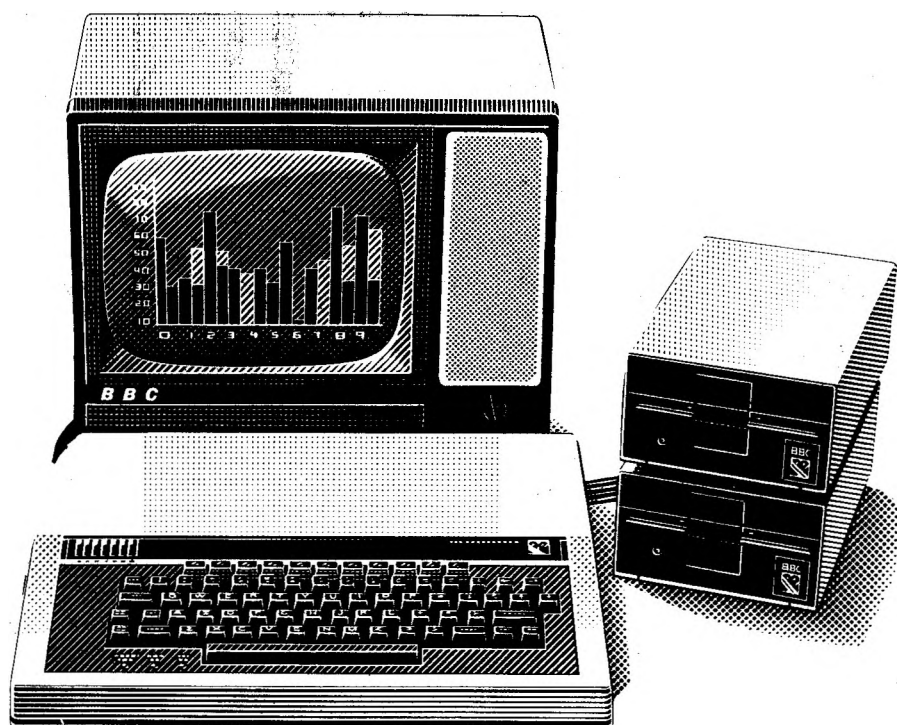


# **THE BBC MICROCOMPUTER DISC FILING SYSTEM**



***A Guide For Teachers***

**A.N.Cook**



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# Using Discs

Using Discs for loading and saving information from the computer has distinct advantages over Tape operation:

A Disc offers much faster operation without the need to rewind the cassette to find the place.

Disc systems offer automatic operation - the disc system is completely computer controlled. The only manual action needed is in the insertion or removal of the Disc from the drive.

The Disc operating system added to the computer gives extra commands that are all closely tied to the disc system itself.

Using discs brings about order and reliability to program storage. Programs can be located and retrieved in seconds compared with the tedious loading from cassette.



A disc system is made up of the following:-

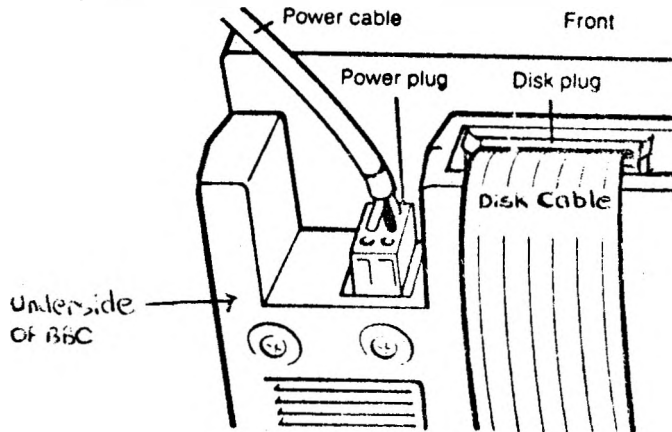
1 DISC DRIVE - a box containing the mechanical parts and electronic circuits which spin the disc and make contact with its surface. Our drives are 5 $\frac{1}{4}$  Cumana Single Sided, that are powered from the computer.

2 CONTROLLING CIRCUITS - for the Disc system - these are in the form of circuits present on the BBC circuit board. When the micro is produced, these circuits are incorporated into the board, but the microchips that make them operate are not. These can be fitted into the computer when it is upgraded for disc use. Ten chips are needed plus one larger controller chip.

3 THE DISC FILING SYSTEM (DFS) - incorporated into one microchip, and consists of a number of commands that are of use when handling information connected with discs. These DFS commands are explained in a later section.

# Disc Drive Connections

Disc Drives require two connections to be made in order to function. One is a Power Supply Cable which may be from the BBC computer itself using the low voltage power take off from underneath the machine, or may be directly from the mains using a conventional 13amp plug.



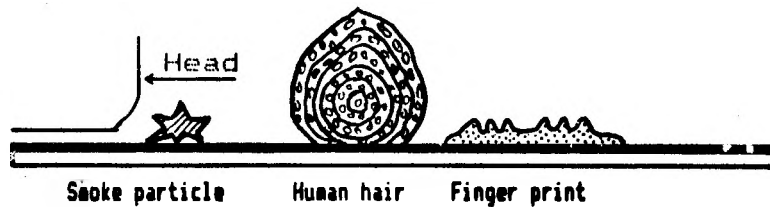
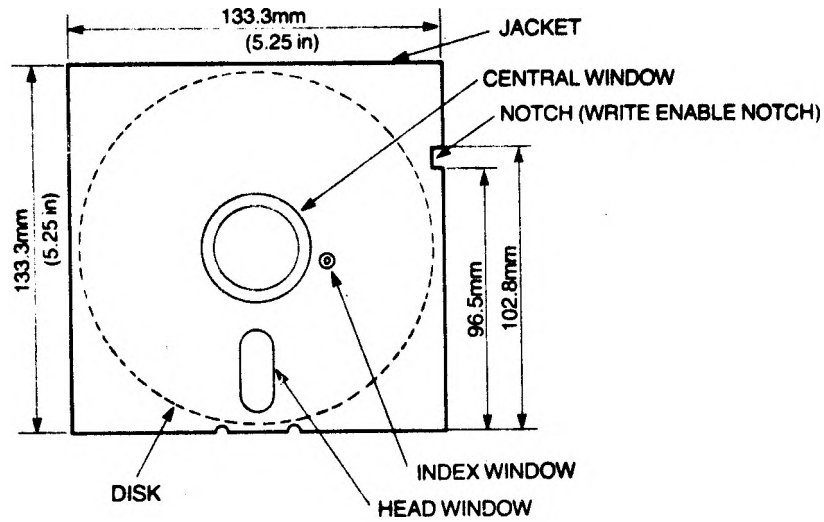
The other longer ribbon cable is used for data transmission between computer and Disc Drive. This plugs into the multiway socket underneath the computer labelled 'Disc Drive'. The plug has a locating piece of plastic that locks with a groove in the socket so that the plug can only be fitted one way round. If all fits then the two locking clips on the socket will grip the plug to keep it firmly attached .

