another drive.

DATA RECORD NOT FOUND DURING READ
DATA RECORD NOT FOUND DURING WRITE

Either of these errors indicates that a certain area of the disk cannot be used. If you're using a floppy diskette, try using another drive or another diskette.

LOST DATA DURING READ
LOST DATA DURING WRITE

These errors indicate a hardware problem with the computer. Have the hardware checked by a service technician.

PARITY ERROR DURING READ
PARITY ERROR DURING WRITE

The usual cause of this error is either faulty media or a dirty disk drive. Change the diskette or clean the disk heads. The disk drives may also need aligning by a service technician.

SEEK ERROR DURING READ
SEEK ERROR DURING WRITE

These errors usually indicate a faulty disk. If you are using floppy diskettes, and this error occurs on several diskettes, the disk drive may need repair.

HARDGEN Error Messages

The following error messages are possible during use of the HARDGEN program:

ERROR - nn in line nn
<press any key to continue>

You are using a bad copy of HARDGEN. Pressing any key returns you to **LDOS Ready** so that you can remove the Hard Disk Initialization Diskette, turn off the system, and then restart with a fresh backup of the master Hard Disk Initialization Diskette.

ERROR - possible system error - (error message)
Please correct before continuing.
<Press any key to continue>

There is a problem with input/output to Floppy Drive Ø. Pressing any key returns you to **LDOS Ready.** To determine the appropriate action to take before continuing, look up the error message in the Hard Disk Operating System Reference Manual.

Software Configuration
A Data Error has occurred, or your configuration is not valid

Either of the following may be causing this error:

- You are using a bad copy of the HARDGEN program. Suspect this if you are trying to configure a standard system.
- Because of new hardware introductions, the internal table does not contain your particular configuration. Consult the personnel at your nearest Radio Shack Computer Center; they may have details on how to include your configuration in the table.

INITHD5 Error Messages

After you respond to HARDGEN's **PASSWORD** > prompt, and you see the message **Executing INITIALIZATION file,** you are automatically in the INITHD5 program. The following sections explain the error messages you may receive while executing INITHD5, either from HARDGEN or from the system prompt as described in Appendix B. The errors are less likely to occur in the first instance.

INITHD5 Syntax

To understand the messages, you need to be familiar with the INITHD5 command. Its syntax is:

DO INITHD5 (option,option,...)

The options are:

NEW assigns logical drive numbers, formats the hard disk, and puts LDOS on logical Drive Ø. This option erases any information you currently have on any of your hard disk drives. To use NEW, you must also use PW=. If data already exists on the hard disk, you must use ABS, or INITHD5 will not perform the format.

ABS tells LDOS you are changing your configuration. This lets you add or remove hard disk drives. To use ABS, you must also use NEW and PW=.

OLD tells LDOS to assign new floppy drive numbers without changing any information on the drives. This lets you easily add or remove floppy drives. Do **not** use this option to change the hard drive configuration.

UPDATE lets you put updated LDOS system information on Hard Disk Drive Ø and your Boot Diskette. You need to use this if you receive any LDOS changes.

PW=password tells LDOS the master password of the hard drives.

MASTER copies files from Floppy Disk Drive 4 to Hard Drive Ø. HARDGEN automatically uses this option to back up the Hard Disk Operating System Diskette to the hard disk.

FLOPPYn sets the total number of floppy disk drives to n, a number in the range 1 to 4.

HARDn sets the total number of physical hard drives to n, a number in the range 1 to 4.

Note: NEW, OLD, and UPDATE are mutually exclusive. Specify only one of these options at a time.

INITHD5 Problems and Error Messages

Certain operations that take place during initialization do not generate an error message, but may cause the system to become locked up.

If an actual error occurred with the operation of the hard disk, an **HD** appears in the upper right corner of the screen. If the **HD** does appear, pressing <SHIFT><BREAK> has no effect.

