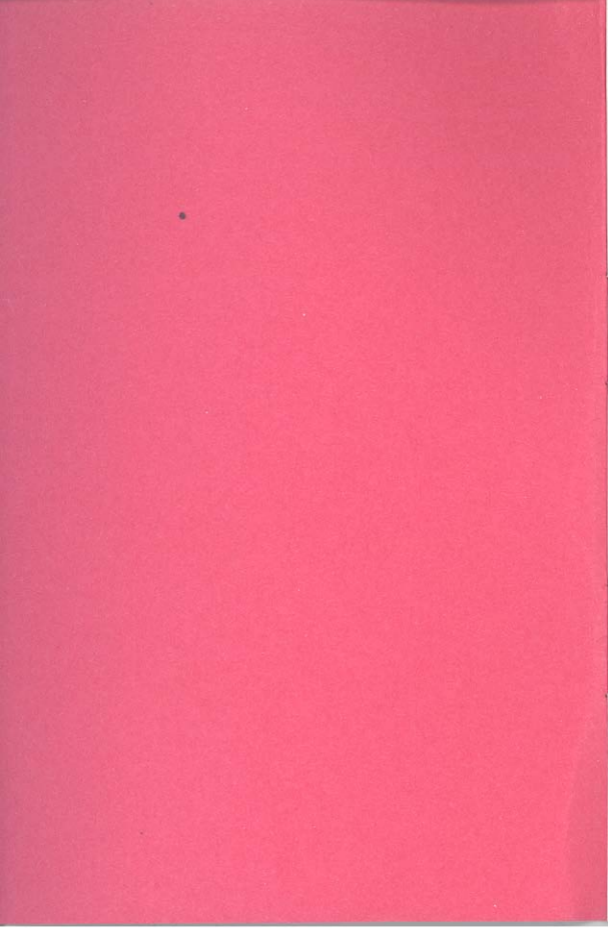# CARTRIDGE
DOCTOR

TALENT
COMPUTER SYSTEMS

FOREWORD

The CARTRIDGE DOCTOR is a utility for recovering information from damaged micro-drive cartridges. The program uses the techniques of Artificial Intelligence and incorporates a powerful rule-based expert system to make sensible decisions and automate much of the labour needed to recover lost data. In addition, the program provides an extensive set of tools for the informed user.

The CARTRIDGE DOCTOR is an invaluable part of any QL program library.

> Jon R. Malone
> TALENT COMPUTER SYSTEMS

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I should like to thank George Mulder for help with testing and quality control, and Andrew and Veronica Colin for assistance with the documentation.

The
CARTRIDGE DOCTOR

A TALENT PRODUCT

1. INTRODUCTION

The best advice we can give you about prising information out of bad cartridges is:

> **DON'T.** AVOID THE PROBLEM BY KEEPING TWO OR MORE COPIES OF ALL YOUR IMPORTANT FILES.

Of course everyone knows this rule perfectly well. But people still get caught, and we have designed the CARTRIDGE DOCTOR for use in an emergency, when the worst has suddenly and unexpectedly happened and the ominous message, 'bad or changed medium' appears on your screen.

The CARTRIDGE DOCTOR will recover most of the files from corrupt or unreadable microdrive cartridges. This will be done **automatically** in the large majority of cases.

NEVERTHELESS, WE STRONGLY RECOMMEND THAT YOU READ THE OPERATING INSTRUCTIONS BEFORE YOU BEGIN TO USE THE CARTRIDGE DOCTOR. YOU SHOULD ALSO TRY SOME OF THE EXPERIMENTS IN SECTION 11.

In most cases, you will only need to read to the end of Section 5. Sections 6 to 10 describe the powerful facilities you may sometimes need if your cartridge is very severely corrupted, and include technical details

for readers who are already familiar with the internal workings of the QL.

2. THE MICRODRIVE CARTRIDGE

A microdrive cartridge consists of a loop of magnetic tape about 4 metres long. The tape moves at 60 cm. per second, and always in the same direction; so that it can take up to seven seconds for any given part of the tape to reach the reading head in the QL.

Magnetic tape is a fragile medium, and the information recorded on it can easily be corrupted. The effects can be quite serious; for example a fault which would result in nothing but a quiet 'pop' on a music tape could well make a file, or even a whole cartridge, completely unreadable. The most common cause, by far is 'finger trouble', or clumsiness. Some reasons for errors are:

- Touching the tape with the fingers — this leaves a layer of grease which hides the information.

- Pressing the reset button with the cartridge mounted in the drive.

- Getting the cartridge wet or dirty.

- Putting the cartridge anywhere near a magnet or powerful electric machine, like a motor.

- Going through a security check at the airport (ask to be hand-searched!)

- Switching your machine off when it is in the middle of writing a file.

- Not loading the cartridge into the drive properly.

Other causes for failure are not directly your fault: they include

- Power cuts (they have the same effect as switching off).
- Wear on the tape: as the tape is used over and over again, the magnetic coating wears thin and eventually stops working.

