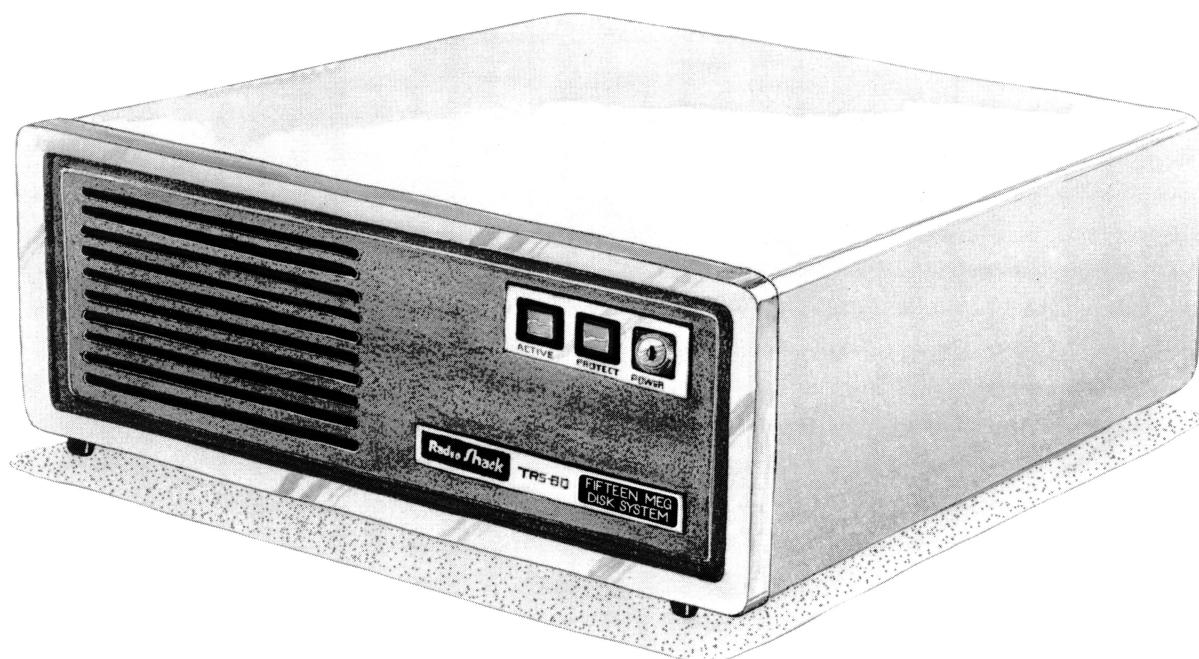


Catalog Number 26-4155

TRS-80®

15-Meg Hard Disk Owner's Manual



Radio Shack®
A DIVISION OF TANDY CORPORATION
FORT WORTH, TEXAS 76102

Warning: The FCC wants you to know-

This equipment generates and uses radio frequency energy and if not installed and used properly, i.e., in strict accordance with the instructions manual, may cause harmful interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

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Read the following before going ahead...

It's important to note that your TRS-80 Computer will need a hardware modification before you can connect a Hard Disk to it. This must be done by a qualified Radio Shack service technician. Also, the last Hard Disk Drive in your System must always contain a Line Terminator. Check with your Radio Shack Computer Center for details.

Never move the Disk Drive Unit while the Drive is running!

Also, do not expose a Disk Drive Unit to a strong magnetic field (such as a bulk eraser); doing so may cause you to lose data or damage the unit. You cannot bulk erase a Hard Disk!

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To Our Customers...

Congratulations on your purchase of the TRS-80® Hard Disk System. You'll find it to be a valuable tool which gives you more information storage and faster data retrieval than ever before with a TRS-80 Computer.

To use the Hard Disk System, you'll need a TRS-80 computer system that has at least 64K of RAM memory.

It's important to note that your Computer will need a hardware modification before you can connect a Hard Disk to it. This must be done by a qualified Radio Shack service technician. Also, the last Hard Disk Drive in your System must always contain a Line Terminator. Check with your Radio Shack Computer Center for details.

This manual will explain:

- What a TRS-80 Hard Disk System is.
- How to connect a Hard Disk to your Computer.
- How to power-up and use a TRS-80 Hard Disk System.

and much more!

If you're already familiar with TRSDOS, you'll find TRSDOS-II easy to use. We'll try not to repeat too much of the information found in your Owner's Manual--just what's necessary. You'll still need to refer to your Computer's Owner's Manual and any other publications you've been using.

TRSDOS-II has been designed to be fully compatible with all Radio Shack programs that operate under TRSDOS 2.0.

Notational Conventions

The following conventions are used to show syntax in this manual:

CAPITALS	Any words or characters which are uppercase must be typed in exactly as they appear.
<u>lowercase underline</u>	Fields shown in lowercase underline are variable information that you must substitute a value for.
<KEYBOARD>	Any word or character contained within a box represents a keyboard key to be pressed.
...	Ellipses indicate that a field entry may be repeated.
<u>filespec</u>	A field shown as filespec indicates a standard TRSDOS file specification of the form: <u>filename/ext.password:d(disk name)</u> Note that with TRSDOS-II, d (Drive) can be any number between 0-7.
punctuation	Punctuation other than ellipses must be entered as shown.
delimiters	Commands must be separated from their operands by one or more blank spaces. Multiple operands, where allowed, may be separated from each other by a comma, a comma followed by one or more blanks, or by one or more blanks. Blanks and commas may not appear within an operand.

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Hard Disk

Owner's Manual

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Introduction

The Radio Shack TRS-80® Hard Disk is a non-removable direct access, mass storage device designed for use with the TRS-80 Computer System.

Radio Shack provides two versions of the Hard Disk Drive--your Hard Disk System must include one Primary Drive and may include up to three Secondary Drives.

You'll find the Hard Disk System provides more storage and faster access than Floppy Diskette Systems. Its special features include:

- Maximum storage capacity of 15 megabytes.
- 5 Mbits/second data transfer rate which is at least 10 times faster than floppy diskettes.
- Environmentally sealed head and disk chamber for safer data storage and longer disk life.
- Keyed power switch for security and prevention of data loss due to inadvertent power-off.
- Write-Protect Switch so you don't accidentally write over stored data.
- An enhanced floppy diskette data storage format that lets you store more information on an 8" diskette than ever before.

Hard Disk

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1/A Brief Description of the System

The TRS-80 Hard Disk System consists of the following major components:

- TRS-80 Computer (includes one or two built-in Floppy Disk Drives -- Drives 0 and 1).
- Floppy Diskette Expansion Unit (optional/extra). You can have up to three floppy diskette expansion drives in your Hard Disk System (Drives 1, 2, and 3).
- Primary Hard Disk Drives. You will need one Primary Unit (Drive 4).
- Secondary Hard Disk Drives (optional/extra). You can have up to three Secondary Drives in your Hard Disk System (Drives 5, 6, and 7).

You can also use any optional add-ons (printers, modems, etc.) that are used with a TRS-80 Computer when it's operating under floppy disk control. (See your TRS-80 Computer owner's manual for details.)

What Is A Hard Disk?

Unlike a floppy diskette, a hard disk cannot be removed from its drive. With minor exceptions, however, the only difference you should notice between hard disk and floppy diskettes is that a hard disk drive has faster access time and more storage space than floppy diskettes.

There are two versions of the Hard Disk Drive:

- A Primary Drive which contains TRSDOS-II, the Operating System (once the Primary Drive is formatted) and
- Up to three Secondary Drives which are used for data and program storage.

Basically, the Hard Disk Unit consists of platters (or disks) spaced approximately one inch apart and Read/Write heads (one on each side of each platter) which move toward or away from the center of the disk as needed.