Check each of the following:

- Be sure all the hard disk drives are on.
- If you have more than one hard disk, verify that all power lights are lighted. If any is not, turn off the system, and be sure the 2Ø-pin data cables are properly connected. Turn on the system again, and reenter the DO INITHD5 command.

- Check the cable connections between the CPU and the primary drive.

If you cannot resolve the problem, have the drives checked by a Radio Shack technician.

These are the error messages that may appear during execution of DO INITHD5. Most do not occur if you use HARDGEN. Each message may or may not be followed by the message **Job Aborted:**

File not in directory

The Initialization Diskette is not in Floppy Drive Ø. Put the diskette in the drive, and reenter the DO INITHD5 command.

Either OLD, NEW or UPDATE must be specified!
Use the format DO INITHD5 (parameter)

You failed to specify the action to be performed by the DO INITHD5 command. Reenter the DO INITHD5 command and specify either OLD, NEW, or UPDATE.

Must have number of hard drives

This may be caused by any of the following:

- You failed to specify the number of hard disk drives on your system with the HARDn keyword or you misspelled the keyword.
- You entered a number of hard disk drives less than 1 or greater than 4.
- You misspelled the keyword MASTER, NEW, OLD, or UPDATE.
- You did not enter the parameters required by INITHD5 in the format: DO INITHD5 (parameters). Reenter the DO INITHD5 command, correcting the error.

Use only one hard drive number 1, 2, 3, or 4.

You entered more than one HARDn keyword in your command. If you have two hard drives, just enter HARD2. Don't enter HARD1,HARD2. Reenter the DO INITHD5 command, correcting the HARDn entry.

Must have number of floppy drives

You did either of the following:

- Failed to specify the number of floppy disk drives on your system with the FLOPPYn keyword, or you misspelled the keyword.
- Entered a number of floppy disk drives less than 1 or greater than 4.

Reenter the DO INITHD5 command and the correct FLOPPYn entry.

Use only one floppy drive number 1, 2, 3, or 4.

You entered more than one FLOPPYn keyword in your command. If you have two floppy drives, enter FLOPPY2 only. Don't enter FLOPPY1,FLOPPY2. Reenter the DO INITHD5 command, correcting the FLOPPYn entry.

NEW and OLD cannot be used together

You used both the NEW and OLD keywords. Reenter the DO INITHD5, specifying either OLD or NEW.

NEW and UPDATE cannot be used together

You used both the NEW and UPDATE keywords. Reenter the DO INITHD5 command and specify either NEW or UPDATE.

Missing PASSWORD parameter. Restart DO command

You failed to specify the PW keyword, or you misspelled it. Reenter the DO INITHD5 command, specifying the master password for the hard disks in the format PW=password.

Missing NEW parameter. Restart DO command

You specified a password to be used on the hard disks, but did not specify the NEW keyword. You need the password only if you want to use the NEW option to format the hard disks and erase their contents. Reenter the DO INITHD5 command. Specify either NEW with the password or OLD or UPDATE without the password.

Setting up new hard drive config files . . .
Write protected disk

The Initialization Diskette in Floppy Drive Ø is write-protected. Place a fresh, write-enabled backup Initialization Diskette in Floppy Drive Ø, and reenter the DO INITHD5 command.

Formatting cylinder ØØØ
Write protected disk

At least one of the hard disks is write-protected. This procedure formats all of the hard disks in your system. If there is data on one of your disks you want to keep, you must save that data on floppy diskettes before performing this procedure. After turning write-protect off on all the hard disk drives, reenter the DO INITHD5 command.

Appendix A: INITIALIZING YOUR SYSTEM MANUALLY

Normal use of the HARDGEN program produces a system configuration of 4 logical hard drives according to the internal table. If you want a different configuration, you may want to manually initialize the system from **LDOS Ready,** as described in this appendix. Manual initialization lets you obtain any configuration that is supported by LDOS.

In addition to the manual procedure, there are two other methods of initialization. The other methods, which are described in Appendices B and C, are:

- **INITHD5/JCL custom configuration,** which formats 4 logical hard drives according to the contents of the user-accessible file INCLUDE/TBL.

