RSHARD - Hard Disk Driver Package
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GENERAL

There may be a file named "README/TXT" on the disk. If so, this file will contain important information which may not appear in this printed documentation. You should read this file by issuing the command: LIST README.

RSHARD is a utility package that provides a hard disk driver which supports certain hard drive assemblies manufactured by the Tandy Corporation. Specifically, RSHARD supports up to two drive units - each of the same physical step rate and interfaced via the Western Digital WD1000 or WD1010 hard disk controller. The driver supports a single drive of up to 1024 cylinders with up to eight (8) heads. Because drive configurations may exceed the maximum limits of a single logical drive afforded by the DOS, the driver supports drive partitioning by both head and cylinder.

This package is provided on a 40-track double density DATA diskette. It supports the Tandy hard drive used with LDOS 5.3 on the Model III [RSHARD5, ARCHIVE5, HDCHECK5, RESTORE5] and also with LS-DOS version 6.3 [RSHARD6, ARCHIVE6, HDCHECK6, RESTORE6]. These files may be easily copied to your working SYSTEM disk by means of the DOS COPY utility.

WARRANTY

These programs are warranted to perform as documented when used on the specified hardware operating under the specified disk operating system as shown on the accompanying documentation. If within 90 days of the date of purchase (1) the program is found to be defective due to a bug in the code, the publisher will, upon request, provide a patch to correct the bug or will update the program diskette with a corrected copy within a reasonable time period after return of the program diskette to the publisher; (2) the documentation proves defective due to missing pages, the publisher will provide substitutes for the missing pages upon request.

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PROCEDURES TO INTERFACE A HARD DRIVE

　　　Interfacing a hard drive (or drives) is not a difficult task. The job can be divided up into a few separate operations. An outline of these steps is:

　　　1) Read the section on partitioning a hard drive so that you can decide on how you want to divide up the storage space on your drive. Once you decide, keep a written record of your decision.

　　　2) Invoke the hard disk driver for each partition you have decided upon. The section, "Invoking The Hard Disk Driver" contains complete instructions on this operation.

　　　3) Use the RSFORM command to both format each partition of the hard drive and add the system information to the drive.

　　　After following the three steps, your drive is ready for use. It would be a good idea to read this entire manual to gain familiarity with the archival and restoral utilities.

HARD DRIVE PARTITIONING

　　　The term "partitioning" refers to segmenting the hard drive into two or more logical drives. The integrator of a hard disk usually has to consider some form of hard disk partitioning. Why is this to be considered? A hard disk has a minimum of five megabytes of storage space. The demand for storage never abates; thus, ten megabyte, twenty megabyte, and higher capacities are being integrated into the microcomputer environment. Both LDOS and LS-DOS have limitations on the total size of a storage device that is addressable as a single volume (logical drive). These are limitations stemming from the size of the directory. A device is limited to a maximum of 256 sectors per logical cylinder, and 203 logical cylinders. [406 physical cylinders]. Given a standard sector size of 256 bytes, the DOS can access 13.3 megabytes total on a single volume. If the physical drive exceeds this capacity, then it must be divided into more than one logical drive in order to address its total capacity.

　　　The DOS also limits the number of files per logical drive to 256 [both LDOS Version 5.3 and LS-DOS 6.3 reserve 14 directory slots for the /SYS files on "system" drives - two slots are always taken up by the BOOT/SYS and DIR/SYS files on "data" drives]. Although database applications may find the most practical arrangement is a single volume, the typical use of even a five megabyte drive will find the file slots filled before all of the space is allocated - thus space is wasted. [It is possible and highly practical for the hard disk integrator to consider combining individual static files into members of a partitioned data set to free up multiple file slots. PaDS and PRO-PaDS are utility programs capable of creating and maintaining such files]. Therefore, even with the smaller five megabyte drive, there exists a rationale for partitioning.

Once the decision is made to divide a drive, the question arises as to how to go about such a division. There are three methods of partitioning. One is to divide the drive by cylinder. For example, take a 306 cylinder, four head, ten megabyte drive. This can be divided into two drives with the first logical drive using cylinders 0-152 while the second used cylinders 153-305. The DOS actually uses logical cylinder numbers 0-152 for both partitions and the hard disk driver must recognize that it needs to translate the 0-152 for the second partition into the range 153-305. Obviously, one can divide up the drive into partitions smaller than five megabytes. A second method is to divide the drive so that all of the cylinders are included in a single logical volume, but volumes use different heads. Thus, the previously mentioned drive could be divided into two, three or four logical drives. A third method would be to partition by both head and cylinder. The driver supplied with this product (RSHARDx/DCT) can accept both head and cylinder specifications for a logical partition.

There are advantages and disadvantages to each method. First, depending on the stepping speed of the drive, it may be advantageous to address as much capacity in a single cylinder prior to having to step the drive. This means that you would lean towards divisions by cylinder. However, if you are alternately selecting different partitions, the drive must be stepped a great distance to get to each partition. Another problem is that a head crash would essentially wipe out all drives since a single head would be used on all partitions. Of course, if the drive physically has more than 406 cylinders, it must be partitioned by cylinder to address the higher cylinders.

Partitioning by head provides less sectors per physical cylinder; however since hard drives today usually use very fast buffered seek, the stepping time to advance a track is minimal. A head crash will also only wipe out a single logical drive.