A failure can show itself in two main ways.

* If you get the message 'bad or changed medium', it means that the information on the cartridge has been corrupted in some way. The cartridge can hold about a million binary digits or 'bits' of data. To get the error message, it is enough for only one of these bits to be corrupt.

* If the cartridge seems to spin indefinitely and the machine 'hangs' or appears to be stuck when you request a directory listing, it means that the computer cannot read even a directory from the cartridge. Perhaps the tape is broken, twisted or jammed so that it can't move; perhaps it has been wiped by a strong magnet. You could also be trying to read an unformatted cartridge or the drive itself might be faulty. It is worth trying the cartridge on the other drive, just to find out.

The CARTRIDGE DOCTOR will usually succeed in recovering data where BASIC or assembler programs fail. It does not rely on standard directory information and is therefore not affected by corruption in this area.

In really catastrophic cases of failure, where the tape is broken or completely demagnetised, not even the CARTRIDGE DOCTOR can help!

3. MAKING A BACKUP COPY

Before you start using the CARTRIDGE DOCTOR make a back-up copy. Use the following procedure:

- Switch on your QL
- Hit F1 or F2 (as may be appropriate)
- Place the program cartridge into drive **one**
- Place a blank microdrive cartridge into drive **two**. You do not need to use a blank cartridge, so long as you do not mind losing any information already recorded on it
- Give the BASIC command

  LRUN MDV1 __ BACKUP (ENTER)

This procedure will format the cartridge in drive two six times and copy across all the files from drive one. When the backup operation is complete, you will be given a message on the screen. You have now made a backup copy of the CARTRIDGE DOCTOR on to drive two: we suggest you label it without delay.

You can use the above procedure to make as many backup copies of the DOCTOR as you wish. As a security measure, to help prevent piracy, we have made it impossible for you to run a copy of the DOCTOR unless the original cartridge is present in drive two when the program is first started. This is achieved by recording a secret and uncopyable password on the cartridge we supply. The password is recorded many times over, so that even if the original cartridge is damaged it can still be used as a 'key' for the system, provided you have made a copy.

4. OVERVIEW OF OPTIONS

The CARTRIDGE DOCTOR consists of five independent but related utilities. Between them, they allow you to:

- Attempt to recover files from damaged or suspect cartridges — even files inaccessible to BASIC
- Recover newly deleted files
- List the files on a microdrive cartridge
- Patch sections of a file (in BASIC, QUILL etc.) which might otherwise be lost

The five utilities are

- A. AUTOCLONE
- B. PATCH FILES
- C. SALVAGE SECTIONS
- D. LIST DIRECTORY
- E. TRANSLITERATE

The utilities are now described briefly. Fuller descriptions, **including specific user documentation,** appear in later sections.

4.1 Option Selection

When the package is first loaded you can select any of the five utilities described above. The first question to appear is

AUTOCLONE?

If you simply hit ENTER, or even do nothing for several seconds, the DOCTOR will call the AUTOCLONE option automatically. If you want a different utility, answer 'N'. The machine will then display the names of the utilities, one by one, until you choose the one you want.

A. AUTOCLONE

This utility will:

* Do its best to recover files from damaged or suspect cartridges, including those which give the 'bad or changed medium' message or where the directory listing is inaccessible.

* Backup a cartridge. AUTOCLONE will automatically copy files from one drive to another.

* Recover newly deleted files.

In practical terms, AUTOCLONE copies all the files from one drive (called the source drive) on to another drive (called the destination drive). An option is provided to format the cartridge in the destination drive first.

AUTOCLONE will identify two kinds of file.

good — undamaged files or files which have just been deleted. Note that the DOCTOR can use more sophisticated and sensitive ways of reading cartridges than those available in BASIC. Many files which consistently give 'bad or changed medium' will still be correctly read and labelled as 'good' by the DOCTOR.

bad — files which — in spite of all attempts at recovery — still have one or more sections which cannot be read reliably.

When the DOCTOR finds a good file, it automatically copies it to the fresh cartridge. When it finds a bad file, it will attempt to copy it. Later, it gives you the chance to correct any corrupted sections by hand, using the FILE PATCH option. A file which is totally corrupt will not be copied.

The DOCTOR will give you a status report on any bad file it finds.

During the AUTOCLONE process, the DOCTOR may find files (or fragments of files) which have been deleted. You can intervene to stop copies being made.

User instructions for AUTOCLONE are given in Section 5.

B. FILE PATCH

The FILE PATCH option is automatically called on your behalf during AUTOCLONE whenever the DOCTOR encounters a bad file. It can also be called manually.

Patching is broadly similar to editing. You can patch any kind of file, text, BASIC, QUILL etc. provided you know the format.

Full user instructions on running the FILE PATCH option are given in Section 7.

Do not run this option manually on a suspect cartridge.