- **HARDGEN's shared configuration,** which formats 4 logical hard drives according to the contents of a Model 4 file README/PCM. This method lets LDOS share the hard drive system with the Model 4's operating system, TRSDOS 6.2.

Before attempting to use manual initialization, read Appendices B and C to be sure of the method that is best suited to your needs. Also, be sure you have backups of your LDOS 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 section, refer to your Hard Disk Operating System Reference 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 2.5Ø 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 1Ø-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 hard drives. (Specify their numbers and sizes.)
2. Set up any logical floppy drives you have, other than Floppy Drive Ø.
3. Format the drives.
4. Move the operating system to the hard disk.
5. Make the hard disk the system device.
6. 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 three operations and a SYSTEM command. This is explained in "Using Hard Disks as Data Drives."

Setting Up the Logical Hard 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="TRSHD5")
```

n specifies the **logical hard 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 **3Ø6** <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 **.Ø1** <ENTER>.

5. **Heads already in use <.-.-.-.-.-.-.>**
   Enter number of heads for partition <1-n>

   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 number of read/write heads to allocate to the logical drive currently being set up. Enter a number in the range 1 to n, in which n is the number of heads not yet assigned. Keep in mind that a logical drive cannot span 2 physical drives.

   If your response to this prompt is the same as your response to the prompt in Step 2, the prompt in Step 6 does not appear.

6. **Enter starting head:**

   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 1 and 2, SYSTEM displays:

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

   If you are assigning 1 head, you can specify either Head 3 or 4 as the starting head. However, if you are assigning 2 heads, you must specify Head 3.

   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.

Setting Up the Logical Floppy Drives

Your first floppy drive is the current system device, and is already set up as Logical Drive Ø. Later, if you make a hard disk the system device, you will change the logical drive number of the first floppy drive. (See "Making the Hard Disk the System Device.") For now, however, you are concerned only about setting up any additional floppy disk drives you may have.

To set up the extra floppy drives, enter the SYSTEM command for each. The command's syntax is:

```
SYSTEM (DRIVE=n,DISABLE,DRIVER="MOD3")
```

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

After you enter the command, SYSTEM displays the following prompt:

Enter drive select address <1-4>

Enter the number of the physical floppy disk drive that is to contain the logical drive specified in the command line. Addresses 1 through 4 correspond to the first through fourth floppy drives, respectively. Because the first floppy drive is already set up, enter a number from 2 through 4.

Formatting the Hard Disk Drives

Your Hard Disk Initialization Diskette contains a program called TRSFORM5/CMD that formats a logical hard drive set up with the SYSTEM command. You must run TRSFORM5 once for each logical hard drive you created.

To run the program, type:

TRSFORM5 <ENTER>

TRSFORM5 asks the following questions:

Note: Pressing <BREAK> as a response to any of the prompts causes program to exit, and returns you to **LDOS Ready.**

1. **Which drive is to be used ?**

   Enter the logical hard 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, TRSFORM5 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 TRSFORM5 proceeds to Step 5.

   If you type **Y** <ENTER>, TRSFORM5 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, TRSFORM5 asks if you want to lock out more tracks. If you do, type **Y** <ENTER>. If not, type **N** <ENTER>.

5. TRSFORM5 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, TRSFORM5 puts the directory information on the logical drive.

Using Hard Disks as Data Drives. Most likely, you will want to put LDOS on a hard disk to make that disk the system drive. If, however, you do **not** want to put LDOS on hard disk (you want to

use all hard disks as data disks), type the following command now:

SYSTEM (SYSGEN=ON) <ENTER>

This command creates the system's configuration file on the Initialization Diskette in Floppy Drive Ø.

To access the data on the hard disks, you must boot the system with this diskette. Because the diskette is so important, make several backups of it immediately. When finished, label all the diskettes--the backups and the diskette in Floppy Drive Ø--as Boot diskettes. If you lose all the Boot diskettes, perform the initialization again, omitting 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 LDOS 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 LDOS to hard disk, making the hard disk the system device, and storing the configuration on the boot diskette.

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

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

2. Use BACKUP to move the LDOS 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 LDOS 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 LDOS system.

When the backup is complete, remove the LDOS 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 LDOS 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, LDOS accesses the first hard disk--rather than the floppy disk drive--as Logical Drive Ø.

Storing the Configuration on the Boot Diskette

Now create the system's configuration file on Logical Hard Drive Ø by typing:

SYSTEM (SYSGEN=ON) <ENTER>

Move the file to the Initialization Diskette by typing this command:

BACKUP CONFIG/SYS:Ø :fd (S,I) <ENTER>

fd is the number of the logical drive associated with the first floppy drive. It is the same as hd in the SYSTEM (SYSTEM=hd) command. Remember, you swapped logical drive numbers with that command.

Once the backup is complete, reset the system while holding down both <ENTER> and <CLEAR>. At **LDOS Ready,** type:

AUTO <ENTER>

Press the reset button to boot your system as a hard disk system.

Whenever you wish to boot the system under hard disk control, you must have this Initialization Diskette, with configuration file, in the first floppy drive. Because the diskette is so important, make several backups of it immediately. When finished, label all

the diskettes--the backups and the diskette in Floppy Drive Ø--as Boot diskettes. If you lose all the Boot diskettes, perform the initialization again, omitting the formatting.

Appendix B: CUSTOM INITIALIZING WITH INITHD5/JCL

The normal HARDGEN program allows one software configuration for a particular hardware configuration. HARDGEN does this by transferring the internal information to a data file called INCLUDE/TBL. This file provides the JCL file INITHD5/JCL with all the information needed to invoke the appropriate LDOS system utilities, to synchronize the data given to those utilities, and to provide the standard 4-logical drive configuration. INITHD5 itself contains no information about hardware or software configurations.

This means that if you invoke INITHD5 from the system prompt, you may have provided all the information for a custom configuration of 4 logical hard drives in the INCLUDE/TBL file. The master Initialization Diskette contains a copy of INCLUDE/TBL that describes the use of the JCL tokens that INITHD5 expects. This INCLUDE/TBL file is a standard ASCII text file. Using any program or text processor that lets you write and edit JCL files, you can edit the file to describe your intended software and hardware configuration. You can assign the appropriate JCL tokens whatever values you need.