Before you set out to assign your drive, you should consider the uses of your hard drive. How many file slots do you need? How many distinct logical drives do you need? Choose how you will partition the drive. Keep written notes as to your scheme. This is especially important if you are using a removable cartridge drive so that each cartridge may be uniformly configured.

INVOKING THE HARD DISK DRIVER

The hard disk driver associates a hard drive or partition of a hard drive to a logical drive slot in the operating system. The drive slot requested must be in a "disabled" condition. Any partitioning of the hard drive is specified via responses to the prompts that are displayed during the driver initialization. The driver is invoked via the command:

```
|                                                                        |
|    SYSTEM (DRIVE=d,DISABLE,DRIVER="RSHARDx")                           |
|                                                                        |
|    d        - Specifies the logical drive number <1-7>.               |
|                                                                        |
|    x        - Specifies the driver version: <5,6>.                    |
|                                                                        |
```

Each hard drive or partition of a hard drive must be identified via a separate invocation of the RSHARDx program. When control is passed to the driver initialization program, RSHARDx, it will display the following message:

RS Hard Disk WD1000/WD1010 Driver - Version x.yz
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Before the disk controller can function with any hard drive, information on the step rate option, number of cylinders, and number of heads of the drive(s) must be known. Since the step rate information is common to all partitions of a drive and both drives connected to the same controller, you only need enter this information once. This is done on the first invocation of RSHARDx. The number of cylinders and heads of a particular drive is also requested only on the first invocation of RSHARDx for a particular drive. Subsequent invocations will bypass the physical drive parameter prompts and re-use the values saved from the first invocation.

Other prompts request information concerning the drive select address, number of heads in a partition, the starting head number, and the number of cylinders in a partition. Many of the prompts support a default value where-upon if you depress only the <ENTER> key without a value, the default will be chosen. The default value is displayed with square brackets "[]" when the prompt message is displayed. If you want to select this default value, it is necessary to depress just the <ENTER> key. If you depress the <BREAK> key in response to any prompt, the program will terminate and display the following message:

Manual Abort - job terminated!

Because hard drive partitioning gives you the capability to select heads and cylinders, there is the possibility of entering a specification that conflicts with logical partitions already assigned. The driver initialization program will NOT permit you to do this. When it detects such a conflicting request, it will re-prompt you to enter a valid value.

The RSHARDx program first checks to see if the logical drive slot you
specified in the "SYSTEM ..." command is available for use. It is available
only if the slot has been "disabled". The slot will be disabled either if you
had entered the "DISABLE" parameter or the slot was previously disabled. If
the slot is "enabled", meaning already in use, the error message:

Requested drive slot already in use!

will be displayed and the program will terminate.

Controller Parameter

The first time that the RSHARDx driver is installed, it prompts you for
information associated with the stepping speed of your drive assemblies. The
prompt associated with the controller parameter is:

Enter the STEP RATE <10us-7.5ms> [10] ------------->

The step rate may be identified on a label affixed to the back of the hard
drive unit, or it may be noted in the documentation received with your hard
drive unit. A "standard" Radio Shack hard drive unit is usually engineered
for "buffered" seek - meaning the fastest step rate to the controller; thus
10 microseconds would be the fastest. The WD controller accepts values of 10
microseconds, and 0.5 milliseconds through 7.5 milliseconds in 0.5 milli-
second increments. Observe that the step rate option default is "10". If the
step rate of your drive is "10", then you only need depress <ENTER>. On the
other hand, if you noted that the label identified a step rate option of
"3.0", then enter the ASCII string "3.0", followed by <ENTER>.

Logical Drive Parameters

The first item of information pertinent to a logical drive is the drive's
address. The Western Digital controller supports four drives per controller;
however the RSHARDx driver supports only two. These are addressed as ONE (1)
and TWO (2).   The drive address associated with each drive is usually
identified on the unit's label. The address is entered in response to the
prompt:

Enter drive address <1,2> and F/R [1;F] ----------->

The "F/R" refers to FIXED and REMOVABLE drive packs. As can be noted, the
default used is ADDRESS 1 and FIXED. If you are addressing drive address 2 on
a fixed disk pack, you only need to enter "2" - the "F" default will still be
used. If you need to specify the drive as REMOVABLE, then you must enter the
drive address. When you make the entry, the characters are entered consecu-
tively without any space, comma, or semi-colon. For instance, to select a
removable drive at address one, enter "1R" or "1r".

Physical Drive Configuration

     The first time that the RSHARDx drive is associated with a particular
drive address, the physical characteristics of that drive must be ascer-
tained.   The RSHARDx does this by means of two prompts.

     The first prompt associated with the physical drive parameters is:

          Enter the physical TRACKS per surface [306] ------->

This figure is the total number of tracks on a single surface.   The default
value is 306 tracks as shown in the prompt.   Another value that is generally
used is 153 tracks. If your drive has 153 tracks, then enter the digits "153"
followed by <ENTER>.   The maximum number of tracks per surface supported in
this driver is 1024 tracks.

     The second and last prompt associated with the drive parameters is:

          Enter the total number of HEADS [4] --------------->

The drive label may provide the number of surfaces, which is the number of
heads, or it may provide the number of platters.   There are two heads per
platter; therefore, a one-platter drive has two heads, a two-platter drive
has four heads, and a three-platter drive has six heads.   The maximum number
of heads supported in this driver package is eight heads.   If your drive has
four heads (two platters), you only need to depress <ENTER>; otherwise, enter
the digit specifying the number of heads followed by <ENTER>.