C. SALVAGE SECTIONS

Occasionally you may be unfortunate enough to lose complete sections of your file. This will occur if the corruption on the cartridge so bad that even the DOCTOR cannot sort it out. Another problem you may discover is that some sections of one file become embedded in another. In both these cases, the SALVAGE utility can be used. This option will allow you to pick up sections from one file and write them into a new file.

Full details of this option are specified in Section 8.

Do not run this option on a suspect cartridge.

D. LIST DIRECTORY

The DIRECTORY option allows you to list the directory of a cartridge.

Details are given in Section 9.

Do not run this option on a suspect cartridge.

E. TRANSLITERATE

Transliteration involves copying a file, while replacing every occurrence of a given character by some other character. This process is often useful in preparing files to be imported by QUILL and other standard utilities.

Do not run this option on a suspect cartridge.

5. GENERAL OPERATING INSTRUCTIONS

Once you have made a backup copy, the way to start the program is:

- ● Switch on your QL
- ● Load the backup copy of the DOCTOR into drive **one**
- ● Load the original copy of the DOCTOR into drive **two**
- ● Press F1 or F2

The DOCTOR will load itself and do the security check. If the check fails, the computer will soon stop responding to commands. If this happens, and you have no reason to suspect that the microdrives are not working correctly, it could be that your original cartridge has become corrupt. Should this happen, send it back to TALENT and we will replace it by return of post.

When the DOCTOR has loaded itself successfully, it will display three windows.

The top window is normally used to tell you what the DOCTOR is doing. Sometimes the window is used to display questions which you are invited to answer.

The middle window displays detailed information such as a directory. The bottom window may hold messages, or a special bar-graph showing how far you have moved through any file. See Section 13 for a more detailed description of the graph.

When these windows appear, take both the original and the backup cartridges out of the QL and put them away.

5.1. Auto-answering

Some of the utilities in the DOCTOR use 'auto-answering' to communicate with you. When a question is displayed on the screen, there will usually be a suggested answer as well. If the answer is satisfactory, (as it generally will be) you just have to hit the ENTER key. Furthermore, if you do absolutely nothing for about 10 seconds, the answer will also be accepted by default! It follows that if you don't wish to accept a suggested answer, you must give a different reply within 10 seconds.

Naturally, auto-answering only applies to 'safe' questions; potentially dangerous operations, such as the reformatting of cartridges, can only take place with your express permission. When the machine does require a specific response from you it will give a soft regular beep and wait until you have typed in your instructions.

5.2. Option Selection

At this point, you can select any of the five utilities described in Section 4. The first question to appear is

AUTOCLONE?

If you simply hit ENTER, or even do nothing for several seconds, the DOCTOR will call the AUTOCLONE option automatically. If you want a different utility, answer 'N'. The machine will then display the names of the utilities, one by one, until you choose the one you want.

NOTE: if you select an option by accident, or if an option is selected by auto-answer, just press ESCape to come out of the option.

The rest of Section 5 assumes that the DOCTOR is in the AUTOCLONE mode.

5.3. Drive Selection

The AUTOCLONE option works by reading files from a 'source' cartridge (which may be suspect or corrupt) and copying them on to a 'destination' cartridge. To start, you must tell the program which drives you are using for the source and destination cartridges. Answer the DOCTOR'S questions by typing 1, 2, 3, or 4 as may be appropriate.

It is vital to get the answers to these questions right. If — for example — you get the source and destination drives confused, you might easily destroy all the files on the source cartridge and be unable to recover anything at all. Take care! To make doubly sure, remove the write permit tab from your source cartridge.

By way of further help, the DOCTOR will ask you to confirm your answer before going on.

When you have selected and confirmed the drive numbers, load the cartridge which you want to copy into the source drive.

5.4 Formatting the Destination Cartridge

To do its job the DOCTOR needs a blank formatted cartridge in the destination drive. When it knows the destination drive number, it asks you for permission to format a cartridge. If you already have a newly formatted cartridge which contains NO FILES, load it into the destination drive and type 'N'. It will then list the directory automatically to verify that it is indeed blank. Otherwise load a cartridge which can be formatted and answer 'Y'.

The destination cartridge does not need to be new, as long as you don't mind losing all the information it may already contain.

Formatting takes about 40 seconds. When it is complete you will receive a report like

    TOT = 200/FREE = 190
    Format satisfactory?

This means that the tape is long enough for 200 blocks, and 190 of them are useable (that is, 10 are 'bad blocks' or otherwise allocated). A block is a unit of memory, somewhat like a page in a notebook. In most cases you don't need to know anything about blocks; but if you are interested you will find the technical details in Section 6.

If a cartridge is brand-new, it pays to format it several times over. New tape stretches slightly, and as you repeat the process you will see the number of blocks creep up to a stable value after five or six runs. Tapes which have been fully stretched this way are more reliable.

If your tape fails to format at all, there could be three possible reasons:

- The cartridge is write-protected
- The drive is faulty
- There is no cartridge in the drive, or the cartridge has not been loaded properly

In general, you should only answer 'Y' to the question "Formatting satisfactory" if you want the DOCTOR to go on to the next stage. If you plan to format again, say 'N'.