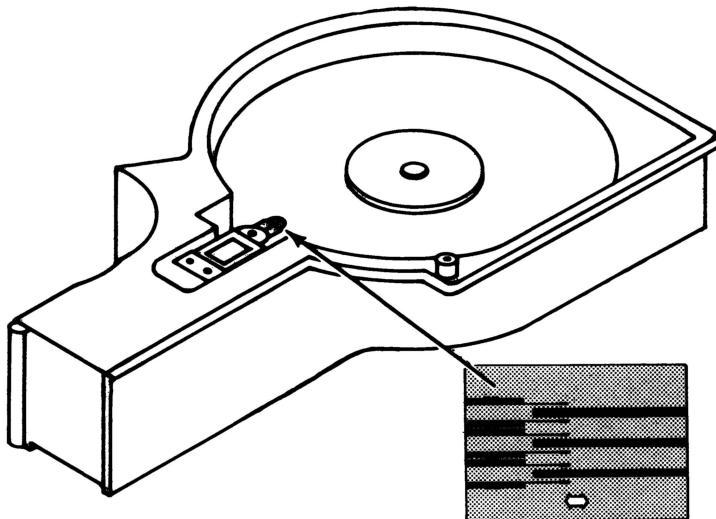


Figure 1. Hard Disk

The Disks and Read/Write Heads are fully enclosed in a sealed chamber. A special air filtration system prevents dust and other particles which might destroy data from reaching the disks. There is also a separate filtering system that permits pressure equalization with the "outside" air pressure.

To store information, each hard disk unit is organized into 306 "cylinders."

Each cylinder is made up of six tracks that have the same radius on each of the six surfaces ($6 \times 306 = 1836$ total tracks per disk).

Each track contains 34 sectors ($34 \times 1836 = 62,424$ total sectors per disk).

Each sector is made up of 256 bytes ($256 \times 62,424 = 15,980,544$ total bytes per disk). A sector is the most basic unit of space allocation on the hard disk. Note that granules (the basic unit of space allocation on the floppy diskette) are not used by the hard disk or floppy diskettes formatted under TRSDOS-II Operating System.

Tables 1 and 2 show the difference in storage space between 5 1/4" hard disk and floppy diskettes.

5 1/4"				
Hard Disk	Cylinders	Tracks	Sectors	Bytes
1	306	1,836	62,424	15,980,544
---	1	6	204	52,224
---	---	1	34	8,704
---	---	---	1	256

Table 1

Floppy Diskette	Tracks	Sectors	Bytes
1	76	2,432	622,592
---	1	32	8,192
---	---	1	256

Table 2

Note: Track 0 on the 8" floppy diskette is reserved for System use and is not available for user storage. It is formatted single-density with 26 sectors that contain 128 bytes each. The total capacity of the floppy diskette is $622,592 + (3,328) = 625,920$ bytes.

TRSDOS-II takes up to 400K bytes of storage area on Drive 4. Therefore, each Primary Hard Disk Drive has 400K bytes less user area than a Secondary Drive.

It's important to note that the hard disk's media can have flaws, and these flaws can cause errors when used. These flaws are due to minor defects in the media. There will be flaws on no more than 4 tracks per surface, not to exceed 12 tracks total. However, the FORMAT utility will not use those areas of the disk that cause errors.

On all Hard Disk Units, flaws in the media are identified before the Disk Drives are delivered to you. Attached to the bottom of your Hard Disk Unit is a DISK FLAW RECORD which specifies the errors on your particular unit. Do not throw this map away! You may need to refer to it when

formatting the Disk and Radio Shack service technicians may need to refer to it if your Drive ever needs servicing.

What Happens To Your Floppy Diskette?

When the TRS-80 Hard Disk System is fully operational, all Floppy Diskette Drives -- including Drive 0 -- are used for data and program storage only (for exceptions, see FORMAT and FCOPY).

One difference between a TRS-80 Floppy Diskette System and a TRS-80 Hard Disk System is the Computer goes to Drive 4 first (instead of Drive 0) when searching for the operating system or any other file (once Drive 4 is initialized). In fact, with TRSDOS-II, the search sequence always begins at Drive 4, then goes to Drives 5, 6, 7, 0, 1, 2, and finally 3. (In other words, if you give a command such as KILL TEST/A, TRSDOS-II will look for the file named TEST/A on Drives 4, 5, 6, 7, 0, 1, 2, and 3 -- in that order).

Can you still use your Floppy Diskette programs under TRSDOS-II?

Yes, but...

There's more involved than just inserting a diskette into a drive and running the program.

Floppy diskettes formatted under TRSDOS-II are different from floppy diskettes formatted under TRSDOS.

TRSDOS-II formats floppy diskettes into 32 sectors per track instead of the TRSDOS floppy diskette 26 sectors per track. These additional sectors are due to a more efficient use of diskette media, allowing more storage space on the same size diskettes.

What this means is you can copy (see FCOPY in TRSDOS-II Manual) data which is stored on TRSDOS floppy diskettes to either a hard disk or to a TRSDOS-II formatted floppy diskette. But it also means you can't read or write to a TRSDOS formatted floppy diskette (26 sectors) directly with TRSDOS-II. Nor can you use a TRSDOS-II formatted floppy diskette (32 sectors) when you are operating under TRSDOS floppy diskette control.

Connections

Although the Hard Disk System must be installed by a Radio Shack computer technician, there may be times when you'll have to connect or disconnect the Disk Drive Units. It is very important that the drives be properly connected to the Computer as well as to each other. Carefully study the following section for proper connections.

Important Note! Never move the Disk Drive Unit while the drive is running! Permanent damage to the drive may occur, resulting in the loss of information or replacement of the disk.

While the minimum requirements for a TRS-80 Hard Disk System are a Computer (with 64K of RAM) and Drive 4, you may eventually want to expand your System to include up to three Secondary Drives.

When you're ready to expand beyond the Primary Drive, simply take Drive 4 to your Radio Shack Computer Center for modification and add Drive 5 (which contains a Line Terminator) to your System. If you later want to add Drives 6 and 7, see your Radio Shack Computer Center for details on expanding the System.