Drive Partition Parameters

     Before proceeding with the partition parameters, RSHARDx will check all
existing logical drives showing up as assigned to the physical drive iden-
tified by the drive address you have specified.   A "head" check is done to
make sure that the DOS does not already show more heads assigned as there are
physical heads on the drive.   If it finds such an error, the message,

          Drive has heads in use higher than entered total!

will be displayed and RSHARDx will abort. Something is wrong with the current
drive assignments.

     The first item of information needed for each partition is the number of
heads assigned to the logical drive. Remember, you may partition a hard drive
by head with one or more heads assigned to a logical drive.   This entry is
entered in response to the prompt message:

          Heads already in use <.-.-.-.>
          Enter partitions number of heads <1-n> ------------>

In this message, each dot, ".", corresponds to a head number 1-n (the example
illustrates a head map as if there were four heads total).   If any heads are
already totally assigned, they will appear in the "<.-.-.-.>" field.   For
example if the first head was in use, the field would be displayed as "<1-.-
.-.>".   The number of dot positions displayed in the message corresponds to
the total number of heads for the drive.   Now in this message, the "n" will
actually be a number that is indicative of the number of heads left un-

assigned and contiguously assignable. For example, the first selection in a four head drive would display "<1-4>". If only one head remains to be assigned, the message will NOT be displayed but that head will automatically be selected for assignment. Since a drive may be partitioned by cylinders as well as by heads, a head will be shown as available provided at least one cylinder is unassigned.

     After you have made your selection as to the head quantity, you then can specify the starting head number. An example will illustrate this concept. Suppose you are selecting two heads of a four-head drive. You can use any of the following heads: 1&2, 2&3, or 3&4. The starting head number will be 1, 2, or 3 respectively. Make your selection and respond to the prompt message:

     Enter starting head ------------------------------>

If the number of heads remaining is equal to the number of heads requested for this partition, then the prompt will NOT be displayed and the obvious selection will be automatically made.

     If you enter a request that conflicts with an existing assignment (i.e. request a starting head number that is already assigned, or request two heads with a usable starting head but the next head is already assigned), the program will display an error message of this form:

     Heads requested conflict with heads in use!

and prompt for another entry to the "starting head" message.

     The last item of information needed to convey to the initialization program is the number of cylinders to assign to the logical partition. This number is entered in response to the prompt:

     Enter partition's number of cylinders [xxx] ------->

In this message, the "xxx" represents the actual number of physical cylinders available using the heads you have requested. This will be the default used if you depress just the <ENTER> key. In no case can you choose a number which exceeds 406 cylinders. The program will automatically choose the first available cylinder as the starting cylinder for this logical drive. You do NOT have any control over the starting cylinder number but control only the quantity of cylinders in a logical partition.

     If your drive physically has more than 406 cylinders, you must perform some partitioning by cylinder to gain access to those cylinders above 406. You will note that invoking the driver again for a different logical drive will not show the heads you have just selected as being unavailable. Remember we stated that "since a drive may be partitioned by cylinders as well as by heads, a head will be shown as available provided at least one cylinder is unassigned". Such a subsequent installation will automatically use the first available cylinder for the heads designated.

     Let's give a brief example. Say you have a two head five megabyte drive which has 406 cylinders. You can partition this into four logical drives of 1.25 megabytes each. Just specify: 1 head, head 1, 153 cylinders; 1 head, head 1, 153 cylinders; 1 head, (head 2 is the default), 153 cylinders; and 1 head, (head 2 is the default), 153 cylinders.

Information Retention

It is strongly recommended that you record on paper, the responses to each prompt in case the procedure has to be repeated. This information may be put on a label and affixed to the drive. It is important data that will be useful for the day that you have to perform the identical procedure when you reconfigure your system. Remember, in order to properly recover files from a partitioned drive that has been reconfigured, it is essential that it be re-configured in exactly the same manner.

If your configuration uses a removable drive pack, then you are strongly cautioned to ALWAYS PARTITION EACH REMOVABLE CARTRIDGE IN EXACTLY THE SAME CONFIGURATION. If you ignore this recommendation, you may destroy the files when a cartridge is changed.

IMPORTANT

Once you configure all partitions of a complete disk drive, you must FORMAT each partition (see the next section) to add the directory in-formation. This must be done before you invoke any other command or program - especially the DOS command, DEVICE. If your disk drive was previously formatted by LDOS 5.3 or LS-DOS 6.3 in the IDENTICAL configuration using THIS driver package, you may bypass the format operation. Also, so that your "configuration" will be available when you reBOOT your system, you should SYSGEN [consult your LDOS manual for SYSTEM (SYSGEN) or LS-DOS 6 manual for SYSGEN].