The ribbon cable also has another plug fitted about half way along its length. This is the extra plug for a second disc drive unit to be connected to if and when funds allow for it to be added to the system

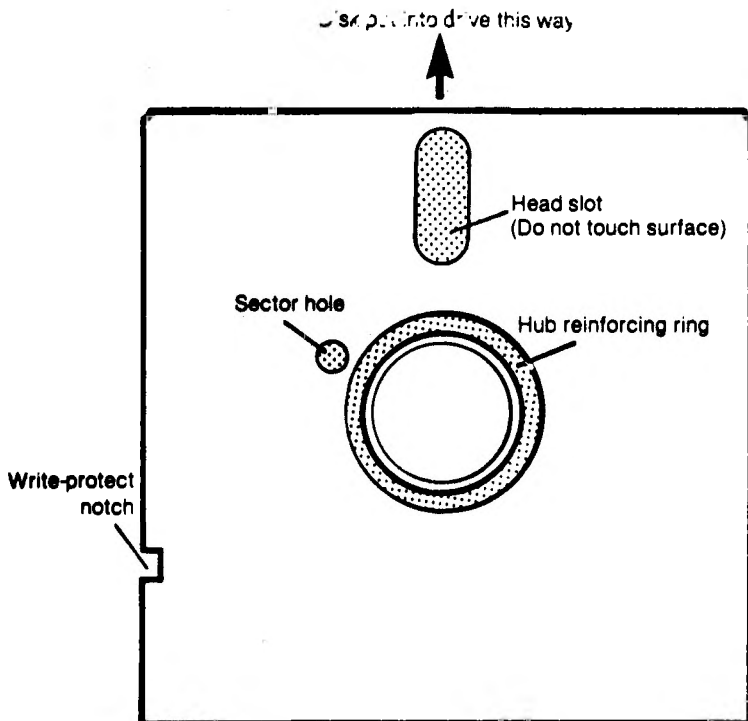


# Floppy Discs

A typical disc consists of a circular flat piece of plastic which has been coated with magnetic material. It is enclosed in a cardboard or plastic jacket in order to reduce the chances of damage to the magnetic surface. On good quality discs the central hub part is reinforced to avoid damage as it is gripped by the drive. The surface of the disc is smooth and flat and any physical damage such as a fingerprint, dust, a scratch, a human hair or other minute particles



can cause a loss of recorded data. The outer jacket has slots and holes cut into it to enable the disc drive to touch the disc in the correct places.



The oval head slot is cut to allow the head of the disc drive to touch the surface of the rotating disc, and it is in this area that all data is read to and from a disc. The head reads across the width of the disc and reads the data from a series of tracks stretching from the centre to the outside of the disc, within the width of the head slot. The most common disc drives use either 40 or 80 tracks. The ones that we use in school tend to be 40 track i.e. 48 tracks per inch. The sector hole is used as a marker by the head when it lays down 10

sectors on each track on the disc.