If the TOTAL number of blocks is less than 190, or the number of FREE blocks is any less than 95% of the total, you are probably trying to format a worn or damaged cartridge. Alternatively, the drive itself may be defective. Try formatting a cartridge which you know to be new.

5.5. Initial Health Screening

When the destination cartridge has been formatted, the DOCTOR enters the next stage of the AUTOCLONE option automatically. First it runs through the source cartridge and gives a general report on its state of health. The initial check is indicated by the message 'checking headers' and possibly other messages. You don't need to do anything during this stage, which may take as long as 2 minutes — longer if the cartridge is badly corrupted. Please be patient.

5.6. File Recovery

The next stage consists of transferring the files, one by one, from the source to the destination cartridge.

The DOCTOR displays the name of each file as it finds it on the source cartridge. Each file name is accompanied by a brief report:

'good' means that the file can be recovered automatically without error.

'Suspect blocks' means that some of the sections are corrupt and cannot be recovered with a guarantee of correctness; but in most cases you will be able to repair the file with the FILE PATCH utility.

'Header block missing' means that the damage is more severe: part of the file has been lost. Recovery can still be attempted. (See Section 7.1)

For each good file, a prompt appears. If you type 'Y' or do nothing, the file is automatically transferred to the destination cartridge. In most cases, the file recovery will have been done automatically.

The names of all 'bad' files (if any) are remembered by ths system. When all the good files have been copied, you are invited to inspect the bad files or correct them with the FILE PATCH utility described in Section 7.

If the DOCTOR finds no bad files, your data will have been recovered. You will find readable copies of all your files on the destination cartridge, and you need go no further.

6. TECHNICAL DETAILS OF THE MICRODRIVE

The processes described in Sections 1 to 5 are sufficient to help the large majority of QL users suffering from cartridge problems. Sections 6 to 10 are meant for anyone who wants to use the DOCTOR'S generalised cartridge handling tools, or for the user whose files are so badly corrupted that the DOCTOR cannot cure them

without human intervention. In both cases, some additional background information is needed.

Section 6 is a technical description of the Microdrive cartridge, which you can skip if you are already familiar with the subject.

6.1 Blocks

The Sinclair QL arranges information on a microdrive cartridge in a complex, structured way.

In normal use, the tape is divided into units called 'blocks'. The blocks are numbered from 1 up to about 200, and each block can hold 512 characters or 'bytes'. Every block also contains a 'checksum', which is a number obtained by adding up the ASCII values of all the characters. The checksum is calculated whenever a block is recorded, and is written on to the tape at the same time. When, later, the block is read back from the tape, a new checksum is calculated from the 512 characters and compared against the old checksum read from the tape. The two checksums should, of course, be exactly the same. If they are different, this is a clear indication that an error has occurred.

From the user's point of view, the cartridge holds a number of 'files'. A file might, for example, be a program, or a piece of text written with QUILL, or some data which was entered with ARCHIVE. Each file uses one or more complete blocks, depending on its length. A block is never shared between two or more files, no matter how short they may be.

A DIRECTORY contains the name of every other file on the cartridge.

As well as a directory, the cartridge has a 'space list' —
this indicates which blocks belong to which files and
those which are not part of any file. Whenever a new file
is being recorded, the operating system can use the
blocks taken from this list. Similarly, when an existing
file is deleted, the numbers of the blocks it used are
returned to the space list where they are available for
the next file to be written.

The space list masquerades as file number 80 or, due to
a bug in QDOS, as file number F8. See Section 7.1 to
find out how to read this file.

6.2. Formatting

When a cartridge is delivered from the factory, the tape
is completely blank. Before it can be used, it has to be
formatted. This process is a bit like painting the white
lines on a new motorway and putting up the signs before
letting the traffic loose. Special markers are recorded to
show the beginning and end of each block, an 'empty'
directory is set up, and a space list which normally
shows every block as 'free' except the ones used for the
directory and — of course — for the space list itself.

The formatting process also does one other vital job — it
tests each block by filling it with bytes and reading them
back to see if there are any errors. If the tape has a minor
defect — for example, a bit of dirt stuck to the surface —
then the block which contains the defect will fail. This
doesn't mean that the tape need be discarded: all that
happens is that the particular block in question is noted
as 'bad' in the free space list, and is never allocated to a
file. So a tape which has a few defects when it is
formatted can still be used to store files.

6.3. Summary

To summarise: each cartridge is divided into a number of 'blocks', each containing 512 bytes of information. Each file on the cartridge uses one or more blocks. There is a directory which gives the name of each file, its file number and its size. A 'space list' keeps a record of block numbers allocated to a file and those still available for new files. Some of the blocks may have been found faulty during formatting, and are marked as 'bad blocks'.

If part of the tape has been very badly corrupted, one or more blocks may be completely unreadable. This condition is known as 'scrambled sector headers'. The file concerned will be irreparably damaged, although some of it may be salvaged. Other files on the drive will still be accessible.