FORMATTING THE HARD DRIVE

     Before you can use the hard drive, it must be formatted an d written with
system information (i.e. the BOOT/SYS and DIR/SYS files - the DIR/SYS file
contains the directory for the logical drive). Formatting is performed via
the formatter provided with the package, RSFORMx. The formatter is invoked
via the command:

```
 _____
|                                                        |
|    RSFORMx :d (MPW="password",Name="packname",...      |
|                ..., System,Verify,NOSTOP)              |
|                                                        |
|    x          - Specifies the driver version: <5,6>    |
|                                                        |
|    d          - Specifies the logical drive number <1-7> |
|                                                        |
|    MPW=       - Specifies the disk master password     |
|                                                        |
|    Name=      - Specifies the disk pack name           |
|                                                        |
|    System     - Specifies to suppress formatting [OFF] |
|                                                        |
|    Verify     - Specifies verification after format [ON] |
|                                                        |
|    NOSTOP     - Specifies to proceed with formatting   |
|                 regardless of drive's contents. Use with |
|                 extreme caution.                       |
|                                                        |
|    Abbreviations: N=NAME, S=SYSTEM, V=VERIFY           |
|_____|
```

     This command provides two forms of operation. One form is the format of
an entire partition of a drive and the writing of system information to that
logical partition.

     The second type of format operation bypasses the formatting and writes
only the system information. This operation is specified by entering the
"SYSTEM" parameter in the RSFORMx command request. This can be done when you
only want to totally refresh the directory of a partition without any hard
formatting being done; however, since no sector verification will be done,
"flawed" areas of the disk will not be detected. It would then be useful to
check out the drive partition with the HDCHECKx utility.

     With this background in mind, the procedure to format a hard drive (or
drives if two drives are included in your configuration) is as follows:

1. Use the logical drive number assigned to the first partition to format
that partition. The RSFORMx command is entered as:

          RSFORMx :d (NAME="packname",MPW="password")

In this command line, "d" is replaced with the logical drive number assigned
to the first partition. The "packname" should be entered to be distinct and
representative. It is recommended that you affix a number that is associated

with the number of the partition. For instance, on a hard drive partitioned
as three logical drives, use names such as RIGID1, RIGID2 and RIGID3. It is
also recommended that you choose a password that is something other than
"PASSWORD". This precaution will be your saving grace when you inadvertently
enter a DOS command that completes undisturbed if the disk's master password
was "PASSWORD".

    If the formatter detects the disk as being previously formatted, it will
display one of the following cautionary messages,

>   **Disk contains data -- Non-standard format**
>   **Disk contains data -- Unreadable directory**
>   **Disk contains data -- Non-initialized directory**
>
>   **Are you sure you want to format it <Y,N>?**

or possibly the message pair,

>   **Disk contains data -- Name=packname Date=packdate**
>   **Enter its Master Password or <BREAK> to abort:**

In the former case, a simple 'Y' proceeds with the format while 'N' or
<BREAK> will cancel the request. In the latter case, you must enter the disk
master password before the formatter will proceed. If you do not know the
password and are absolutely positive you want to reformat the partition, you
can re-invoke the RSFORMx command and specify the NOSTOP parameter to force
the formatting without these integrity checks.

    FORMAT will display a cautionary message to provide you time with which
to double check what you are doing. When you provide the go-ahead, it will
check to see if you want to manually lock out any tracks. The message,

>   **Lock out track manually? <Y/N>?**

will be displayed. Respond 'N' if you don't want to lock out any tracks. If
you respond 'Y', you will be asked for the physical head number and track
number with the queries,

>   **Enter physical head number <s-e>**
>   **Enter physical track number <ssss - eeee>**

    These numbers may have been provided to you with your hard drive
documentation. The head designation must be in the range of heads assigned to
the partition being formatted. These are actual head numbers. The track
number must also be an actual track number (a physical number between 1 and
the highest track number of the head's surface). The physical track numbers
assigned to the partition will be identified in the message. The formatter
will then recycle to the "Lock out track..." message until you answer 'N'.

    RSFORMx will then display the "Formatting cylinder ..." message and
proceed to format the entire partition. This may take some time so please be
patient.

2. Format each additional partition with the same kind of command as noted in
step 1. The RSFORMx utility formats only the tracks assigned to the partition
associated with the logical drive number specified.

At the conclusion of the physical formatting, the formatter will automatically lock out physical cylinder 1; it is reserved as a diagnostic cylinder by Radio Shack. This will only be done when physical cylinder 1 is part of the logical group of cylinders assigned to the partition.

Errors During Formatting

Because the format operation is highly destructive to any data previously written to the disk, a number of safeguards are built into RSFORMx. To begin with, it verifies that the hard disk driver installed is the RSHARD driver. If not, the message

Formatter incompatible with disk driver!

will be issued and the format aborted. Because you need your SYSTEM drive at the conclusion of the format process, the formatter will not allow you to format drive 0. Under that circumstance, it will display

Hard drive cannot be drive 0!

and abort.

Other integrity checks before proceeding with the formatting have been previously discussed. These are associated with the formatter's detection of possible data on the drive thusly requiring your acknowledgement before proceeding with the formatting process.

The DOS must have cylinder 0 available for certain system information. If, after the formatting, sector 0 of cylinder 0 is not available, you will see the message,

Can't, Disk Pack not formatted.