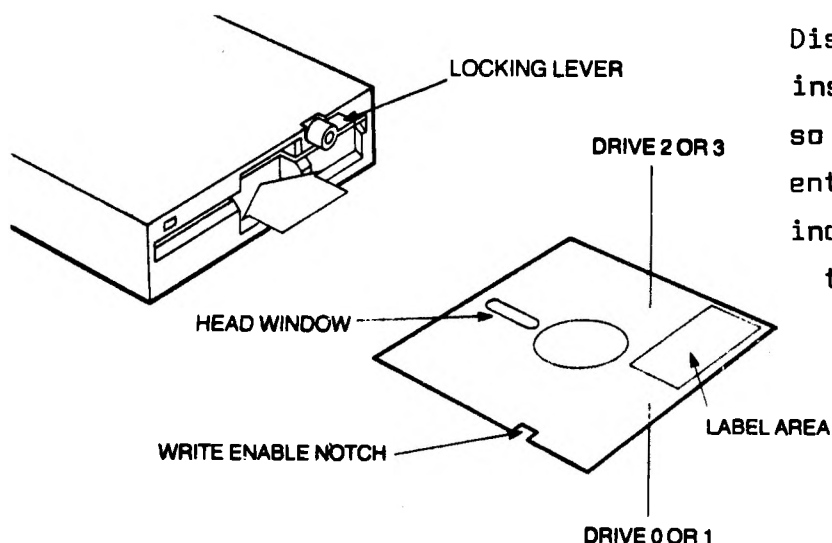
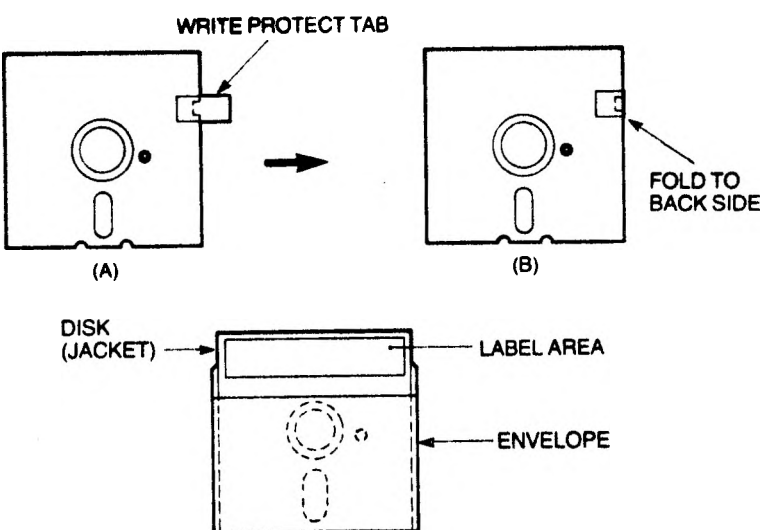
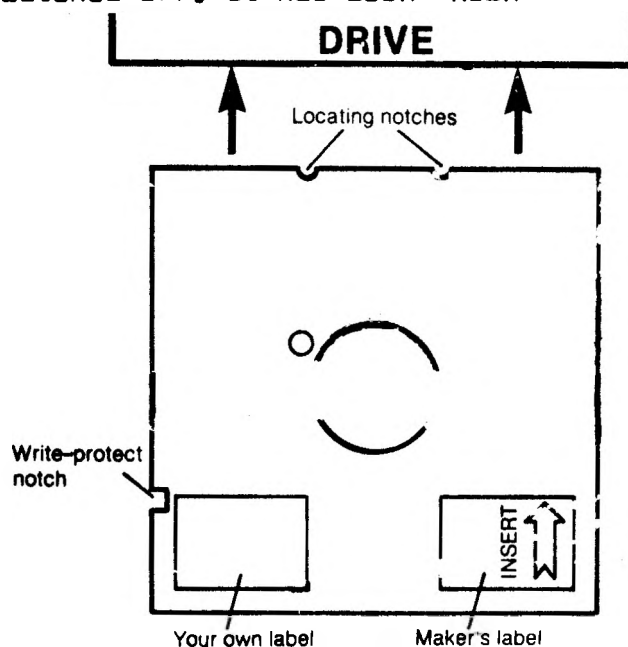
Along the top right hand edge of the disc is a small slot called the 'write protection notch' which when covered by an adhesive tab, will prevent any further data being written to the disc. Discs should always be handled with care and the oval head slot should never be handled or touched with fingers. If you wish to title a disc either use a felt pen designed for use with discs or

GENTLE pressure with an ordinary felt pen. It is possible to damage discs with biros or hard pencils when labelling.

Discs should always be inserted into the disc drive so that the oval head slot enters the drive first, the index label is face up, and the write protect tab is the same side as the drive light. Once inserted, the drive door should be locked, which engages the hub onto the disc. The

disc drive should be switched on BEFORE inserting any discs and discs should be removed BEFORE the unit is switched off. It has been known

for data to be lost or corrupted when left in the drive during switching on or off. Always return discs to their protective jackets after use and store in a proper plastic disc storage box. Never store discs near heat or magnetic fields generated by speakers, electric motors etc. Data can be corrupted unless care is taken, so if you have a valuable disc, always make a backup copy and keep in a different location.





# Formatting A Disc

All new discs are supplied totally blank and it is up to the user to set out the tracks on the disc as is required by the particular disc drive that he or she possesses. This process is known as formatting. The school disc drives are the 40 track system and the special formatting program sets up tracks 1 to 39 for the storage of data. Track 0 contains the catalogue of the disc contents.

To format a disc, a special formatting program has to be used. This is contained on a special disc in the Computer cupboard. To format a brand new disc, insert the formatting disc and type the following into the computer:-

\* FORM 40 (return)

The formatting disc will spin, the screen will go blank, after which it will display the Cumana name and version number along with the central diagram. The Cumana formatter uses a triangular pattern which represents a segment of the diskette. The tapered end is the centre of the disk and the left hand side which is wider in section represents track 0

The Bottom of the display will read:-

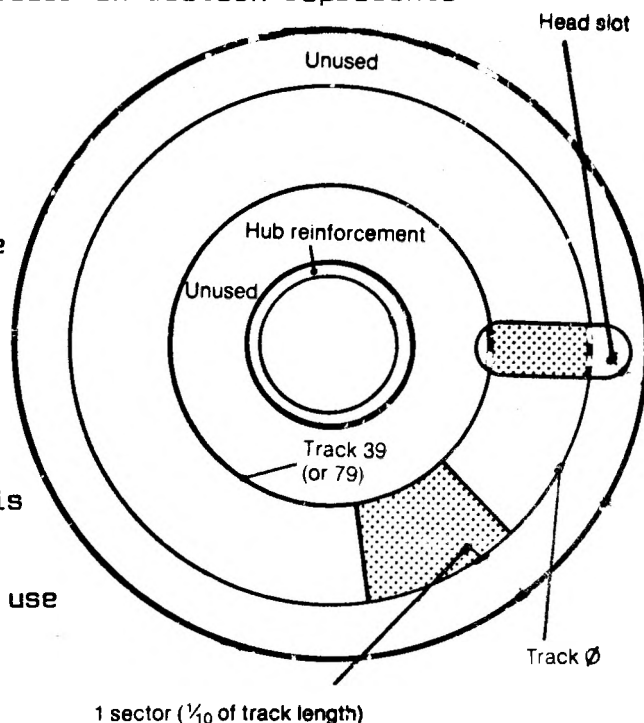
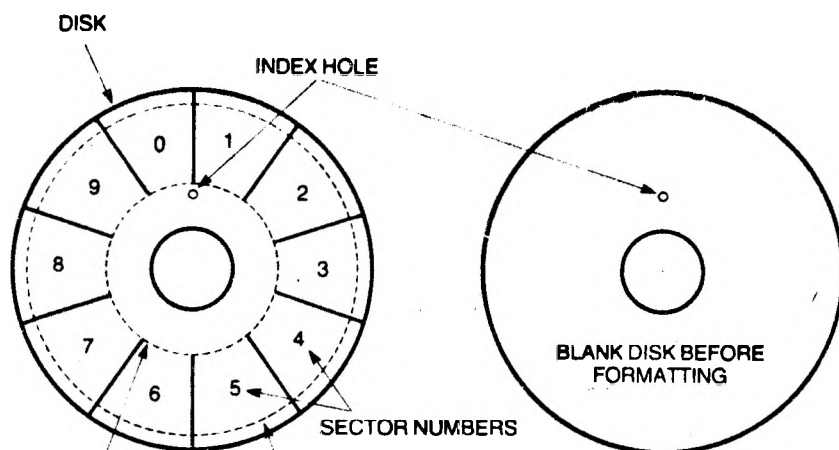
" ON WHICH DRIVE DO YOU WISH TO FORMAT?"