If the corruption is less serious, the machine will find incorrect checksums in one or more of the blocks it reads. The check will fail if even one character in the block is wrong. The exact effect will depend on whether the corruption is in an ordinary file block, or in the organisational blocks such as the directory or space list.

If one block in a file is corrupt, the operating system may refuse to read any of the files on the cartridge and will display the message

BAD OR CHANGED MEDIUM

7. THE FILE PATCH UTILITY

There are many possible reasons for running the FILE PATCH utility. For example:

- A data block may have been incurably corrupted by a faulty cartridge or by a runaway program.
- An entire section of a file may have been lost or damaged.
- You may wish to modify a part of a file in a way which would be difficult or impossible through the normal methods. For example, you could translate the prompts in a binary program — perhaps from English to Serbo-Croat — without reassembly. Of course you will have left plenty of blank spaces after each prompt so that the translations still fit.

The FILE PATCH utility gives you access to a file on a block by block basis. This means that you can browse through the file, locate the character or characters which are wrong and correct them.

The File Patch screen which appears in the middle window has two sections:

```
┌─────────────────┐
│   Status Line   │
├─────────────────┤
│                 │
│   DATA BLOCK    │
│                 │
└─────────────────┘
```
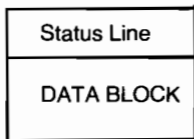
The status line looks like this:

CH: 0 x 5a   Block: 0 x 10   READ O.K.

Hex code of current character

Block number

Read status
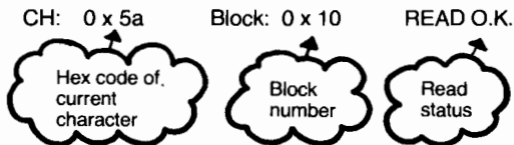
'CH' is followed by the hexadecimal code of the selected character in the data block. Here and elsewhere, a hex quantity is preceded by the marker 'Ox'. A useful table for conversions etc. can be found in Appendix 2.

'Block' is followed by the hexadecimal number of the block you are patching.

READ STATUS is either 'READ BAD' or 'READ O.K.' In general, this indicates whether or not the data block was read correctly. However, it is important to note that the last block of the file may be reported as having a 'bad' status. This indicates that the end of the file has been reached. It does not necessarily mean that the block is in error.

This feature is, of course, an anomaly in the behaviour of the DOCTOR. The reason is that the DOCTOR does not use any information from the high-level directory (which may be corrupt) but reconstructs all the files from local information. The actual length of any file in blocks is kept in the high-level directory, and at the local level there is no way to distinguish 'bad' from 'last' blocks.

Characters which occur after the end of the file are indicated by ? These cannot be patched.

The data block is an array of 32 x 16 characters. These are the 512 characters in the data block being patched. A flashing cursor points to the character currently selected.

The top and bottom windows are also used by the FILE PATCH utility. Various messages appear in the top window and a bar graph is built up in the bottom window. This graph is described in Section 13.

When in FILE PATCH mode, you can use the cursor keys to move about the block. Characters which are readable (the letters, numbers, mathematical symbols etc.) will be shown. Every other character appears as a shaded square. If you are unsure about the code of any character you can always position the flashing cursor over it and refer to the status line.

You can change a character in a block by moving the cursor over the character to be changed and then either

- Typing the character — if it can be typed using the alpha-numeric or maths symbols

- Typing ESCape followed by the two digit hexadecimal code of the character (See Appendix 2)

Special sequences to the FILE PATCH utility all start with the ESCape key.

Options are:

ESC H Call the Help option to explain the ESC sequences. The Help menu will automatically return to the FILE PATCH mode within 20 seconds. Hit any key if you want to return sooner.

ESC QQ Quit patching the current file. The current block is not written out automatically.

ESC + Move on to the next block in the current file.

ESC − Move back to the previous block in the current file.

ESC S Stop patching the current file. The current block is written out.

ESC W Write out the current block.

ESC R Re-read the current block. This option is useful if you make a mistake in patching a block and wish to start patching it again.

ESC Gnn nn is a hexadecimal number. This will 'GOTO' block nn of the file. If nn is greater than the number of blocks in the file, the last block in the file is fetched.

ESC N Skip to next bad block. This option is only used when 'Block Patch' is called by AUTOCLONE. Each ESCape N will cause the program to move on to the next bad block in the file.

7.1. A Note for specialists

Each QL file has a 64 byte header. This is invisible to most users. If you know about headers, you can examine or patch the first 14 bytes of a header using the FILE PATCH option.

Start patching the file, then press ESCape I. You will be given the header of the file. When you exit from this mode (using ESC + or ESC S) the header will be updated. Take care patching headers. We never do it at TALENT.

If the first block of a file is lost, it may be impossible for the DOCTOR to recover the file. In particular, the name

of the file may not be known. In such a case, the DOCTOR will generate a file name automatically. This name will be in the form MDVX __ YY, where YY is the internal number of the file expressed in hexadecimal. Each missing block will be filled with the '?' character. You are then given the opportunity of patching this file.