CHECKING THE HARD DRIVE - Using HDCHECK

     The HDCHECK utility is designed to check whether each sector of the hard
disk is readable (and optionally writable). Where an error is detected, the
granule containing that sector can be optionally locked out for further use.
HDCHECK is invoked via the command:

```
 _____
|                                                              |
|    HDCHECKx :d (LOCK,QUERY=N,WRITE)                           |
|                                                              |
|    x        - Specifies the program version: <5,6>           |
|                                                              |
|    d        - Specifies the drive number to be checked.      |
|                                                              |
|    LOCK     - Unless this parameter is entered, HDCHECK will only  |
|               advise you of errors it finds.  Specify the LOCK     |
|               parameter to keep the system from using these bad    |
|               sections of the drive.                         |
|                                                              |
|    QUERY=N  - If LOCK is specified and a bad sector is found, you  |
|               will be prompted prior to locking out the granule.   |
|               If you do not want the prompts, then specify Q=N.    |
|                                                              |
|    WRITE    - HDCHECK will check a drive by reading every sector   |
|               (except the directory which was already checked      |
|               by FORMAT).  Reading will usually discover all errors|
|               that may exist.  A greater stress test is to write   |
|               all sectors as well.  HDCHECK uses a non-destructive  |
|               write by first reading then re-writing the data that  |
|               was read.  The WRITE check will take longer.         |
|                                                              |
|    Abbreviations: L=LOCK, Q=QUERY, W=WRITE                    |
|_____|
```

     It is important to run the HDCHECK utility on all partitions of your hard
drive which you format using RSFORMx with the SYSTEM parameter. It is
suggested that you use the WRITE and LOCK parameters. For example, a
suitable command invocation is:

          HDCHECK :4 (LOCK,WRITE)

A message, Checking Cylinder: ccc, Sector: sss, is displayed as each sector
is being checked. If an error is encountered, HDCHECK will display either of
the messages,

          Lockout <Y,N,C> ? or
          Automatically Locked

depending on whether QUERY is on or off, or no message if LOCK has not been
specified. Other messages may be displayed with any response needed being
immediately obvious.

USING THE HARD DRIVE AS THE "SYSTEM" DRIVE

It is easy to use one of your hard drive partitions as a "system" drive. This means that the drive must contain all of the /SYS files and be referenced as the "zero" drive. In order to do this, the procedure takes two steps.

First, you need to transfer all of the files from a floppy "system" diskette to the hard drive. Do this via the command:

BACKUP :s :d (SYS,INV)   [with LDOS 5.3/LS-DOS 6.3]

This will transfer all files from the floppy identified by ":s" to the logical hard drive, identified by ":d".

Second, make the hard drive the "system" drive via the command:

SYSTEM (SYSTEM=d)

which will change the hard drive identified by ":d" to now be referenced as logical drive zero, ":0", and the previous drive zero will now be referenced with the logical drive number previously assigned to the hard drive, ":d".

If you want to configure the hard drive as drive zero so that the next time the floppy is booted, the hard drive will automatically come on line as drive zero, you can do this with the following procedure:

---[LDOS Version 5.3]--   [LS-DOS Version 6.3]
SYSTEM (SYSGEN,DRIVE=d)   SYSGEN (DRIVE=d)

In either case, "d" references the current logical drive number of the floppy system diskette to be used for booting.

This driver package does not support booting the DOS directly from the hard disk drive.

SHARING A DRIVE WITH LDOS AND LS-DOS

Your hard disk drive may be shared between both LDOS and LS-DOS as both operating systems use a compatible format and directory structure. However, since other vendors driver and formatter packages may construct different allocation schemes, you must use the RSHARD5/DCT driver with LDOS 5.3 and the RSHARD6/DCT driver with LS-DOS 6.3 when you are sharing identical surfaces.

Your best operation is to perform identical partitioning operations under each DOS (that's another reason for writing down your responses). Each partition is then available to whatever DOS you BOOT with.

BACKING UP THE HARD DRIVE - Using ARCHIVE

The ARCHIVE utility is designed to provide a controlled archival of one or more files from a large capacity storage device to a smaller floppy disk drive. It is invoked as follows.

```
┌──────────────────────────────────────────────────────────────────┐
│                                                                    │
│    ARCHIVEx source :d (QUERY=N,SIZE=nn,TEST,VERIFY)                │
│                                                                    │
│    x        - Specifies the program version: <5,6>                 │
│                                                                    │
│    source   - Specifies the filespec or drivespec of the file or   │
│               drive you wish to archive.  If a filespec is entered,│
│               only that file will be archived.  If only a drivespec│
│               is entered, all files of length greater than the     │
│               destination floppy size will be archived (see text   │
│               on the SIZE parameter).                              │
│                                                                    │
│    d        - Specifies the drive which will receive the archived  │
│               segments.                                            │
│                                                                    │
│    QUERY=N  - If a "source" drivespec was entered, then you will   │
│               be prompted with each source filename to archive.    │
│               If you do not want the prompts, then specify Q=N.    │
│                                                                    │
│    SIZE=nn  - If a "source" drivespec was entered, then only files │
│               that are larger than the capacity of the destination │
│               drive will be selected for archival.  If you with to │
│               alter this threshold, enter a new size.  The value   │
│               is entered in quantities of sectors.  Entering       │
│               <SIZE=0> will select all files for archival.         │
│                                                                    │
│    TEST     - Since any given archival requires a set of formatted │
│               floppy diskettes on hand, you may wish to know how   │
│               many floppies are required for an archival set.  If  │
│               you specify this TEST parameter, ARCHIVE will report │
│               on the quantity of diskettes needed.                 │
│                                                                    │
│    VERIFY   - Normally, ARCHIVE does not verify sectors written to │
│               the floppy diskettes.  If you wish to force a verify │
│               operation, specify "VERIFY" when you invoke ARCHIVE. │
│                                                                    │
│    Abbreviations:  Q=QUERY, S=SIZE, T=TEST, V=VERIFY               │
└──────────────────────────────────────────────────────────────────┘
```

The hard drive partition is backed up to floppies. You may use the BACKUP utility provided with your DOS to copy the hard disk files onto floppy diskette. However, when a single hard drive file exceeds the total size of a floppy diskette, the ARCHIVE utility can be used to segment the file and transfer each individual segment to a corresponding floppy diskette. The RESTORE utility is then used to restore each segment when you need to reclaim the backup copy.