Remove the Cumana Formatter and put in the blank disc that you wish to format. Answer the question above by typing in:-

0

The formatter will check the disc. If it is blank it will continue to format; if any data is present i.e. the disc has been in use before, it will print on the screen:-

"DISC ALREADY FORMATTED ARE YOU SURE?"



Answer Y to continue.

Answer N to escape from the formatting program ( in case you are trying to format a disc that you want to keep)

During formatting each of the vertical lines that represent the tracks in the triangle will be filled in green for each successful track, accompanied by a bleep from the computer.

The formatter will verify each track as it formats it. It will try up to ten times to format a track successfully. If it fails the track may be coloured yellow or red and the disc should be discarded as faulty.

If the disc is formatted correctly, the end of the formatting process will be signified by the computer playing the first two bars of Beethovens 5th Symphony.

If Formatting fails, this will be signified by the initial bars of the Funeral March being played. The display will also read:-

"FATAL FORMATTING ERROR ON DISC"

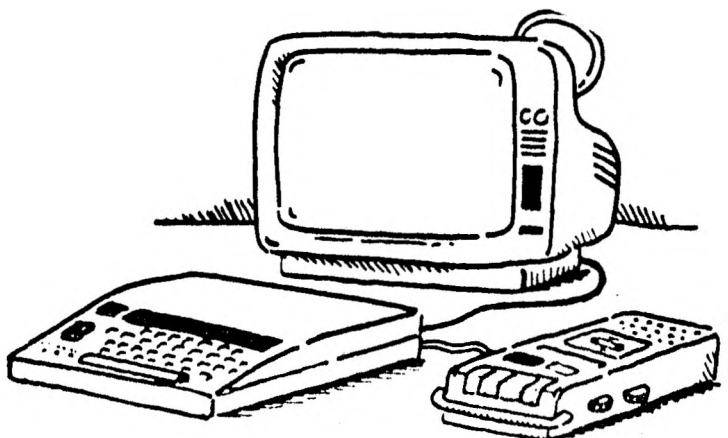
After successful formatting of a disc , the screen contains a further option to repeat the proceedure with additional blank discs. The screen has the following information:-

FORMATTING COMPLETE

Do you wish to format another disc?

Simply answer Y or N

Pressing BREAK should escape the formatter program.



# Reading From \ Writing To Disc

The commands used are very similar to those used by the Tape System:-

Type in:-

```
LOAD (filename) (return)
```

To Load & Run a program:-

Type in:-

```
CHAIN (filename) (return)
```

In the Case of Machine Code Type in:-

```
*RUN (filename) (return)
```

Or:-

```
* LOAD (filename) (return)
```

Type in:-

```
SAVE (filename) (return)
```

For Machine Code Programs:-

```
* SAVE (filename) (Start Address) (Finish Address) (return)
```



# Tape To Disc Transfer

Sometimes you may wish to transfer a program that is on tape and save it onto disc so that it can be used on a disc drive. The procedure is to load the program into the computer from tape and then save it onto a disc.

When the computer is switched on the Disc operating system is in use, and LOAD and SAVE apply to disc. In order to change back to the Tape Loading and saving operation it is necessary to type in:-

\* TAPE (return)

The system can be switched back to Disc operation by typing in:-

\* DISC (return)

To Transfer a program from Tape to Disc- type in:-

\* TAPE (return) -(this sets up the tape loading system)

LOAD "(program title)" (return) - (to load program from tape)

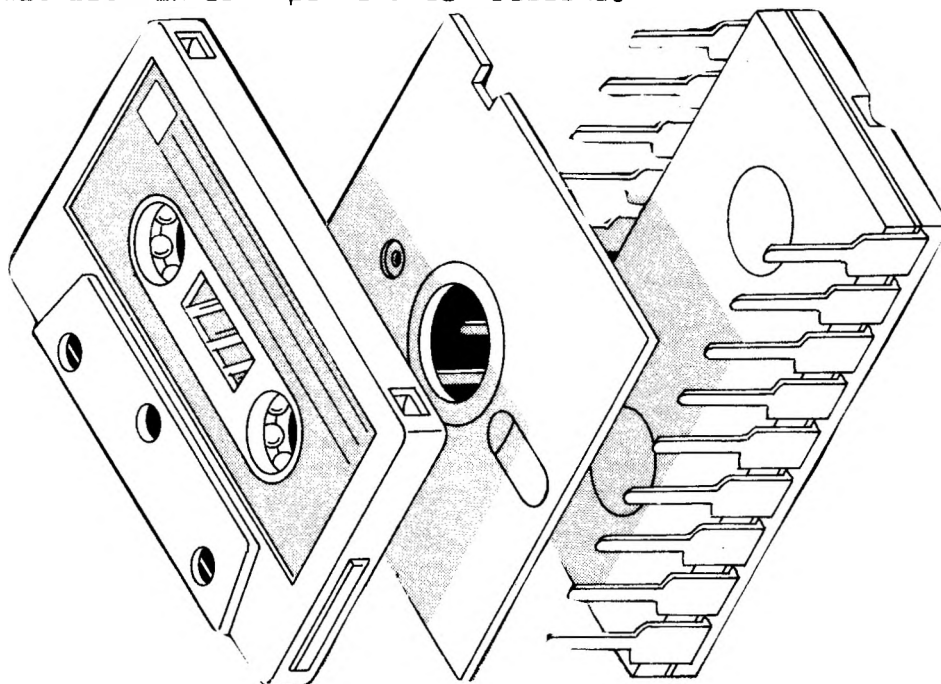
After tape has loaded, the computer has beeped and the cursor has returned to the next line - type in:-