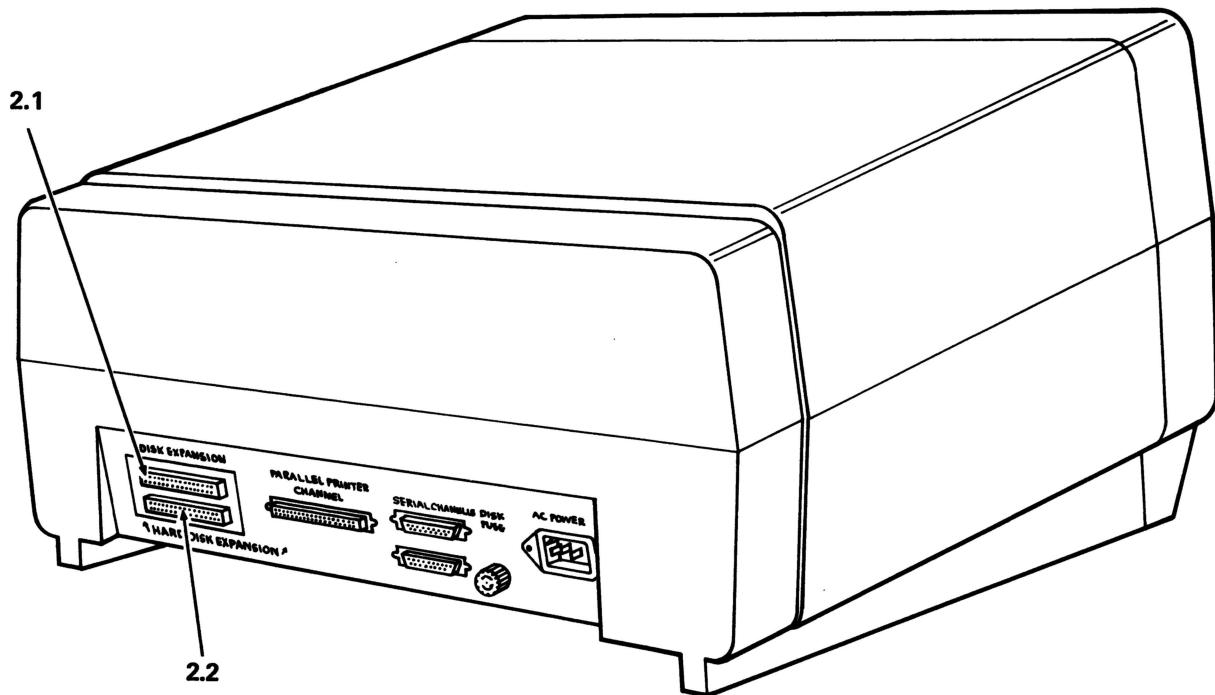


Figure 2. TRS-80 Connection Panel

2-1. Floppy Diskette Expansion Connector (50-pin).

One end of the Floppy Diskette Expansion Cable should be connected to this connector and the other end attached to the Floppy Diskette Expansion Drive (Drive 1).

Note: If your system requires a Terminating Connector one will be included with your computer; otherwise you do not need to use a Terminating Connector.

2-2. Hard Disk Expansion Connector (50-pin).

Connect one end of a Hard Disk Expansion Cable to this connector. The other end should be connected to the Hard Disk Primary Drive (Drive 4).

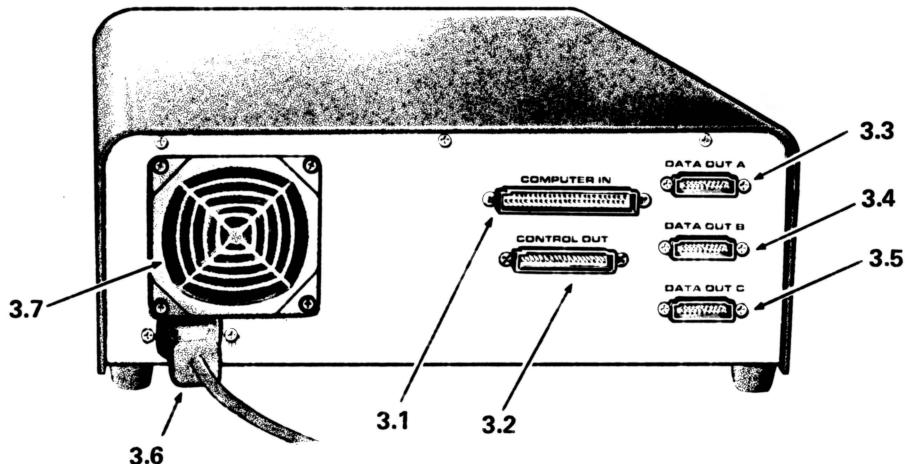


Figure 3. Primary Drive (Rear View)

- 3-1. **Hard Disk Expansion Connector (50-pin).**
Connect the Hard Disk Expansion Cable from the Computer to this connector (Drive 4).
- 3-2. **Secondary Drive Expansion Connector (34-pin).**
Connect one end of a Secondary Hard Disk Expansion Cable to this connector.
- 3-3. **Drive 5 Data Connector(OUT) (20-pin).**
Connect one end of the Data Cable for the Secondary Drive you've labeled as Drive 5 to this connector.
- 3-4. **Drive 6 Data Connector(OUT) (20-pin).**
Connect one end of the Data Cable for the Secondary Drive you've labeled as Drive 6 to this connector.
- 3-5. **Drive 7 Data Connector(OUT) (20-pin).**
Connect one end of the Data Cable for the Secondary Drive you've labeled as Drive 7 to this connector.
- 3-6. **Power Cord Connector.**
- 3-7. **Filter.** Clean when filled with dust and particles. Carefully remove the outer grill. DO NOT REMOVE THE SCREWS. Remove filter and rinse with tap water. When the filter is completely dry, put it back in the drive.

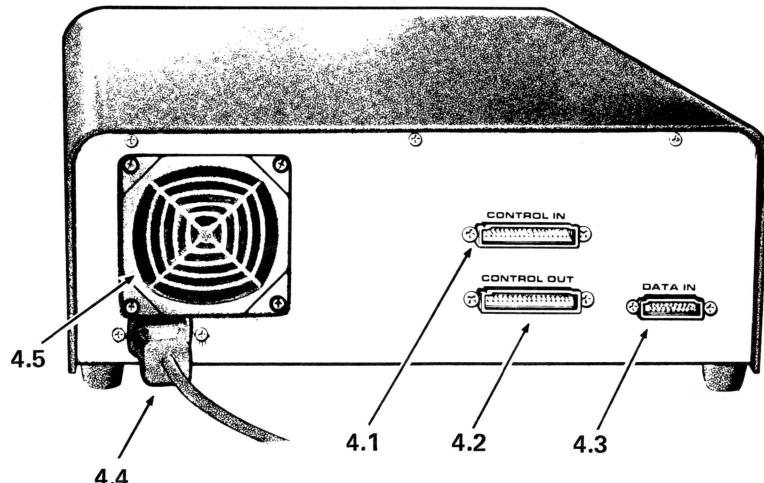


Figure 4. Secondary Drive (Rear View)

**4-1. Secondary Drive Expansion Connector (IN)
(34-pin).**

Connect the Hard Disk Expansion Cable from the next lower numbered drive to this connector.

**4-2. Secondary Drive Expansion Connector (OUT)
(34-pin). Connect the Hard Disk Expansion
Cable which goes to the next higher numbered
drive to this connector.**

4-3. Data Cable (IN) (20-pin).

Connect the Data Cable from the Primary Drive to this connector.

4-4. Power Cord Connector.

4-5. Filter. Clean filter when filled with dust and particles. Carefully remove the outer grill. DO NOT REMOVE THE SCREWS. Remove the filter and rinse with tap water. When the filter is completely dry, put it back in the drive.

When the complete system is properly connected, it should look like Figure 5.