From time to time you may want to incorporate blocks from one file into another. We recommend that you use the SALVAGE SECTION utility to do so — it is much safer. However, there is a mechanism provided in the FILE PATCH utility which will let you read and write blocks directly to and from a cartridge.

Give the command

    ESC J ff bb

    where

ff is the hexadecimal number of the file
bb is the hexadecimal number of the block

The specified file number and block number will be read from the source drive (default drive 1) into the current file. When you have finished patching, the block is written to the new file. You should not use this option if you are patching a file on the source drive.

The ESC J command gives you enormous flexibility, since you can extract blocks from any file and construct new files with them.

8. SALVAGE SECTIONS

This option allows you to make a new file which contains just a selected section of an existing one. If your cartridge is so severely garbled that the DOCTOR is unable to reassemble all the blocks in the right way, it will make a special file in which all the odd blocks will be strung together at random. The SALVAGE SECTIONS option will allow you to extract meaningful blocks from such a file, one by one, and put them into separate files so they can eventually be merged together.

In response to the screen prompt, give the name of the file from which you want to copy data (the source file) and the name of the file to which you want to write the data. The source file should exist but the destination file should be a new one, specially created for this purpose.

Next, type in the number of bytes which you want the utility to skip before starting to read data to the destination file. Finally give the number of bytes to copy. If this number is zero then the entire file (after skipping) is copied.

9. LIST DIRECTORY

When the prompt appears, just type in the name of the drive. The directory of the cartridge in that drive will be displayed on the screen. All the file names are given, together with their file numbers in hexadecimal. If the directory contains more than 15 files, the first 15 will be displayed and the message 'more' will appear in the top window. Hit any key to obtain the next screenful.

10. TRANSLITERATE

Here again you must specify the source and destination drives, together with the codes for two characters.

Each character code is entered as two characters in hexadecimal (see Appendix 2). The option copies the source file to the destination file, substituting the second character for every occurrence of the first. No other characters are changed.

11. PRACTICAL EXPERIMENTS

Recovering data from a damaged cartridge can be a difficult process, even with the help of the DOCTOR. In many cases, chunks of your files may have been completely and irretrievably lost. When this happens, you need a lot of courage and a fair amount of inspired (and informed) guesswork!

You can take some of the panic out of the operation if you have already had experience in 'dummy' situations — like an airline pilot in a flight simulator.

You can gain this experience by running the DOCTOR on a number of non-critical test cases, using old or deliberately corrupted cartridges. In this way you will understand the DOCTOR'S various utilities far better.

We suggest that you try the following simple experiments.

EXPERIMENT 1 — Recovery of deleted files

A. ● Take a blank microdrive cartridge, format it and create a few files on it
   ● Delete one or two of these files
   ● Run the DOCTOR in AUTOCLONE and confirm that it successfully recovers your deleted files

B. ● Take a blank cartridge and format it
   ● Create three files on it
   ● Delete the first of these files
   ● Save a few more files on to the cartridge

● Run the DOCTOR in AUTOCLONE mode and see if it recovers your deleted file. If it does, you are lucky! In the majority of cases this experiment will not succeed, because the operating system will have re-allocated the space to the new files.

This demonstrates the importance of taking a cartridge with a deleted file to the DOCTOR as soon as possible.

EXPERIMENT 2 — Block patching

In order to give you some practice in patching, we have included a damaged BASIC program on the DOCTOR cartridge. The file is called BAD1 and has a corrupt line number. The line should read

    100 REM Version Control V1. 1a

It has been deliberately changed to read

    XYZ REM Version Control V1. 1a

First, try to load the BASIC program using

    LRUN MDV1__BAD1

This will fail.

● Now load the DOCTOR and format a blank cartridge.

● Use the SALVAGE SECTIONS utility to make a copy of the file BAD1 to the destination cartridge.

● Now use the FILE PATCH option to correct the deliberate error.

● Try to load and run the program again. If you have been successful, it will tell you so!

EXPERIMENT 3 — Recovering Sections of a file

We have included a file, BADQ, on the DOCTOR cartridge. This is a file in QUILL format which has been deliberately damaged. The damage could be similar to the kind inflicted if the control section of the QUILL file is corrupt.

Demonstrate the fact that the file is damaged by trying to load it into QUILL (use F3 L MDV2—BADQ). You will get the message

    Not a valid QUILL file

and QUILL will refuse to accept it

Next, try to import the file into QUILL (Use F3 O F I MDV2_BADQ). The operation will apparently proceed correctly but will not present you with any text. You have lost the information contained in the file BADQ.

The following sequence can be used when trying to recover such files. Note that even though the recovery may be successful, you will lose most of the formatting information. If the file is short it may be quicker just to retype it.

The steps are:

- Use the TRANSLITERATE option to copy the file BADQ to the new file, GOODQ_DOC, replacing all the characters with code 0x00 by characters with code 0x0a — type in only 2 hexadecimal digits. (See the Import section in the QUILL documentation.)