To use the INITHD5 custom configuration, follow these steps:

1. Make a backup of the master Initialization Diskette.

2. Using an appropriate editor, assign values of your choice to the appropriate JCL tokens in the file INCLUDE/TBL. The ASSIGN statements are given numeric values for inclusion when INITHD5 is compiled.

3. Similarly, you may give values of SET or RESET to the remaining tokens to provide INITHD5 with information it needs to synchronize the numeric data with the system prompts.

4. Two tokens have been set up in the file INITHD5 that must be given the appropriate true/false evaluation in INCLUDE/TBL or compilation ceases. You must **reset original**, and **set HARDGEN**. These two tokens have been set up to prevent the accidental use of the INCLUDE file.

   Note: The use of each token is described in your master copy of INCLUDE/TBL. The HARDGEN program overwrites this file on a used Initialization Diskette.

5. Test compilation. The JCL file INITHD5 can be tested using the "compile only" syntax of the DO utility. At **LDOS Ready**, type:

   DO $ INITHD5 (parameter,parameter,...) <ENTER>

   The required parameters are: NEW, PW=password, HARDn, FLOPPYn, and ABS. These parameters are explained in Chapter 11. In addition to the error messages listed in Chapter 11, you may also see these messages if you fail to act on Step 4:

   File INCLUDE/TBL is in original unmodified condition.

   File INCLUDE/TBL is improperly constructed.

   If the message **Invalid JCL format** appears during compilation, there is a syntax error in INCLUDE/TBL. Such an error may be caused by having an incorrect number of spaces around the keyword; only one space is required.

6. INITHD5 is compiled to the file SYSTEM/JCL. If you list the file, you can see that it contains the data you wish to pass to LDOS. If the file contains a target substitution field in the format #CYLS2#, you probably misspelled a word or forgot to assign a value to that token.

7. When SYSTEM/JCL appears to contain the desired configuration details, copy INCLUDE/TBL to a backup of the master Initialization Diskette. Then place this diskette into Floppy Drive Ø and press the reset button, <CLEAR>, and <ENTER> at the same time. This defeats the AUTO function, and ensures that the system starts up under floppy disk control. At **LDOS Ready**, enter the DO INITHD5 command as in Step 4, but without the dollar sign ($).

   DO INITHD5 (parameter,parameter,...) <ENTER>

   This compiles and executes INITHD5/JCL to initialize the system according to information in INCLUDE/TBL.

8. The procedure now becomes identical to that begun at Step 9 of the HARDGEN program.

Appendix C: INITIALIZING AN LDOS/TRSDOS SYSTEM

This method of initialization lets LDOS (for the MODEL III) and TRSDOS 6.2 (for the Model 4 or 4P) share space on a hard disk system.

To use this option, the following criteria must be met:

- You must have a TRS-8Ø Model 4 or Model 4P
- All portions of the physical hard drives that are to be used under TRSDOS 6 must be formatted with the head-by-head allocation option of the **TRSDOS 6** HARDGEN program. (See Model 4/4P Hard Disk System Startup.) This includes those areas to be shared by LDOS, as well as those to be used only by TRSDOS 6.
- The data file README/PCM, which is produced by the Model 4 or 4P, must be available on floppy diskette when you invoke the LDOS HARDGEN program.

Using this option imposes the following restrictions:

- LDOS must be used on 4 logical drives, either with or without TRSDOS.
- All logical drives set up under LDOS must have boundaries consistent with the boundaries defined under TRSDOS 6. This rule has one exception; in any area in which several contiguous read/write heads remain unformatted by TRSDOS 6, LDOS can make more than one logical drive of the area.
- The LDOS system hard drive must be on the primary hard drive. Usually, it is not on the first head of the primary drive.
- You cannot assign the LDOS system hard drive to the same physical area as the TRSDOS system hard drive.
- The LDOS HARDGEN program has complete control over the logical drive numbers associated with particular physical areas. Under most circumstances, a physical disk area has a different number assigned to it under LDOS than under TRSDOS.

- You must be sure that running a shared disk system, in which there may be logical drive number differences or duplicate filenames, does not adversely affect your application program.

Procedure

To use the disk-sharing option, follow these steps:

1. Start up your system under Model 4 mode, TRSDOS 6.

2. If you have not yet used TRSDOS 6 HARDGEN to initialize your hard disk system, do so now. Use the head-by-head assignment option (Option D of the space allocation menu) to format all areas that are to be used by TRSDOS, either alone or with LDOS.