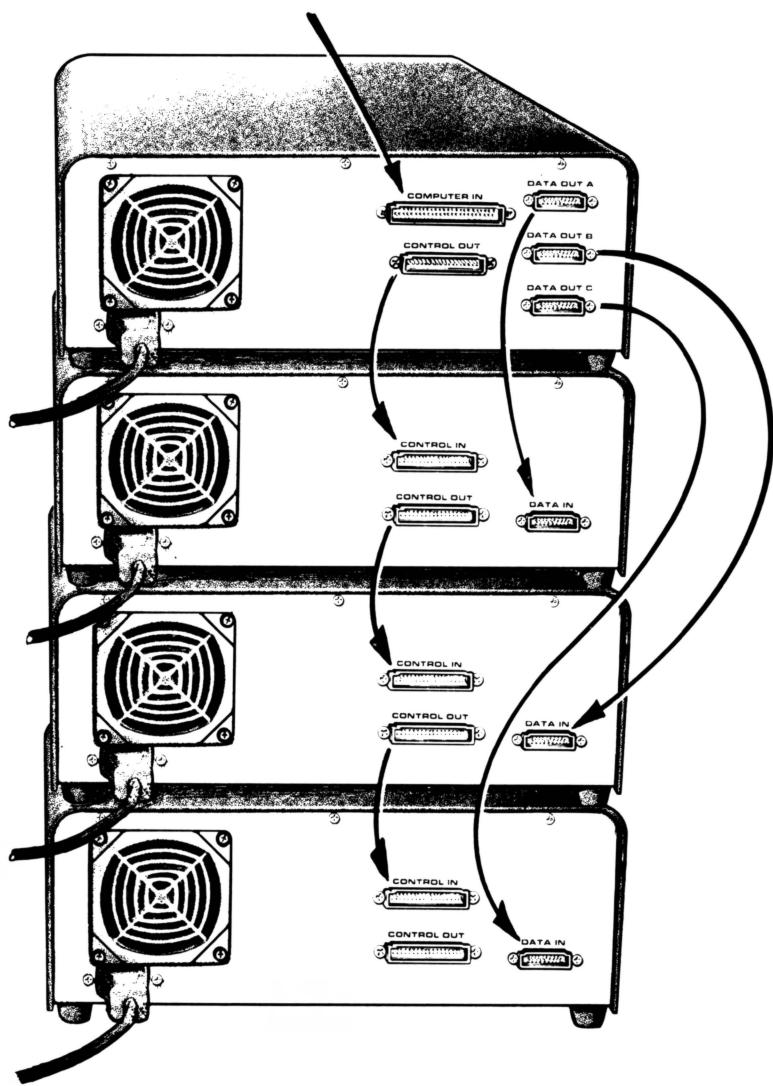


Figure 5. Hard Disk System (with optional drives).*

*Cables lengths shown do not represent actual cable length. Also, multi-drive systems must be "stacked" for proper cabling.

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2/Using the Hard Disk Drive

Once the System is properly connected, it is relatively simple to use the Hard Disk Drive. Figure 6 details the controls found on the front panel of the Hard Disk Unit.

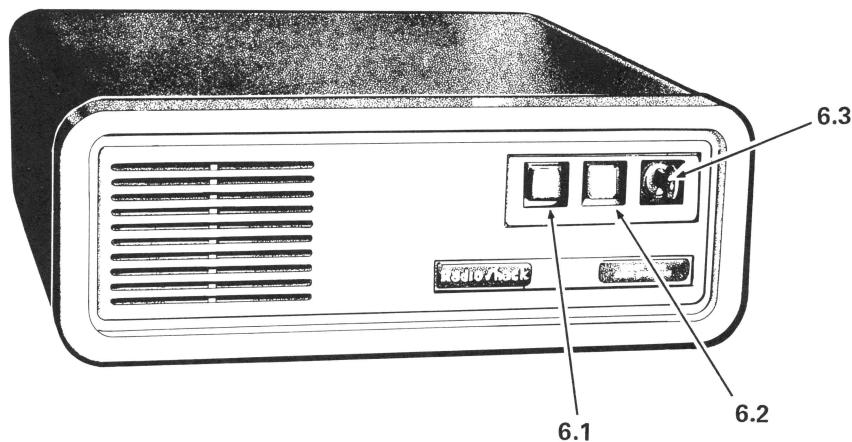


Figure 6. Hard Disk Drive (Front View)

6-1. Drive Active Light (Green).

6-2. Write-Protect Switch (Red).

6-3. Power Switch (or light).

Drive Active Light

When this light is illuminated, the Drive is being used or is ready to be used.

In other words, the Active Light is on whenever the Read/Write heads are stationary and a drive has been selected.

When you power-up, the Drive 4 Active Light will light up and remain illuminated until another drive is accessed.

Under no conditions should more than one Active Light in the System be on at any one time. If you have a multi-drive System, more than one light may appear to be on (or off) under extreme "seek" operations but, in reality, only one light is on. If more than one light actually is on, turn the System off, wait a few minutes and turn the System on again. If the problem recurs, contact a Radio Shack service technician.

Write-Protect Switch

The Write-Protect Switch serves the same purpose for the hard disk as the Write-Protect notch serves for the floppy diskette.

When this Switch is illuminated, you cannot write to the drive (although you can read from it). If you try to write to a write-protected drive, an ERROR 15 will occur.

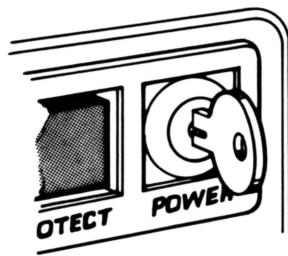
Press this button once to light up (write-protect), once more to turn the light off (so you can write to the disk).

Although the Write-Protect Switch may be pressed at any time, we suggest you press it only when the drive is in the idle state (not reading or writing). If you press the Write-Protect when the Computer is "writing" to the hard disk, data may be lost or destroyed.

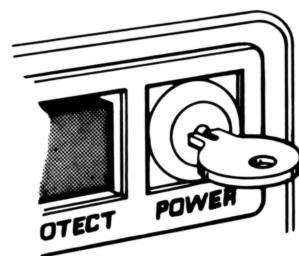
When you power-up, the Write-Protect Switch is at the same setting as when the drive was last used.

Power Switch (or light)

You must use a key to turn the primary disk drive on or off. Turn the key clockwise to turn the Drive ON. Turn the key counterclockwise to turn the Drive OFF. The secondary drives are equipped with a light to indicate when they are on. (See Figure 7)



OFF



ON

Figure 7. Primary Power Switch

You'll find it's a good idea to power-up the System, then remove the key until you're ready to turn the entire System off.

Note that the key is used for minimum security only. If you lose this key, you can obtain another one from the nearest Radio Shack Computer Center since all Radio Shack Hard Disk Drives use the same key.

Power-Up

To protect your data, the proper power up sequence should be followed. To simplify the power-up procedure, we suggest you use the **Automatic Power Controller** (26-1429).

1. Be sure all floppy diskette drives are empty and all components are turned OFF.
2. Turn Drive 4 (the Primary Drive) ON.

The secondary drives will be turned on automatically
Allow 1 minute warm-up for the Disk Drives.

3. Turn your Computer ON.
4. Turn all peripherals (including Floppy Disk Expansion Unit) ON.
 - . If your operating system is stored on Hard Disk (TRSDOS-II), the Computer will go to Drive 4 and automatically load the operating system. You can then begin using your TRS-80 Computer System as described in the Owner's Manual.
 - . If Drive 4 hasn't been formatted (or you've had a problem and are re-formatting it), the display will "white out" and the message BOOT ERROR HN will appear. Press RESET, then press <REPEAT> <ESC> or <REPEAT> <BREAK> and control will go to Drive 0 (under Floppy Disk control). You will then need to format Drive 4 (see FORMAT later in this section) or use the Floppy Disk TRSDOS-II Operating System.

When turning the power OFF...

Always be sure Drive 4 (the Primary Drive) is the last Disk Drive turned off. If Drive 4 is not the last Drive turned off, data may be lost or destroyed. For example:

1. Turn all peripherals (including Floppy Disk Drives) OFF.
2. Turn the Primary Drive (Drive 4) OFF.
3. Turn the Computer OFF.

Preparing Drive 4 For Use (FORMAT)

When the Hard Disk System is installed, all hard disk drives are effectively "blank." Consequently, each drive (Drive 4 and all Secondary Drives) must be formatted before the Hard Disk System can operate under hard disk control.

Once the System is powered-up, you must initialize the Primary Drive by transferring the operating system (TRSDOS-II) to Drive 4. To do this, use the utility **FORMAT**, which is contained on the TRSDOS-II diskette (labeled **TRSDOS-II Operating System** and supplied with the Hard Disk). Note: We suggest you make a backup copy of the supplied diskette before you begin transferring the operating system to Drive 4.