- Use QUILL's import option to recover the file (F3 0 F I MDV2_GOODQ_DOC).

  The file will have a few strange lines at the beginning and a number of strange lines at the end.

Use the Erase facility in QUILL to delete these lines. The resulting document will contain all your text but will have a very long line length — (about 160 characters). This is because the formatting information has been lost. Use the Margin option in QUILL to reset the right hand margin to a more sensible value.

You have now recovered the main body of your text and can insert suitable format commands. You may like to prove your success by correcting the spelling mistakes in the text and saving the file.

12. ACCIDENTAL DELETION OF A FILE

If you delete a file by accident and realise this fact while the cartridge is still spinning, **do not take any action.** Your first instinct will be to whip the cartridge out of the drive or turn the machine off, but this will only make things worse. Wait until the deletion is complete, and then make sure that you do not write any information to the cartridge.

Load up the DOCTOR and AUTOCLONE the cartridge. If you have followed these instructions and there is no corruption on your cartridge, you will recover your deleted file.

13. THE BAR GRAPH DISPLAY

A bar graph display appears in the bottom window during the auto-salvage phase of AUTOCLONE and during FILE PATCH mode.

Figure 1

```
┌─────────────────────────────────┐
│                                 │
└─────────────────────────────────┘
 0 ↑      28      50      78     A0      C8
 Block map:   WHITE – OK;  RED – BAD
```

The top line represents the blocks in the file being processed. Each good block is shown as a white vertical bar. Thus a continuous white horizontal line indicates a good file. Any bad, suspect or unreadable blocks will be indicated by a red vertical stripe. If the display contains a lot of red, the file is in poor health!

The second bar graph shows how far the system has got with processing the file. In auto-salvage mode, this graph will slowly creep up until it matches the top display.

If black sections appear in this second bar graph it implies that one or more blocks of a file have 'gone bad' during the copy operation. You should re-attempt an autoclone to a fresh cartridge. The blocks on the current destination drive may be all you ever recover of your file so do not reformat it.

The indicator arrow on the third line is used in FILE PATCH mode only. It points to the block you are currently examining. Try using ESC G00 and ESC GFF in FILE PATCH mode to move the arrow from one end of the graph to the other.

The fourth line gives the approximate indication of the block numbers in the file. These numbers are given in hexadecimal. The table in Appendix 2 will enable you to convert between decimal and hexadecimal, should you need to do so.

Figure 1 shows block 10 of a 50-block file being patched.

APPENDIX 1

The following reports will be generated by the DOCTOR for information purposes only: no action is required.

CAN'T STAT DIRECTORY	The directory cannot be found
BLOCK SUSPECT	One block is suspect
FAILED	The file which was being autocloned has not been copied correctly. Is the destination cartridge write-protected?
HEADER BLOCK MISSING: FILE LOST	See Section 7.1
NOT FOUND	The Sector map cannot be found
SET HEADER ERROR SET HEADER OK	Results of trying to update the header using ESC I
SUSPECT BLOCKS	More than one block is suspect
WARNING: can't read directory block.	Part of the directory is corrupt

LIST OF PROMPTS IN ALPHABETICAL ORDER

The notation [PQR] means that you can respond to the question with either P or Q or R.

Auto Clone? [YN]

Type Y to enter the AUTOCLONE utility in which files are salvaged from one drive to another.

Auto Recovery? [YN]

This is presented for each good file found in AUTOCLONE mode. Type Y to salvage the file from the source drive to the destination drive.

Block changed; write it out? [YN]

This prompt can appear from the FILE PATCH utility. It is warning you that the block you are working on has been changed, but that you are trying to leave the option without writing the block out.

Bytes to process (0 means all)?

This prompt is used in the SALVAGE SECTIONS utility. Enter the number of bytes you want the utility to work on. The number zero (0) will cause the entire file to be processed.

Bytes to skip on input?

This prompt is used in the SALVAGE SECTIONS utility. Enter the number of bytes you want the utility to skip before it has to start processing the file. Reply zero (0) if you want to process the entire file.

Char to replace (hex)?

Part of the TRANSLITERATE utility. Enter the hex number corresponding to the character you wish to search for in the file.

Char to replace it (hex)?

This prompt appears as part of the TRANSLITERATE utility. Enter the number of the character you wish to write into the new file.

Can't stat directory

If you try to AUTOCLONE to a drive which you do not format, the DOCTOR will attempt to list the directory on that drive. Should the drive be faulty in any way—

● The system will hang

or

● This message will appear

This operation is carried out at the start of the AUTOCLONE operation to avoid failure while it is in progress. Hit the space bar to acknowledge.

Destination Drive? [1234]

Type in the number of the drive containing the cartridge which will receive the salvaged files.

Destination file?

This prompt is used in the SALVAGE SECTIONS and in the TRANSLITERATE utilities. Enter the name of the output file. The name SCR__ can be used. This will cause the output to appear on the screen. It can be useful to check that an operation has had the effect you want before committing it to a file.