\* DISC (return) to reset the Disc Filing System

SAVE "(program title)" (return)

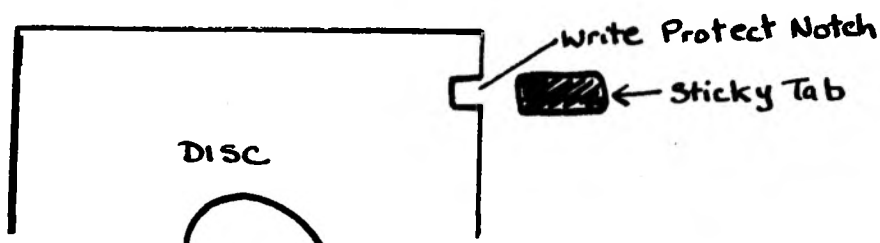
The Disc Drive will operate and the program will be saved onto disc.

This method will work with about 70% of software available to schools. Some programs require a larger memory space in order to run and will need to be downloaded in memory in order to function. This procedure is dealt with under Tape to Disc Problems.



# Protection Of Disc Files

There are several ways of preventing the deletion of files from a disc. One method of doing this is universal to all disc systems, and makes use of the write protect notch. This is a small rectangular slot cut in the left hand side of the disc. When the disc is inserted the notch can be detected either by mechanical means or by a light beam. If the notch is uncovered the disc can be read from and written to. If the notch is covered by a small sticky tab supplied in every box of quality discs, then the disc can be read from but not written to.



Trying to write to the disc will produce the message:-

```
DISC WRITE PROTECTED
```

To reuse the disc in the normal way it is only necessary to remove the tab.

## \*ACCESS

In addition to this general protection device the DFS allows you to protect each individual file on a disc against being accidentally erased from the disc. The command used is \* ACCESS.

To lock a file-Type in:-

```
* ACCESS "filename" L
```

The file will be locked and the catalogue name will display a L beside it:-

```
FILENAME L
```

To lock all the files in the disc catalogue:-

Type in:-

```
* ACCESS *.* L
```

All the files on the disc will be locked and will display a L beside each title

## Files Unlocked

```
>*ACCESS*.*
>*.
WELCOME (66)
Drive 0
Directory :0.*
Option 3 (EXEC)
Library :0.*
```

```
ALPHASO
BIO
CALCULA
INDEX
KEYBOAR
MESSAGE
PATTERN
POEM
TELEPHO
!BOOT
BAT'N'B
BIORHYT
CLOCK
INTRO
KINGDOM
MUSIC
PHOTO
SKETCH
```

## Files Locked

```
*ACCESS*.* L
>*.
WELCOME (64)
Drive 0
Directory :0.*
Option 3 (EXEC)
Library :0.*
```

```
ALPHASO L
BIO L
CALCULA L
INDEX L
KEYBOAR L
MESSAGE L
PATTERN L
POEM L
TELEPHO L
!BOOT L
BAT'N'B L
BIORHYT L
CLOCK L
INTRO L
KINGDOM L
MUSIC L
PHOTO L
SKETCH L
```

To unlock any individual locked file type in:-

\* ACCESS "filename" (return)

To unlock all files in the catalogue - type in:-

\* ACCESS \*.\*

When a file has been protected by \*ACCESS it cannot be removed by any of the Commands - \*DELETE , \*WIPE , \*DESTROY. Its filename cannot be changed by using \*RENAME and it cannot be overwritten by a file of the same name. Attempting to write to any locked file or using any of the above commands will result in the message:-

FILE LOCKED

\* ACCESS \*.B.\* would access all files in directory B

\* ACCESS \*.B.\* L would Lock all files in directory B



# Tape To Disc Problems

Most programs can be successfully transferred from tape to run on disc. Some programs may well transfer successfully and run from disc, but may fail on execution with the error message:-

NO ROOM or BAD MODE

indicating that the program has run out of memory.

The reason is that the DFS occupies a greater memory space than the cassette filing system and therefore encroaches on the users basic program memory space. The program therefore does not have enough memory to function.

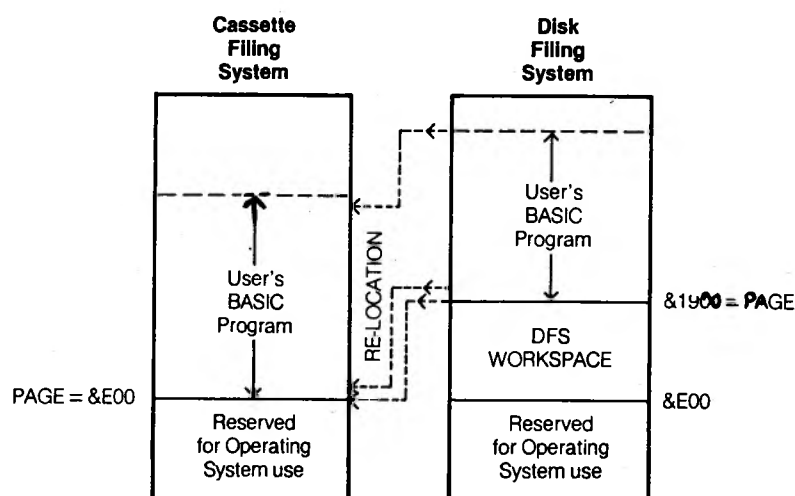


Fig. 2-1 Memory maps for program re-location

As long as the program will fit into the available space, there is no reason why it should be moved down the memory to the position it would have been loaded to under the cassette system. To relocate such a program requires a downloading program to move each byte of the program 2816 locations down the store.