FORMAT**Erase and Format a Disk/Diskette****FORMAT :d {options}**

d specifies the drive to be formatted and is a number from 0-7. d is optional; if omitted, TRSDOS-II will prompt for the drive number.

{options} is one or more of the following:

ABS= tells TRSDOS-II not to prompt if the specified drive contains data. If ABS is omitted, TRSDOS-II prompts before overwriting any existent data.

ID= disk-name tells TRSDOS-II the name to assign to the disk. If omitted, TRSDOS will be used.

PW= password tells TRSDOS-II the master password to assign to the disk. If omitted, PASSWORD is used. The master password allows access to all user files (via the PROT command).

DIR= nnn tells TRSDOS-II where to place the primary directory. For hard disks, nnn can be any number between 0-300; for floppy diskettes, 1-71. If omitted, cylinder 44 is used for floppy diskettes, cylinder 130 for hard disks.

ALT= nnn tells TRSDOS-II where to place the alternate directory. If nnn= 000, an alternate directory will not be created. If omitted, the formula directory + 3 is used to compute placement of the alternate directory. For floppy diskettes, 3 represents three tracks; for hard disks, 3 represents three cylinders. For hard disks, nnn can be any number between 0-303; for floppy diskettes, any number between 1-74. The default value is 52.

SIZ= nnnn tells TRSDOS-II how many filenames to allow for in the initial directory. For hard disks and floppy diskettes, nnnn can be any number between 1-1220. If omitted, 180 is used for floppy diskettes; 336 for hard disks. If **SIZ=** nnnn is specified, TRSDOS-II rounds off to the next multiple of 4.

ILV= nn when used, it sets the interleave factor (ratio of n:1), which determines the order in which TRSDOS-II is to access disk sectors. Between disk accesses, TRSDOS-II must do a certain amount of processing. (The amount depends upon your application.) The proper ILV factor can reduce the processing by minimizing disk rotation between accesses. If you omit the option, nn defaults to 10.

Hard Disk only

HDS= nn tells TRSDOS-II the number of heads on the drive. This is required for Hard Disks. If omitted, TRSDOS-II prompts you for the number. **CYL= nnnn** tells TRSDOS-II the number of cylinders on the drive. This is required for Hard Disks. If omitted, TRSDOS-II prompts you for the number. **PRE= nnn** tells TRSDOS-II the precompensation start cylinder(128 or greater). Default value is 128. DIR and ALT defaults will be increased automatically to be greater than the precompensation to ensure the most reliable directory access.

verification level is one of the following:

FULL reads the value of each sector and compares that value with what was written during formatting.

NONE No verification is done.

verification level is optional; if omitted, **FULL** is used.

With TRSDOS-II, this FORMAT consists of 32 sectors per track instead of the TRSDOS 26. Because of this, floppy diskettes formatted by TRSDOS-II cannot be used under TRSDOS and vice versa.

For more details on FORMAT, see your TRS-80 Computer owner's manual.

Examples

FORMAT 5 <ENTER>

formats the diskette on Drive 5, using the default values for options. You will be prompted for HDS and CYL numbers.

FORMAT 2 <ENTER>

formats the diskette in floppy Drive 2, using the default values for floppy diskettes.

FORMAT <ENTER>

prompts you for the drive to use before it begins formatting. Since no options are specified, the disk will have the option's defaults. If hard disk you will be prompted for HDS and CYL numbers.

FORMAT :6 {DIR=75} <ENTER>

formats the disk in Drive 6, placing the primary directory on cylinder 75. You will be prompted for HDS and CYL numbers

Once your Computer has been modified and all Hard Disk Drives have been properly connected, follow this procedure to format Drive 4 and move TRSDOS-II to Drive 4.

1. Power up your System as described earlier.
2. The error message **BOOT ERROR HN** will be displayed. Press **RESET** then **<REPEAT> <BREAK>** or **<REPEAT> <ESC>**.

If Drive 4 has previously been formatted and if you wish to re-format, you will need to insert the floppy diskette containing the **FORMAT** program into Drive Ø and start-up the System under control of floppy diskette TRSDOS-II as described earlier.

3. When the prompt **INSERT DISKETTE** appears, insert the supplied floppy diskette (labeled **TRSDOS-II Operating System**) into Drive Ø and close the drive door.
4. Answer the date and time prompts as described in your Computer owner's manual.
5. When **TRSDOS-II Ready** appears, type **FORMAT**, specify any options, and press **<ENTER>**. (**FORMAT 4 HDS= 6, CYL=3Ø6 <ENTER>** will format drive 4 for 6 read/write heads and 3Ø6 cylinders and automatically transfer TRSDOS-II to drive 4. (The **FORMAT** program takes about 2Ø-25 minutes to run.)

The **FORMAT** program will then load and format Drive 4. **FORMAT** will automatically move TRSDOS-II to the Hard Disk (Drive 4).

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6. When TRSDOS-II Ready re-appears, you may either format other hard disks (5-7) or press RESET to boot from the newly formatted drive 4.
7. The System will then repeat the power-up sequence but "go" directly to Drive 4 and load TRSDOS-II. The prompt TRSDOS-II Ready will then appear.
8. Remove the supplied floppy diskette (which contains TRSDOS-II) and store it in a safe place.

You will then be ready to format any Secondary Hard Disk Drives (Drives 5, 6, and 7) which are in the System. For details on doing this, see FORMAT in this manual.

3/ Power-Up Diagnostic Messages

Whenever the Computer is turned on or reset, it executes a built-in diagnostic program to help insure that the System is in good working order. If the Computer detects a hardware fault or other problem, it will display an error message--then stop. This checkout program reduces the chance that you will lose time or data without knowing it because of a defective system.

If one of these error messages is displayed, the first thing you should do is RESET the Computer and attempt to duplicate the error. If the message reappears, consult Table 3.

This program does not check for multiple faults; as soon as the first fault is found, the Computer displays the appropriate message and stops.

Before suspecting hardware problems, try the operation several times. Recheck to see that all power and interconnections are correct. As a last resort, try re-formatting the Operating System on the Hard Disk Drive. Remember! FORMAT will erase all data on Drive 4. To prevent losing data altogether, be sure to keep backup copies of all data on the disk as you go along.

Note: All of the error messages listed in the TRS-80 Computer owner's manual (for floppy diskettes) apply to the Hard Disk System as well. If a diagnostic message appears that is not listed in Table 3, see your Computer owner's manual.

Error Code	What it means	What to do about
CT	CTC Chip Failure	
HA	Aborted Command -- Problem during boot-up. Controller Error.	
HC	CRC Error--Invalid data in data field.	Re-format Hard Disk.
HD	Busy Not Reset -- Controller Error.	
HI	CRC Error -- Invalid data in ID field.	Re-format Hard Disk.
HM	Data Address Mark Not Found	Re-format Hard Disk.
HN	ID Not Found -- No Boot Track	Re-format Hard Disk with FORMAT.
HØ	Track Ø Error -- Didn't find Track Ø before timeout. (Also occurs in multi-drive Systems when Secondary Drives are not powered-up.)	Press RESET.
HT	Time-out while waiting for Ready. Hard Disk Drive not powered up. Hard Disk Drive is not turned on and ready within 1Ø seconds after TRS-8Ø Computer. Error will occur if Hard Disk Drive is disconnected.	Turn Hard Disk ON. Press RESET.
MF	Memory failure in address range X'1ØØØ'-X'7FFF'.	Contact RSSC.
MH	Memory failure in address range X'8ØØØ'-X'FFFF' .	Contact RSSC.
ML	Memory failure in address range X'ØØØØ'-X'ØFFF' .	Contact RSSC.
PI	Defective PIO chip.	Contact RSSC.