All segments of all files that are archived include a header record generated by the ARCHIVE utility. This header record is used essentially by the RESTORE utility to enable it to regenerate an exact image of the original

file from its segments. The header record is also used to identify each
diskette included in an archive set. The contents of the header record are
detailed in the TECHNICAL INFORMATION SECTION. If there is a problem in
reading one or more sectors of a source file, information on those sectors is
placed into the appropriate header record and may be needed by you in a data
recovery operation.   Since each file segment has this header record
introduced, the archived file segments cannot be directly used to BACKUP to
the source file via the DOS's BACKUP utility. The RESTORE utility provided
with this package is the tool to restore a hard drive from its archived
files.

     ARCHIVE will only select files that are classified as visible. Also, the
visible files on the hard disk must be greater in size than the floppy used
for the archive process in order to be selected. Since ARCHIVE only selects
files of size greater than the destination floppy, where your hard drive
intermixes both small and large files, you may need to use both the DOS's
BACKUP and ARCHIVE to make archival copies of all your hard disk drive files.
Since using two utilities may prove cumbersome, you may want to use the SIZE
parameter with a value of zero to force ARCHIVE to select all visible files.
Bear in mind that the archived files must be RESTOREd prior to their use.

     There is no requirement that you must restore an archived file to the
drive that the source was on. Archived file sets may be restored to other
drives providing that the size of the drive is sufficient to handle the file
or files. This provides a method to transfer large files from one hard disk
drive to another.

     During the archival process, ARCHIVE will display various messages - some
of which require a response from you. The meaning of each message and any
responses required will now be discussed.

> **Enter filespec or drive to archive? > ....**
> **Source filespec requires DRIVESPEC...**

     These messages indicates that you either omitted the "source" entry on
the command line or entered an erroneous filespec. If a filespec is entered,
it must include the drive specification. No password is required and none
should be entered. For a single-file archival, enter its file specification.
If you wish to select the files to archive by query, then enter a drive
specification (in the form, <:s> where "s" is the logical drive number).

> **Enter destination drive <1-7>? >.**

     This message indicates that you either omitted the destination entry on
the command line, or entered an erroneous drivespec. Note that you cannot
archive files to drive 0.

> **Archive file: FILENAME/EXT:D DD-MON-YY   ? .**

     This is the prompt that is displayed for each file when you are archiving
a drive. There are three choices for a response. Choose <Y> or <y> and that
file will be archived. Choose <C> or <c> and that file will also be
archived. In addition, the QUERY operation will henceforth be turned off
during the archival operation. Choose <N> or <n> and that file will be
ignored. The DD-MON-YY display is the directory date of the file.

Destination drive is write protected - replace <ENTER>

If ARCHIVE senses one of your destination floppy diskettes as being write protected, this message will be displayed. Remove the write protection from the diskette and depress the <ENTER> key to continue. If you had software write protected the drive (via the DOS's SYSTEM command) you must abort the archival by depressing the <BREAK> key, remove the software write protection, then re-invoke the archival command.

Destination drive not ready - prepare <ENTER>

The destination drive is not available for writing. Either the diskette is not in place or the drive door is open. Prepare the drive with a floppy diskette and then depress the <ENTER> key.

Destination disk already used...

This message indicates that the diskette in place in the destination drive already has a file containing one of the segments of the file currently being archived. Change to an unused destination diskette.

This destination disk has no space available...

This indicates that the diskette in place in the destination drive has no more space for archiving a file segment. Change to an unused diskette or one with unused space available. Depress <ENTER> to resume.

Enter new destination disk and <ENTER>

This message will be displayed during the archival process when each of the destination diskettes has been completed. Change to a new disk and depress the <ENTER> key to resume the archival process with the next file segment.

Sectors to archive: xxxxx - Archiving sector yyyyy

This message is displayed while a file is being read from the source and written to the destination. The "xxxxx" field is a count of the total number of sectors that need to be read from the source file. The "yyyyy" field is the number of the sector (relative from 1) that is currently being transferred.

Source disk read error - Sector zzzzz

This unfortunate error will be displayed if there is any error in reading a sector from the source file. The field "zzzzz" contains the relative sector number (relative from 0) of the file. The sector number will be listed in the BADREC field of the header record contained in the file segment currently being written. All bytes in the sector will be stored as an ASCII space character (decimal 32).

Cannot run ARCHIVE from JCL!

Because ARCHIVE generally requires the controlled exchange of diskettes and responses to queries, it is not designed for operation in a batch environment. If ARCHIVE senses its invocation from Job Control Language, it will display this message and abort.

Parameter Error!