   Note: It is a good idea **not** to assign all available primary drive heads for use with TRSDOS.

3. When the Model 4/4P hard disk system is working satisfactorily, copy README/PCM from the TRSDOS 6 diskette to a backup of the master LDOS Hard Disk Initialization Diskette.

4. Insert the backup LDOS Initialization Diskette into Floppy Drive Ø, and reset the system.

5. The LDOS HARDGEN program begins automatically, and asks if your system is ready. Type **Y** <ENTER>.

6. Assuming that README/PCM is on the floppy diskette, LDOS HARDGEN informs you that the file is available, and asks if you want to use it for input to HARDGEN. Type **Y** <ENTER>.

7. The screen shows brief details of the TRSDOS 6 initialization. If any physical hard disk has no TRSDOS 6 logical drives assigned to it, HARDGEN asks you to give the size (in megabytes) of the physical hard disk in question. With this one exception, you need enter no other information concerning the physical configuration or logical configuration under TRSDOS 6.

8. If any areas of any hard drive are not being used by TRSDOS, the screen gives you the physical locations of these areas. If adjacent heads are unformatted, the area that includes the heads is treated as one area. Such areas have a number in parentheses with the description.

   HARDGEN then gives you the opportunity to use any unformatted areas exclusively for LDOS. For each area, it asks:

   Do you wish to use area (n) for LDOS <Yes or No>

   Type **Y** <ENTER> or **N** <ENTER> as suits your needs.

   The maximum number you can use is 4. If you use 4 areas for LDOS, the program skips to Step 1Ø. Otherwise, it automatically continues to Step 9.

   Note: The areas **not** assigned by TRSDOS are assigned the lowest numbered logical positions, under LDOS.

9. The screen displays the logical hard drives as set up under TRSDOS 6, with a number in parentheses preceding each. For each TRSDOS logical drive, up to a maximum of 4, HARDGEN asks:

   Do you wish area (n) to be shared <Yes or No>

   Type **Y** <ENTER> or **N** <ENTER> as suits your needs.

   If, at this point, you have not set aside the required 4 logical drives for use by LDOS, either with or without TRSDOS, HARDGEN warns you. Then it automatically divides the largest "exclusively LDOS" logical drive as many times as needed to give the total system configuration 4 LDOS drives. If, at any point, it can divide the largest drive no further--because the drive contains only 1 read/write head--HARDGEN returns you to the start of the program.

1Ø. After you have the necessary 4 logical drives, HARDGEN asks:

   Do you wish a hard drive to be the system drive <Yes or No>

   If you type **N** <ENTER>, HARDGEN makes the first floppy drive the system drive, and continues to Step 11.

If you type **Y** <ENTER>, HARDGEN finds the first "exclusively LDOS" area on the primary hard drive, and assigns it as Logical Drive Ø. If no such area exists, HARDGEN assigns the first shared area on that disk as Logical Drive Ø. In any case, it never makes the TRSDOS system drive Logical Drive Ø. If HARDGEN succeeds in assigning Logical Hard Drive Ø, it continues to Step 11. If it does not, it warns you, and assigns the floppy drive as Logical Drive Ø.

11. The screen displays the system configuration and any HARDGEN-supplied details. The program now continues at Step 6 of the standard HARDGEN program. It provides an audit trail called README3/PCM that contains details of the LDOS aspects of the shared initialization.

    At Step 9 of the standard program, HARDGEN warns you that all information on the hard drives is to be overwritten. This is not the case for logical drives that are to be shared by TRSDOS and LDOS.

Appendix D: CARE OF YOUR HARD DISK DRIVES

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 E: HARD DISK SPECIFICATIONS

General Specifications	5-Meg	15-Meg
Disks (Platters)	2	3
Heads (Recording surfaces)	4	6
Cylinders	153	3Ø6
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,Ø13,5Ø4 (4896K)	15,Ø4Ø,512 (14,688K)

Technical Specifications	5-Meg	15-Meg
Disk RPM	36ØØ	36ØØ
Recording capacity unformatted:		
per drive (megabytes)	6.38	19.14
per surface (megabytes)	1.59	3.19
per track (kilobytes)	1Ø.4Ø	1Ø.4Ø
Recording density (BPI)	769Ø	9Ø9Ø
Step rate (milliseconds)	.Ø1	.Ø1
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.ØØ	8.ØØ
Hard disk drive case dimensions (inches)		
height	14.ØØ	14.ØØ
width	5.5Ø	5.5Ø
length	15.ØØ	15.ØØ
Backwall clearance requirement (inches)	3	3
Hard disk drive system power	12Ø VAC, 6Ø HZ, .9Ø amps	12Ø VAC, 6Ø HZ, .9Ø amps
Disk power		
+12V dc +/- 1Ø%	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° to 85°F)
nonoperating	-4Ø°C to 6Ø°C (-4Ø°F to 14Ø°F)	-4Ø°C to 6Ø°C (-4Ø°F to 14Ø°F)
Relative humidity	8% to 8Ø%	8% to 8Ø%
Max. wet bulb temperature	26°C without condensation	26°C without condensation

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