Table 3

4/ Specifications**Power Requirements****AC Power Requirements**

50/60 Hz +/- 0.5 Hz

100/115 VAC Installations (90 to 132V at 1.0A typical)

200/230 VAC Installations (200 to 260V at 0.6A typical)

Disk Characteristics

No. of Cylinders	306
No. of Heads	6
Track Access Time	3msec
Data Transfer Rate	5.0MB/Sec

Dimensions (Case)

Height	5.5" (140 mm)
Width	14" (356 mm)
Depth	15" (381 mm)
Weight	15.5 lbs. (7.02 kg)

Environment**Ambient Temperatures****Operating:**55 to 85 degrees F.
(13 to 29 degrees C.)**Nonoperating:**-40 to 140 degrees F.
(-40 to 60 degrees C.)**Relative Humidity**

8% to 80%

Relative Humidity Gradient**Operating:**

20% per hour

Nonoperating:

Below that causing condensation

Maximum Wet Bulb Temp.78.8 F.(26 C.) degrees
non-condensing**Heat Dissipation Altitude**

1500 Watts (511 BTU/Hr) Max.

Operating Density-Altitude

1500 to 9750 ft. (457 to 2972 m.)

Storage 0 to 12000 ft.

(0 to 3650 m.)

Warm-Up Period

Minimum Delay To Turn System
On After Turning Off 15 seconds

Hard Disk Drive**Disk Organization**

Cylinders per Disk	306.0
Tracks per Unit	1836.0
Tracks per Platter	612.0
Sectors per Track	34.0
Bytes per Sector	256.0
Average Latency	8.3 msec
Rotational Speed	3600.0 rpm
Recording Density	9625.0 bpi
Flux Density	9625.0 fci
Track Density	345.0 tpi

Storage Capacity (Hard Disk)

Unformatted	
Per Drive	19.0 Mbytes
Formatted	
Per Drive	15.5 Mbytes (Primary) 15.9 Mbytes (Secondary)

Storage Capacity (TRSDOS-II Formatted Floppy Diskette)

Sectors per Track	32.0
Bytes per Sector	256.0
Bytes per Diskette	625,920.0
Tracks (single-side)	76.0

5/ Making Copies (Backup) of Diskettes and Disks**TRSDOS-II Backup**

The TRSDOS-II BACKUP command makes a copy of a diskette. If you have two or more floppy diskette drives, use BACKUP to copy:

- . The TRSDOS-II System Diskette
- . Other TRSDOS-II system diskettes, including TRSDOS-II application program diskettes
- . TRSDOS-II data diskettes

Backing Up TRSDOS-II System Diskettes

To backup the TRSDOS-II System Diskette or any diskette that contains the TRSDOS-II System, follow steps:

1. Power up your Computer. Insert the TRSDOS-II system diskette you wish to copy (source diskette) into Drive Ø. Insert the destination diskette (the diskette being copied to) into Drive 1. Use a double-sided destination diskette for maximum storage capacity.
2. Enter the date and time.
3. When TRSDOS-II Ready appears, type:

BACKUP Ø TO 1 <ENTER>

When the backup is finished the message:

BACKUP SUCCESSFULLY COMPLETED
Drive 1 Disk ID is:
TRSDOS-II Ready

appears.

BACKUP
Duplicate a Diskette**BACKUP source TO destination {options}**

source and destination are drive numbers in the form of d, where d is a floppy diskette (0-3) only.

options is one or more of the following:

PW= source-password tells TRSDOS-II the master password of the source diskette. TRSDOS-II will not duplicate the diskette unless you give the correct password. **PW=** is optional; if omitted, TRSDOS-II will assume the password is **PASSWORD**.

NEW= destination-password tells TRSDOS-II the password to assign to the destination diskette. The master password allows access to all user files via the **PROT** command. **NEW=** is optional; if omitted, TRSDOS-II will use the same password as the source diskette.

ID= diskette-name tells TRSDOS-II the diskette name to assign to the destination diskette. **ID=** is optional; if omitted, TRSDOS-II will use the diskette name of the source diskette.

ABS= tells TRSDOS-II not to prompt you if the specified drive contains data. **ABS** is optional; if **ABS** is omitted, TRSDOS-II will prompt before overwriting any data that already exists on the floppy disk.

This utility allows you to make a "mirror image" of a TRSDOS-II floppy diskette onto another floppy diskette. Diskettes do not need to be formatted before BACKUP. BACKUP automatically formats during the track-by-track duplication.

Note: BACKUP is used for floppy-to-floppy duplication only. If you want floppy-to-hard, use **FCOPY**, **SAVE/RESTORE**, or **COPY**.

The TRSDOS-II BACKUP utility is much faster than the TRSDOS BACKUP because it makes a "mirror image" on a track-by-track basis instead of file-by-file.

Single-drive BACKUPs are not allowed with the TRSDOS-II BACKUP command.

TRSDOS-II BACKUP will not allow the following TRSDOS options:

- . wildcarding
- . prompting before each file
- . NOAUTO
- . SYS

Examples

BACKUP 3 TO 1 {PW=ASHER} <ENTER>

makes a mirror image copy of the diskette in Drive 3 to the diskette in Drive 1, using the password ASHER.

BACKUP :2 TO :Ø {NEW=TEST} <ENTER>

copies the diskette in Drive 2 to Drive Ø and assigns the password TEST to the new diskette.

BUILD

Create an Automatic Command Input File

BUILD file

file is a file specification which cannot include an extension.

The BUILD command allows you to create or edit a DO file on a line by line basis.

When you enter a BUILD file that already exists, TRSDOS-II will display the first line of the file, followed by the prompt:

```
Keep, Delete, Fix, Replace, Insert or Quit?  
Enter (K/D/F/R/I/Q)...?
```

The Fix option lets you edit the displayed command line.

Example

Suppose you have a command file named TRANSFER that consists of the lines:

```
COPY FILE/1  
COPY FILE/2  
COPY FILE/3  
DIR
```

You can fix one of the lines of the command file without retying the entire line.

Load the command file by typing:

```
BUILD TRANSFER <ENTER>
```

TRSDOS-II will display the first line of the file, followed by the options:

```
COPY FILE/1  
Keep, Delete, Fix, Replace, Insert or Quit?  
Enter (K/D/F/R/I/Q)...?
```

To change the filename in the first line, type F <ENTER>. TRSDOS-II will display the line with the cursor over the first character in the line. Use the <--> (rightarrow) to position the cursor over the letter F, then type:

```
NEWFILE <ENTER>
```

TRSDOS-II will position the cursor at the beginning of the line. Press <ENTER> again and the Fixed line will be saved. You can now edit the next command line.

RESTORE
Recover SAVED Files**RESTORE source TO destination {options}**

source specifies a floppy diskette and is one of the following:

d where d is a drive specification and a number between 0-3.

filespec:d where filespec is a standard TRSDOS file specification and drive is a drive number between 0 and 3.

wildcard:d where wildcard is a standard TRSDOS wildcard and drive is a number between 0 and 3.

destination is optional and is one of the following:

d where d is a drive specification and a number between 0-7. d cannot be the same as source.

filespec:d where filespec is a standard TRSDOS-II file and d a drive specification. If IND is used, d is optional.

{options} is one or more of the following:

ABS tells TRSDOS-II to retrieve the specified files(s). If used, an already existing file with the same name will be written over.

DIR If VOLUME 0 is in source drive, TRSDOS-II will display the DATASET directory and identifier; if VOLUME 0 is not a source drive, TRSDOS-II will display only the DATASET identifier.