This message indicates that one or more parameters entered on the command line are incorrect. Re-enter the command line using correct parameters.

Archival disk count: ccccc

This message will be displayed when you have selected the TEST parameter. The disk count will be in field ccccc. The count assumes that all diskettes are identical to the one in the destination disk drive, all have totally unused space except for the DIR/SYS and BOOT/SYS files, and that ARCHIVE detects no flawed media during the subsequent archival process.

RESTORE UTILITY

The RESTORE utility is used to reconstruct files that have been archived via the ARCHIVE utility. RESTORE combines all of the segments of an archived file into a single file. The restoral process does not require the restored file to be existing on the drive that is restored. All attributes of the original file will be restored. RESTORE can be used to reconstruct a single original file from the archived file set, or it can be used to reconstruct all archived files contained in the archived file set. RESTORE is invoked via:

```
|                                                                      |
|  RESTOREx source :d (QUERY=N,VERIFY)                                 |
|                                                                      |
|  x        - Specifies the program version: <5,6>                     |
|                                                                      |
|  source   - Specifies the filespec or drivespec of the file or       |
|             drive you wish to restore.  If a filespec is entered,    |
|             only that file will be restored.  If only a drivespec    |
|             is entered, all files in the archived file set will      |
|             be selected for restoral.                                |
|                                                                      |
|  d        - Specifies the destination drive which will receive       |
|             the reconstructed file(s).                               |
|                                                                      |
|  QUERY=N  - If a "source" drivespec was entered, then you will       |
|             be prompted with each source filename to restore.        |
|             If you do not want the prompts, then specify Q=N.         |
|                                                                      |
|  VERIFY   - Normally, ARCHIVE does not verify sectors written to      |
|             the floppy diskettes.  If you wish to force a verify      |
|             operation, specify "VERIFY" when you invoke ARCHIVE.      |
|                                                                      |
|  Abbreviations: Q=QUERY, V=VERIFY                                     |
|                                                                      |
```

An archived file set may contain one or more diskett es - each containing a segment or segments of archived files. If you want to reconstruct all of the files archived in the file set, specify the drivespec of the drive that will be used to read the diskettes. If you only want to reconstruct one of the files contained in the archived file set, enter its complete filespec as the "source" entry.

RESTORE posts messages concerning its progress in the reconstruction process and prompts for diskette exchanges when it completes the reading of all file segments contained on a diskette that were selected for restoral. RESTORE keeps track of which diskettes have been completed and will automatically terminate the restoral process when it recognizes that the reconstruction is complete. The meaning of the messages displayed and the appropriate responses required for entry by you are now discussed.

Enter SOURCE filespec or drive? > ....
SOURCE filespec requires DRIVESPEC...

RSHARD - Hard Disk Driver Package

One of these messages will be displayed if you omit the filespec of the file you wish to restore or drivespec of the disk drive to be used to read the archived file set. Respond by entering the requested information.

Enter DESTINATION drive to restore <0-7>? > .

The display of this message means that you have either omitted the specification of the drive to write the reconstructed file(s) or have entered an erroneous drive number. Respond by entering the requested information.

Restore file: FILENAME/EXT:D DD-MON-YY   ? .

This is the prompt that is displayed for each file when you are restoring a drive. There are three choices for a response. Choose <Y> or <y> and that file will be restored.   Choose <C> or <c> and that file will also be restored.   In addition, the QUERY operation will henceforth be turned off during the restoral operation.   Choose <N> or <n> and that file will be ignored on diskettes of the file set that it appears.

DESTINATION drive is write protected - replace <ENTER>

If RESTORE senses your destination hard disk drive as being write protected, this message will be displayed. Remove the write protection from the drive and depress the <ENTER> key to continue. If you had software write protected the drive (via the DOS's SYSTEM command), you must abort the archival by depressing the <BREAK> key, remove the software write protection, then re-invoke the restoral command.

SOURCE drive is not ready - prepare <ENTER>

The source drive is not available for reading. Either the diskette is not in place or the drive door is open. Prepare the drive with a floppy and then depress the <ENTER> key.

DESTINATION drive not ready - prepare <ENTER>

The destination drive is not available for writing. Either you referenced a non-existent drive or you referenced a removable cartridge drive that is not active. Prepare the drive and then depress the <ENTER> key or abort by depressing the <BREAK> key.

SOURCE disk already used...

This message indicates that the diskette in place in the source drive has already been restored. Change to an unused source diskette.

SOURCE disk from different archive set...

This indicates that the diskette in place in the source drive has a file segment with the same name as one currently being reconstructed; however, it does not belong to the same archived file set. Change to a proper diskette in the archived file set currently being restored. Depress <ENTER> to resume.

Enter new SOURCE disk and <ENTER>

This message will be displayed during the restoral process when each of the source diskettes has had all of its selected file segments completed.

Change to the next disk and depress the <ENTER> key to resume the restoral process.

Sectors to restore: xxxxx - Restoring sector: yyyyy

This message is displayed while a file is read from the source and written to the destination. The "xxxxx" field is a count of the total number of sectors that need to be read to complete the reconstruction of the original file. The "yyyyy" field is the number of the sector (relative from 1) that is currently being transferred.

Source disk read error - Sector: zzzzz

This unfortunate error will be displayed if there is any error in reading a sector from the source file. The field "zzzzz" contains the relative sector number (relative from 0) of the file. All bytes in the sector will be restored as an ASCII space character (decimal 32).