If Function Key 0 is programmed to do this ,the sequence would be:-

Load program from disc

Press f0 to download program

Wait for a few seconds while the program relocates itself and then it should run.

To program f0 Type in:-

```
* KEY0 *TAPE ; M FOR I%=PAGE TO TOP:?(I%-2816)=?I%: NEXT: CLEAR:
PAGE = &E00: RUN ; M
```

# Disc Catalogue

Whenever a file is saved onto a formatted disc a small section of track 00 is used to keep a record of the file name. The Disc catalogue can hold 31 filenames and can be displayed on the screen by typing:-

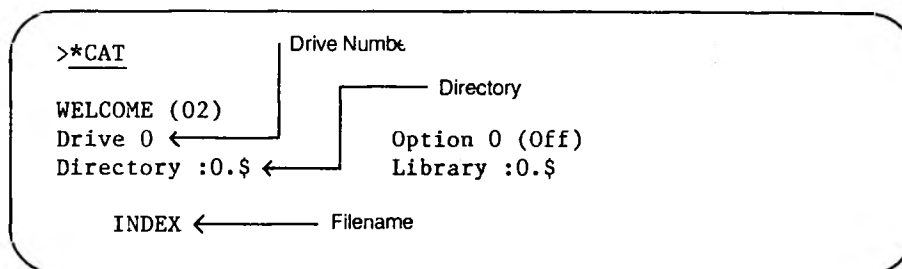
\*CAT or \*.

This will give the catalogue of the currently selected drive.

Typing in:-

\*.1 gives the catalogue of Drive 1 if Dual Drives are in use.

Typing in \*CAT for a disc containing the 'Welcome' programs results in a display as illustrated below:-



Each Heading has a particular function:-

WELCOME - is the Title of the disc. Any disc can be titled using the command:-

\* TITLE "disc title" (return)

Any title of up to 12 characters can be inserted.

(02) - is the number of times that the disc has been written on since it was last formatted. As a general rule when this number reaches 100 the disc should be reformatted.

DRIVE 0 - Is the drive for which this catalogue is displayed.

OPTION 0 (OFF) - is the value of the boot up (\*OPT4) option for this disc which is annotated with an explanation such as (OFF)

LIBRARY:0.\$ - means that the default machine code library is drive 0 and directory \$ (See \*LIB)

DIRECTORY:0.\$ - means that the default general purpose directory is drive 0 and Directory \$ (See \*DIR)

INDEX - Is the title of one of the possible 31 files the catalogue could hold. Each file name can have up to 7 letters.



# Directories

The Catalogue can be subdivided into sections called Directories, each being represented by a letter A to Z. They are shown on the catalogue below as a letter followed by a full stop preceding each filename.

```

>*CAT
WELCOME (77)
Drive 0          Option 0 (Off)
Directory :0.$   Library :0.$

    !B          !BOOT
    DCONV  L    FORM40  L
    FORM80  L    VERIFY  L
    content
                                } Directory $

W.ALPHA          W.BATBALL
W.BIO            W.BIORTHM
W.BPART2        W.CALC
W.CLOCK         W.HELP
W.INDEX         W.KEYBD
W.KINGDOM       W.MESSAGE
W.MUSIC         W.PATTERN
W.PHONE         W.PHOTO
W.POEM          W.SKETCH
W.WELCOME
                                } Directory W

```

On the disc the default directory is \$ and therefore no preceding directory code is shown. The members of directory W also present on the disc are preceded by the letter W.

To change the default directory type in:-

\*DIR (directory Title) (return)

Typing in \* DIR W will result in a catalogue displayed as below:-

```

>*DIR W
>*CAT
WELCOME (78)
Drive 0          Option 0 (Off)
Directory :0.W   Library :0.$
                                New "Current" Directory
                                ↙
    ALPHA        BATBALL
    BIO          BIORTHM
    BPART2       CALC
    CLOCK        HELP
    INDEX        KEYBD
    KINGDOM      MESSAGE
    MUSIC        PATTERN
    PHONE        PHOTO
    POEM         SKETCH
    WELCOME
                                } Directory W

$.!B           $.!BOOT
$.!DCONV  L    $.!FORM40  L
$.!FORM80  L    $.!VERIFY  L
$.!content
                                } Directory $

```

The new current directory is W and all the titles are now displayed without the letter W. All files in the \$ directory are now preceded by the \$ directory letter

It is possible to rename files to move to different directories.

Type in:-

\* RENAME (old file name) (new file name)

Renaming some of the titles on the previous catalogue to create a directory E would be achieved as shown below:-

```

>*RENAME W.ALPHA E.ALPHA
>*RENAME W.CLOCK E.CLOCK
>*RENAME W.KEYBD E.KEYBD
>*RENAME W.MUSIC E.MUSIC
>*RENAME W.SKETCH E.SKETCH
>*DIR E
>*CAT
WELCOME (79)
Drive 0          Option 0 (Off)
Directory :0.E   Library :0.$

      ALPHA          CLOCK
      KEYBD          MUSIC
      SKETCH
      } Directory E

$.!B             $.!BOOT
$.DCONV  L       $.FORM40  L
$.FORM80  L     $.VERIFY  L
$.content    W.BATBALL
W.BIO        W.BIORTHM
W.BPART2     W.CALC
W.HELP       W.INDEX
W.KINGDOM    W.MESSAGE
W.PATTERN    W.PHONE
W.PHOTO      W.POEM
W.WELCOME

} Directories $ and W

```

This would result in a directory E being created shown as the default directory, with directory \$ and directory W present on the disc catalogue.

Any program saved to a disc will always be saved to the default directory. If the default directory is W then the program will be saved as W.'Program' when displayed.

## \*LIB

This is of more use to the owners of dual disc drives and enables the owner to store all machine code routines in drive 1 under a particular directory e.g. U. By typing in \*LIB:1.U (return) for the disc in drive 0 you will force the machine to search the disc in drive 1 for a program in directory U every time you use a command such as \* FIXIT (not part of the DFS or operating system commands)

# \*Delete\*Wipe\*Destroy

All the above commands relate to the deletion of single or multiple files from a disc and should therefore be used with great care.