IND (indirect) tells TRSDOS-II to use the contents of the destination file as a list of destination filespecs that meet the requirements stated above.

KILL tells TRSDOS-II to kill the specified destination file before it is opened for RESTOREing.

PROMPT will prompt for verification of each file for RESTOREing. Press Y (yes), N (no), Q (quit restoring), or S (stop prompt).

PRT can only be used with the DIR option. Prints the DIRectory listing on the line printer.

SYS TRSDOS-II will retrieve System and data files. This includes System (language) and Applications programs. If used with DIR, SYS will list the directory of System files.

To retrieve all non-system files, specify both the source and destination as drive numbers.

RESTORE reads information from a dataset created by SAVE. If you enter a volume of this dataset out of sequence, TRSDOS-II informs you of the mistake. The system also informs you if you accidentally enter a volume from a different dataset during a RESTORE.

Note that the TRSDOS-II diskette must remain in Drive Ø on floppy drive systems. Also, single-drive saves and restores are not allowed. For example, RESTORE :1 :1 is illegal.

When you're restoring files in a dataset, TRSDOS-II prompts you with:

Mount NEXT Diskette in Drive n -- Press ANY Key to continue.

which instructs you to enter the next volume of the dataset.

Examples

RESTORE Ø TO 4 <ENTER>

retrieves all saved non-system files on Drive Ø and puts them in Drive 4.

RESTORE !:2 TO 4 <ENTER>

retrieves all saved non-system files, with and without extensions, from the floppy diskette in Drive 2 and puts them on the hard disk in Drive 4.

RESTORE 1 PROGRAMS {IND} <ENTER>

where PROGRAMS is an indirect file containing the files:

MAILIST/PRG:4
MAILDAT/TXT:4
CHANGES/TXT:4

retrieves the files from the floppy diskette in Drive 1 and puts them in the filespecs, defined in PROGRAMS, on hard disk Drive 4. Note that "TO" is optional.

RESTORE */SRC:Ø 4 <ENTER>

retrieves all Drive Ø user files that have the extension /SRC and puts them on hard disk Drive 4. The filenames stay the same.

RESTORE :1 {DIR,PRT}

sends the directory of the floppy diskette in Drive 1 to the printer.

SAVE
Backup File to Floppy Diskette**SAVE source TO destination {options}**

source may be one of the following:

:d which is a drive specification and is a number between 0-7.

filespec:d specifies a TRSDOS-II file or INDIRECT file to be saved.

wildcard:d is a TRSDOS-II wildcard and includes a disk drive number (0-7).

destination specifies a floppy disk drive number and is a number between 0-3 in the form d.

{options} is one or more of the following:

ABS tells SAVE not to prompt for destination disk status. SAVE will format the destination disk if it is not already in SAVE format.

DC value date will compare the creation date of each specified source file against the date entered and SAVE the file if all other criteria are met. value is <, >, or = where < (less than) and > (greater than) mean less than or equal to and greater than or equal to.

date must be in the form: MMDDYY

DM value date will use the last modification date in the manner specified above. value is <, >, or = where < (less than) and > (greater than) mean less than or equal to and greater than or equal to. date must be in the form: MMDDYY

IND (indirect) tells SAVE to use the contents of the source file as a list of source filespecs that meet the requirements stated above.

PROMPT will prompt for file verification before SAVEing. You may respond with Y (yes), N (no), Q (quit) or S (stop prompting and continue).

ALL tells TRSDOS-II to save all files. (ALL won't transfer System files, use SYS.) If you use drive as source, you must use ALL.

SYS allows you to SAVE language and application programs.

Backing Up Your Hard Disk

What would you do if you suddenly lost the data stored your hard disk system? Imagine the time it would take to re-enter all the data.

If, however, you have safe, floppy-diskette copies of the data, you would not have to re-enter all the data. You could simply restore the data to the hard disk, update the information, as needed, and continue.

Two programs on your hard disk assist you in creating such duplicates.

- **SAVE** stores a specified group of files on a set of floppy diskettes. These diskettes are in a special, compact format that is not directly readable from TRSDOS-II.

In this format, files consume almost half the space they normally do on floppy diskettes. **SAVE** also lets you store files (from the hard disk) that are normally too large to fit on a floppy diskette.

- **RESTORE** lets you retrieve the **SAVED** files onto the hard disk.

This is the only way to recover **SAVED** diskettes. Trying to access a **SAVED** diskette using a TRSDOS-II command makes the system appear "locked up" for a short time while TRSDOS-II tries to read the **SAVED** diskette.

Saving Multiple Diskettes

Because the hard disk drive is a larger storage system than the floppy diskette, you sometimes need to save information onto more than one diskette. In such a case, **SAVE** prompts you to insert a new diskette.

There are two terms related to SAVE with which you need to be familiar:

- **Dataset**- A set of one or more diskettes created by SAVE. Each dataset has a unique identifier, such as 84 4E 56.
- **Volume**- A diskette that is a member of a dataset. TRSDOS-II numbers each dataset's volumes in order from Ø.

The dataset identifier serves two purposes. First, it prevents the accidental mixing of datasets. Second, when a saved dataset has more than one volume, RESTORE uses the identifier to ensure that you do not insert a volume from a different dataset.

When you are saving files that require more than one volume, TRSDOS-II prompts with:

Insert NEXT Blank Diskette on Drive n --
Press ANY Key to Continue.

After you do, TRSDOS-II prompts with:

The Diskette Presently on Drive n
will be referred to as "VOLUME 1"

TRSDOS-II saves the files and then prompts:

Insert "VOLUME Ø" on Drive n --
Press ANY Key to Continue

TRSDOS-II writes its housekeeping information -- including the number of volumes in the dataset -- to Volume Ø.
RESTORE uses the information to retrieve the files.

Examples

There are a variety of ways to use SAVE. The simplest is:

SAVE 1 TO 2 {ALL} <ENTER>

This copies all the files from Drive 1 into a compact form on the diskette in Drive 2.

Wildcarding

Wildcards also offer an easy way to save several files or an entire disk. For example:

```
SAVE */CBL:4 TO Ø <ENTER>
```

saves all Drive 4 files with the extension /CBL and puts them on the diskette in Drive Ø.

Using the IND Option

The indirect option lets you save groups of files by creating an indirect file, a file consisting of one or more filespecs (similar to a DO file). You can use the BUILD command to create this list of filespecs.

When TRSDOS-II Ready, type:

```
BUILD PROGRAMS:Ø <ENTER>
```

This creates an indirect file called PROGRAMS.

After TRSDOS-II prompts you with:

```
Enter command line (1-8Ø)
```

```
.....
```

enter your list of file specifications including drive numbers, for example:

```
ORDERS:5 <ENTER>
REPORTS/*:6 <ENTER>
```

To exit the BUILD and return to TRSDOS-II Ready, press <BREAK>.

You are now ready to save the files (specified by the indirect file) to the specially formatted floppy diskette. Type:

```
SAVE PROGRAMS:Ø TO 1 {IND} <ENTER>
```

Both ORDERS and REPORTS are now found in the file named PROGRAMS on the diskette in Drive Ø and saved to the diskette in Drive 1.

Note: The IND option lets you save more than one file from each hard disk; it also lets you save from more than one hard disk. As a result, you might save multiple files that have the same name. Because the save and restore directory does not specify drive numbers for files, you could lose duplicate filenames.

For example, if you created an indirect file that has these files:

```
*/FOR:4  
*/CBL:4  
*/FOR:5
```

Drives 4 and 5 may have duplicate filenames with the /FOR extension. Before you use indirect, examine all the files to be saved. Rename any duplicate filenames before saving.