DESTINATION disk write error: hh - Sector: zzzzz

This error message will be displayed if RESTORE detects an error when writing a sector to the destination disk. Field "hh" contains the DOS error code in hexadecimal while field "zzzzz" contains the number of the sector (relative to 0) that was written.

Out of memory - can't continue!

Each file that is being reconstructed requires a 128 byte buffer maintained in memory. As a file is completely restored, it frees up this buffer. Thus, 128xN bytes of memory are required where "N" is the number of files being actively reconstructed. It would be most unusual to obtain this error message. It would most likely mean that a large part of your machine's memory is unavailable - perhaps being used as a spool buffer or other abnormally extra usage. Attempt to free up the high-memory space and attempt the RESTORE operation again.

Cannot run RESTORE from JCL!

Because RESTORE generally requires the controlled exchange of diskettes and responses to queries, it is not designed for operation in a batch environment. If restore senses its invocation from Job Control Language, it will display this message and abort.

Parameter error!

This message indicates that one or more parameters entered on the command line are incorrect. Re-enter the command line using correct parameters.

TECHNICAL INFORMATION

DRIVE CONTROL TABLE USAGE

     This section covers the use made of fields in the Drive Control Table
record assigned to a hard drive partition.

DCT+3, Bit-3

     This bit is set to indicate the logical drive is a hard drive.

DCT+3, Bit-2

     This bit is RESET if the drive is a REMOVABLE cartridge.

DCT+4, Bits 1-0 and DCT+5

     These fields contain the number of the starting cylinder for the logical
partition. If DCT+4, Bit-5 is set, then this number represents half the
actual value.

DCT+4, Bit-5

     This bit, termed the DBLBIT, will be SET if you requested more than 203
cylinders for a single logical drive. In this case, a logical cylinder is
composed of two physical cylinders.

DCT+4, Bit-4

     This bit is set to indicate that the controller does not supply an index
pulse indication to the disk driver on each rotation of the drive surface.

DCT+4, Bits 2-0

     This field contains the starting head number, counting from zero.

DCT+4, Bit-3

     This bit field contains the drive address.

DCT+6

     This field contains the highest numbered logical cylinder on the parti-
tion. This number is relative - it references the actual number of cylinders
assigned to the partition and is counted from zero. If the DBLBIT is set,
the number of physical cylinders assigned is twice this number.

DCT+7, Bits 7-5

     This field contains the number of heads assigned to the partition.

DCT+7, Bits 4-0

     This field contains the number of sectors per track counted from zero.
The entry is hard coded with a X'1F' which indicates 32 sectors per track.

DCT+8, Bits 7-5

This field contains the number of granules allocated per physical cylinder. If the DBLBIT is set, the actual quantity of granules per logical cylinder will be twice this amount. The initialization program will attempt to allocate all eight granules per logical drive. It does this by dividing the total number of sectors per logical cylinder by eight with the resulting value used as the number of sectors per granule.

DCT+8, Bits 4-0

This field contains the number of sectors per granule. The initialization program will always attempt to minimize this value (see above). For example, 32 sectors per cylinder (SPC) drives use 4-sector granules (1K), 64 SPC drives use 2K granules, 96 SPC use 3K, 128 SPC use 4K, 256 SPC use 8K granules.

DCT+9

This field contains the logical cylinder number of the directory. If the DBLBIT is set, then this number is actually half the physical number.

ARCHIVE FILE SET HEADER RECORD

Each file segment of an archived file has a header record written as the first sector of the file segment. The information contained in the header is used to support fail-safe reconstruction of the original file. This section covers the information contained in the fields of the header record. Each like-named file in the file set will have a header record where the first forty bytes are identical. The numbers contained within angle brackets are sector offset values in hexadecimal.

DIRECTORY <00 - 15>

This 22 byte field contains the first twenty two bytes of the original file's primary directory entry record. Any technical manual on the operation of the DOS will detail these bytes.

DATE <16 - 1D>

This field contains the date that the file set was created. The date is in standard ASCII string notation: MM/DD/YY.

TIME <1E - 25>

This field contains the time that the file set was created. The time is in standard ASCII string notation: HH:MM:SS.

RANDOM <26 - 27>

This field contains a 15 bit random number.

DISKNUM <28 - 29>

     This field contains the 16-bit number of the disk set for a given file segment. Each file that is archived begins its header with a disk number of zero. The value is stored in standard low-high order.

RECBGN <2A - 2B>

     This field stores the relative sector number (relative to zero) of the first record contained in this file segment.

RECEND <2C - 2D>

     This field stores the relative sector number (relative to zero) of the last record contained in this file segment.

SPARE <2E - 3F>

     This 18-byte region is currently unused. It is always filled with zeroes.

LOCKED <40 - 7F>

     This field is composed of 2-byte subfields. Each subfield contains a file segment record number that was detected as bad on the destination disk during the archival process and was thus locked from use. A value of zero indicates no record lock (the zeroth record is the header). These numbers are used during restoral to indicate if any source sectors should be skipped.

BADREC <80-FF>

     This field is composed of 2-byte subfields. Each subfield contains a record number of the SOURCE file that was detected as unreadable during the archive process and that was written to this file segment as all spaces. This number may be useful to you if you neglected to write it down during the archival process.