## \*DELETE

This command will delete a single file from a disc. Type in:-

\* DELETE (filename) (return)

and the file will be deleted

## \*WIPE

This command can be used to remove a series of files from the catalogue. Type in:-

\*WIPE \*.\* (return)

to wipe the entire disc.

Each file will be presented to the user by title. If 'Y' is entered the file is deleted - if 'N' is entered the file remains intact. This allows the catalogue to be sorted without losing all the files.

## \*DESTROY

This will also delete all programs from a disc. \*DESTROY must be prefixed by \*ENABLE to activate the command.

Type in:-

\*ENABLE

\*DESTROY \*.\*

to erase the whole disc.

The computer will present a list of all the files on the disc and will ask:-

DELETE Y/N

Typing Y will delete all the files.

Typing N will escape the routine.



# ! Boot

The computer can be made to automatically load programs in response to the Shift and Break keys being pressed. This procedure is known as Booting the system. !BOOT is a special filename. It is the name given to a file which can be 'built' directly onto the disc. The options set by \*OPT 4,(n) can act in the file.

To create a boot file that will allow the user to Shift/Break to a menu of program titles it is necessary to type in:-

```
* BUILD ! BOOT (return)    -   creates a boot file
```

The Computer responds by printing:-

```
001
```

Type in after 001:-

```
001 CHAIN "MENU" (return)
```

The Computer responds by printing:-

```
002
```

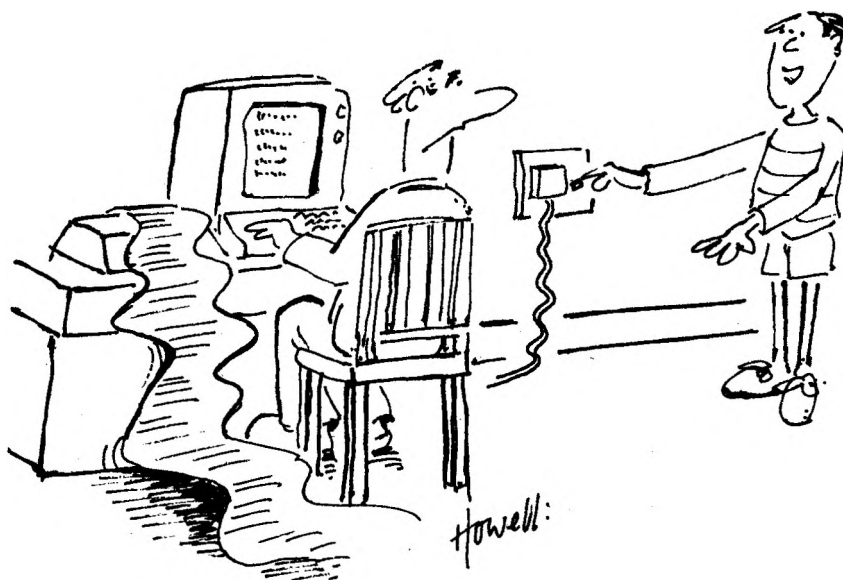
Press the ESCAPE Key to terminate \*BUILD and it is saved onto the disc as !BOOT

Type in:-

```
*OPT 4,3 (return)
```

to set up the auto start option for Drive 0 Directory \$

Pressing SHIFT and BREAK should call up the Menu program from which your program can be selected.