Using the DC and DM Options

Another way to save files is to do so with respect to their creation or modification (update) dates. For example, suppose your directory showed these creation and update dates for your files:

Filename	Created	Updated
MENU/PRG	6/1/81	9/2/81
PRGONE/PRG	6/1/81	8/16/81
PRGTWO/PRG	6/1/81	7/30/81
PRGTHR/PRG	6/1/81	6/16/81
PAYROLL/DAT	9/15/81	10/15/81
CHECKS/DAT	9/15/81	10/15/81
TEST/PRG	10/29/81	10/29/81

If you want to save only those files created on June 1, 1982, use the following command:

```
SAVE */*:5 TO Ø {DC=Ø6Ø182} <ENTER>
```

The first four files are saved to the floppy diskette in Drive Ø.

In the same sense, the first four files were updated on or before September 2, 1982 (9/2/82). Type:

```
SAVE */PRG:5 TO Ø {DM<Ø9Ø282} <ENTER>
```

and all files updated before the specified date are saved.

How Often Should You Save Your Files?

How often you should save your files depends upon you and how much data you enter. If you enter large amounts of data, you should make frequent backups, once or twice a day.

We suggest you keep two major sets of backup files:

- **Monthly Save Set** At the first of each month, make a save set of the complete hard disk, including your programs.
- **Daily Save Set** At the end of each day, or at most every third day, make a save set of all files that have been created or updated since the monthly save set was created.

If your hard disk fails, your monthly save set supplies most of your lost data and programs. After you restore this information and that from the daily save set, the amount you need to re-enter is minimal.

Creating a Monthly Save Set

Creating a monthly save set takes time, but it is worth it. Have a supply of blank diskettes ready. Do not format them; SAVE organizes the diskettes into its own special format.

Insert a blank diskette into Drive Ø. At TRSDOS-II Ready, type:

```
SAVE :4 :Ø {SYS,ALL,ABS} <ENTER>
```

This SAVES all programs and data files, including system files stored on Drive 4, the primary drive. The files are stored on diskettes in Drive Ø. As one diskette becomes full, TRSDOS-II prompts you for the next diskette.

When all of the files are SAVED, TRSDOS-II prompts you to insert Volume Ø (of your monthly save set) into Drive Ø. TRSDOS-II now updates that diskette with housekeeping information.

When the save is finished, you will return to TRSDOS-II Ready. Be sure to label, number, and date the diskettes.

Rotating Monthly Save Sets

The set just created in the previous example is the current monthly save set. At the beginning of the next month, create a new monthly save set using different diskettes. This set becomes the current set; the other becomes the previous set.

Rotate these two sets of diskettes when making monthly save sets, always using the previous set (older) to make the current set.

Creating A Daily Save Set

When you RESTORE lost information, your daily save sets determine how much information you must re-enter. The more often you save, the less you re-enter.

Because the daily save sets are so important, you should keep two sets of them: the current daily set and the previous daily set. This way, if something happens to the current set, you have the previous set to fall back on.

The simplest way to create a daily save set is to save those files created or updated since you created the monthly save set. To do this, type:

```
SAVE !:4 :Ø {DM>mmddyy,ABS,SYS} <ENTER>
```

The !:4 specifies all files, with or without extensions. The option DM>mmddyy saves all files updated on or after the specified date. However, if you keep a monthly save set as suggested, this also saves files created on or after a specified date. (The update date and the creation date in the directory are the same when the file is created.)

For example, if you create a monthly set on January 1, 1983 (Ø1/Ø1/83), then use the following command to make a daily set:

```
SAVE !:4 :Ø {DM>Ø1Ø183,ABS,SYS}
```

This saves all files created or updated on or after January 1, 1983 up to the current date. Because the absolute option is specified, you are not prompted as each file is saved.

Rotating Daily Save Sets

The set just created is the current daily save set. At the end of the next working day, create a new daily save set using different diskettes. This set becomes the current set; the other becomes the previous set.

Rotate these two sets of diskettes when making daily save sets, always using the previous set (older) to make the current set.

Restoring Your Files

If your hard disk system fails, and you must recover all files, follow these steps:

1. If Drive 4 is not bootable, or the operating system is lost, you must re-format your system, following the instructions given in your Hard Disk Owner's Manual (FORMAT). If you are sure Drive 4's operating system is not damaged, proceed to step 2.
2. Insert Volume \emptyset of your monthly save set, into Drive \emptyset and type:

RESTORE : \emptyset :4 {ABS,SYS} <ENTER>

3. Insert Volume \emptyset of your daily save set into Drive \emptyset and type:

RESTORE : \emptyset :4 {ABS,SYS} <ENTER>

4. Re-enter any information added since the last current daily save set was created.

To restore one file, type the following command:

RESTORE filespec: \emptyset :4 {ABS} <ENTER>

where filespec is the name of the file you want restored.

To restore a group of files, type:

```
RESTORE :Ø :4 {PROMPT} <ENTER>
```

Restore prompts before restoring the files. Answer by pressing <Y> or <N> (for "yes" or "no").

Always restore files from the last save set available.

When a Boot Error Occurs on Hard Disk

If your hard disk system returns a boot error, flip the RESET switch on the front of your computer. Then, try to start up your system again. If your system continues to return a boot error, you probably have lost the boot track, Track Ø.

Even when this happens, there is a way to save the contents of your primary hard disk. But, to do so, you must have at least two floppy disk drives on your system.

To save the contents of your hard disk system:

1. Transfer control to the floppy disk system (press <BREAK> <REPEAT> during "white-out").
2. Insert a diskette containing the floppy version of TRSDOS-II in Drive Ø and start up the system so that you see TRSDOS-II Ready.
3. To be sure there is a chance to save the contents of your hard disk, try to get a directory of your primary hard disk drive. Type:

```
DIR 4 <ENTER>
```

If you can get a directory, then you probably can save the contents of your hard disk.

4. Save the contents of your primary hard disk drive. Insert a blank diskette in Drive 1 and type:

```
SAVE 4 TO 1 {SYS,ALL,ABS} <ENTER>
```

5. Re-format your primary hard disk drive. (Once the contents of your hard disk are saved, you must re-format your primary hard disk drive.) (See the FORMAT command in this manual for details.)
6. When the FORMAT process is finished, (in about 15 to 20 minutes), you can restore the files that you saved. Type:

RESTORE 1 TO 4 {SYS} <ENTER>

5 1/4"					
Hard Disk	Cylinders	Tracks	Sectors	Bytes	
1	306	1,836	62,424	15,980,544	
---	1	6	204	52,224	
---	---	1	34	8,704	
---	---	---	1	256	

Table 1

Floppy Diskette		Tracks	Sectors	Bytes
1		76	2,432	622,592
---		1	32	8,192
---		---	1	256

Table 2

Note: Track 0 on the 8" floppy diskette is reserved for System use and is not available for user storage. It is formatted single-density with 26 sectors that contain 128 bytes each. The total capacity of the floppy diskette is $622,592 + (3,328) = 625,920$ bytes.

TRSDOS-II takes up to 400K bytes of storage area on Drive 4. Therefore, each Primary Hard Disk Drive has 400K bytes less user area than a Secondary Drive.

It's important to note that the hard disk's media can have flaws, and these flaws can cause errors when used. These flaws are due to minor defects in the media. There will be flaws on no more than 4 tracks per surface, not to exceed 12 tracks total. However, the FORMAT utility will not use those areas of the disk that cause errors.

On all Hard Disk Units, flaws in the media are identified before the Disk Drives are delivered to you. Attached to the bottom of your Hard Disk Unit is a DISK FLAW RECORD which specifies the errors on your particular unit. Do not throw this map away! You may need to refer to it when

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