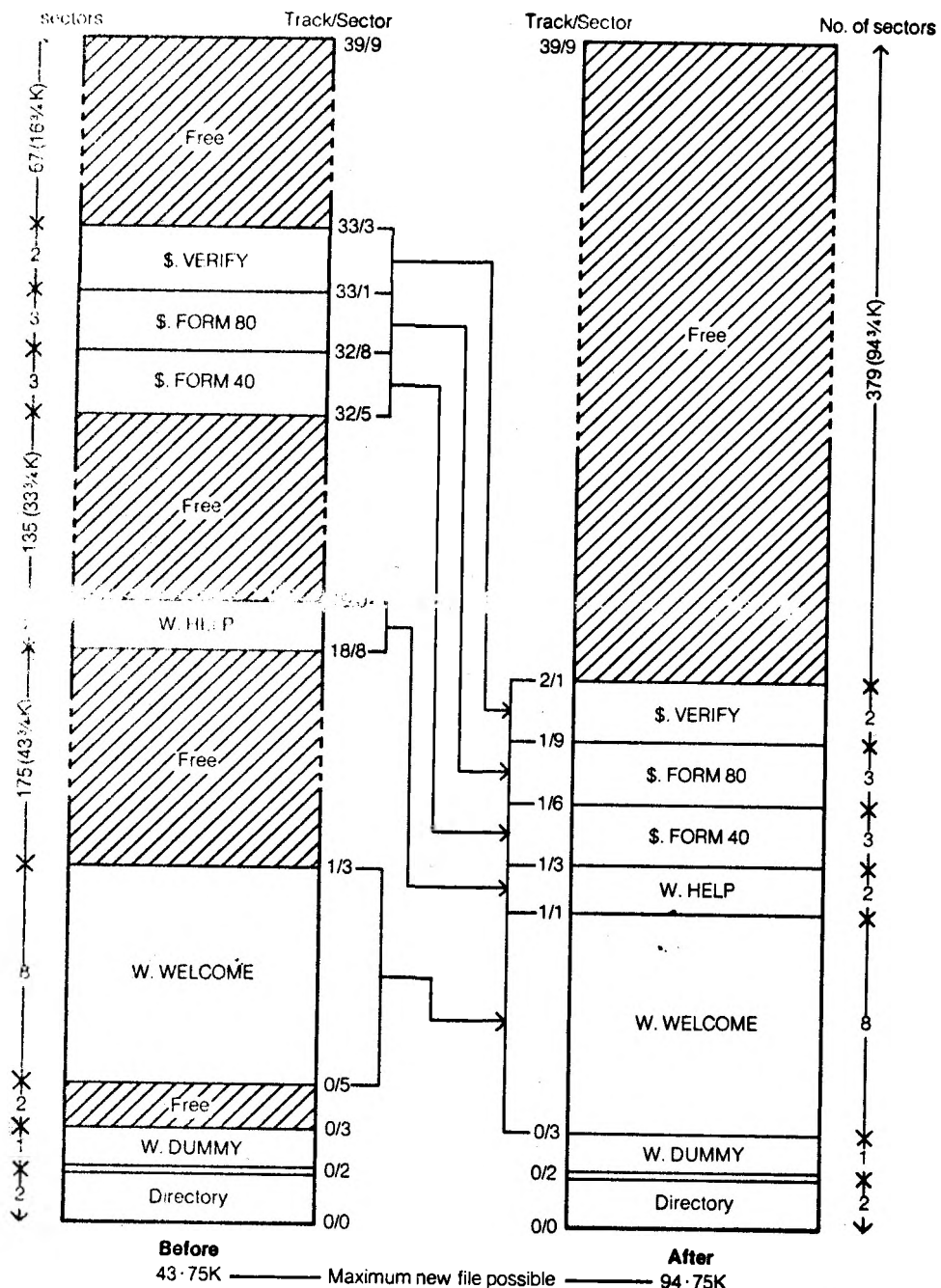
# \*Compact

Eventually a point is reached when a disc is full of programs and the computer responds with a message:-

DISC FULL

This does not necessarily mean that the disc is actually full as gaps may exist from where programs have been deleted. The disc full message merely implies that the gaps left are not of sufficient length to accept the program. \*COMPACT moves all the files to the start of the disc, leaving all the spare space as one continuous length at the end. During \* COMPACT information passes from disc to computer to disc and it is vital

that any program residing in the computer memory is saved onto another spare disc BEFORE Compaction takes place, or corruption of the program may result. To Compact a disc type in:-  
 \*COMPACT(Drive No)(return)  
 The Computer will list each program and its length and completes the compacting operation by printing the space remaining on the disc as a hex number.



# DFS Commands

Typing in \*HELP DFS lists the \* commands available in the Acorn DFS.  
Each command has a particular function:-

```
*HELP DFS                                fsp = file specification
DFS 0.90
ACCESS <afsp> (L)
BACKUP <src drv> <dest drv>             afsp = alternative file
COMPACT (<drv>)                          specification.
COPY <src drv> <dest drv> <afsp>
DELETE <fsp>                             dir = Directory
DESTROY <afsp>
DIR (<dir>)
DRIVE (<drv>)                            drv = Drive
ENABLE
INFO <afsp>
LIB (<dir>)                               src drv = Source Drive
RENAME <old fsp> <new fsp>
TITLE <title>
WIPE <afsp>                               dest drv = destination Drive
```

OS 1.20

- \*ACCESS - Used to lock & unlock files
- \*BACKUP - Used to copy Disc to Disc.
- \*COMPACT - For compacting discs to recover spare space.
- \*COPY - Copies files from one drive to another.
- \*DELETE - Deletes individual file.
- \*DESTROY - Deletes all disc files.
- \*DIR - Selects Disc Directory for default.
- \*DRIVE - Selects Disc Drive.
- \*ENABLE - Prefixes \*DESTROY & \*BACKUP
- \*INFO - Prints file address of individual program.
- \*LIB - Sets up machine code directory.
- \*RENAME - Renames file.
- \*TITLE - Titles Disc.
- \*WIPE - Deletes selected files.

# Copying Discs

It is sometimes necessary to make a backup copy of a whole disc for use in school. To copy a disc using a SINGLE disc drive type in:-

```
*ENABLE (return)
*BACKUP 00 (return)
```

The computer will respond by printing:-

Copying from Drive 0 to Drive 0

Insert Source disc and hit a key

Put the disc you want to copy in the drive and press any key on the computer.

The computer responds by printing:-

Insert destination disc and hit a key

Remove original disc from the drive and replace with a blank formatted disc.

Press any key on the computer.

The computer responds by printing:-

Insert source disc and hit a key

Swap discs and repeat the procedure until the prompt symbol (>) reappears.

This signals that the disc has been copied.

The printout below illustrates a typical disc copying routine.

```
>*ENABLE
>*BACKUP00
Copying from drive 0 to drive 0
Insert source disk and hit a key
Insert destination disk and hit a key
Insert source disk and hit a key
Insert destination disk and hit a key
Insert source disk and hit a key
Insert destination disk and hit a key
Insert source disk and hit a key
Insert destination disk and hit a key
Insert source disk and hit a key
Insert destination disk and hit a key
Insert source disk and hit a key
Insert destination disk and hit a key
>
```

If Dual drives are being used, place the source disc in drive 0 and the destination disc in drive 1 and type in:-

```
*ENABLE (return)
*BACKUP 01 (return)
```

and the discs will be copied automatically

# Disc Care

- 1 AVOID SMOKING WHEN WORKING WITH DISCS.
- 2 KEEP DISCS CLEAR OF ALL MAGNETIC FIELDS.
- 3 NEVER TOUCH THE SURFACE OF A DISC.
- 4 USE ONLY SOFT FELT TIPPED PENS WHEN YOU WRITE ON THE DISC CASE
- 5 REPLACE THE DISC IN ITS DUST JACKET WHEN NOT IN USE.
- 6 KEEP DISCS AWAY FROM SOURCES OF HEAT SUCH AS THE SUN, RADIATORS ETC.
- 7 KEEP DISCS & DRIVES AWAY FROM DUSTY ENVIRONMENTS.
- 8 NEVER INSERT A DISC UNTIL THE DRIVE HAS BEEN SWITCHED ON
- 9 NEVER SWITCH A DRIVE OFF UNTIL THE DISC HAS BEEN REMOVED.
- 10 NEVER BEND A DISC - THE MAGNETIC COATING MAY BE DAMAGED.
- 11 ALWAYS MAKE A BACKUP DISC OF IMPORTANT PROGRAMS.