Directory of device?

This prompt asks for the name of the drive for which you want a directory listing. Your answer will usually be MDV1__ or MDV2__Press ESCape if you want to abort this option.

File to Patch?

This takes you into the FILE PATCH mode. Type in the name of the file you want to repair. Press ESCape if you want to abort this option.

Format failed. Retry? [YN]

For some reason a format operation has failed. Type Y to try the operation again. Continued failure to format would suggest a missing write tab or a damaged tape.

Help: Write Error Acknowledge? [Y]

A fatal fault has occurred while writing a file to the destination cartridge. You should acknowledge the error by typing Y. Write errors should not occur; if one does happen, the file which was being processed will be lost. Possible causes for a write error;

- The destination cartridge is full and has no space for any more files. Use a freshly formatted cartridge. If the error persists, use the DOCTOR to save the first few files on to one cartridge, then swap to another fresh cartridge.

- The destination cartridge is write protected. Check that the tab is present on the right hand side of the cartridge.

- The cartridge is old and worn. Although it is reformatted frequently, it continually gives write errors. Discard the cartridge. However, we have found that microdrive cartridges will stand up to at least six months of fairly heavy use.

Input file would not open; Aborted. Ack? [Y]

This message can appear from the SALVAGE SECTIONS and TRANSLITERATE utilities if the input file to the utility will not open. Have you remembered to type the full file name (including the drive name)? Type Y to acknowledge.

List Directory? [YN]

Type Y if you want to call this option. You will then be asked for the name of the drive — MDV1__ or MDV2__.

OK to Reformat Drive 'X'? [YN]

The DOCTOR wants to reformat drive 'X'. Type Y to continue. You will destroy any information on the cartridge in drive 'X'.

Output file would not open; Aborted. Ack? [Y]

This message can appear from the SALVAGE SECTIONS and TRANSLITERATE utilities if the output file cannot be created. Have you remembered to enter the full file name (including the drive name)? Type Y to acknowledge.

Patch Files? [YN]

Type Y to enter the FILE PATCH utility.

Salvage Sections? [YN]

Type Y to enter the SALVAGE SECTIONS utility.

Seek failed on input file; Aborted. Ack? [Y]

This message can appear from the SALVAGE SECTIONS and TRANSLITERATE utilities. It occurs if the system is unable to skip over the number of bytes which you specified. It can occur if the number of bytes specified is larger than the number of bytes in the file.

Source can't be destination

This message appears if you try to select the same drive for both source and destination. Hit space to acknowledge and then reselect the correct drives.

Source Drive? [1234]

Type the number of the drive containing the cartridge to be salvaged. Press ESCape if you want to abort this option.

Source file?

This prompt is used in the SALVAGE SECTIONS and TRANSLITERATE utilities. Enter the name of the file to be processed. Press ESCape if you want to abort this option.

TOT = X/FREE = Y
Format satisfactory? [YN]

A drive has been formatted. If there are sufficient good blocks you can type Y. If not, type N and the system will format the drive again.

Transliterate? [YN]

Type Y to enter the Character Exchange utility.

*   *   *

Character			DEC	HEX	Char	DEC	HEX
(CTRL)	@	NUL	000	00	SP	032	20
(CTRL)	a	SOH	001	01	!	033	21
(CTRL)	b	STX	002	02	"	034	22
(CTRL)	c	ETX	003	03	#	035	23
(CTRL)	d	EOT	004	04	$	036	24
(CTRL)	e	ENQ	005	05	%	037	25
(CTRL)	f	ACK	006	06	&	038	26
(CTRL)	g	BEL	007	07	'	039	27
(CTRL)	h	BS	008	08	(	040	28
(CTRL)	i	HT	009	09	)	041	29
(CTRL)	j	LF	010	0A	*	042	2A
(CTRL)	k	VT	011	0B	+	043	2B
(CTRL)	l	FF	012	0C	,	044	2C
(CTRL)	m	CR	013	0D	—	045	2D
(CTRL)	n	SO	014	0E	.	046	2E
(CTRL)	o	SI	015	0F	/	047	2F
(CTRL)	p	DLE	016	10	0	048	30
(CTRL)	q	DC1	017	11	1	049	31
(CTRL)	r	DC2	018	12	2	050	32
(CTRL)	s	DC3	019	13	3	051	33
(CTRL)	t	DC4	020	14	4	052	34
(CTRL)	u	NAK	021	15	5	053	35
(CTRL)	v	SYN	022	16	6	054	36
(CTRL)	w	ETB	023	17	7	055	37
(CTRL)	x	CAN	024	18	8	056	38
(CTRL)	y	EM	025	19	9	057	39
(CTRL)	z	SUB	026	1A	:	058	3A
(CTRL)	[	ESC	027	1B	;	059	3B
(CTRL)	/	FS	028	1C	<	060	3C
(CTRL)	]	GS	029	1D	=	061	3D
(CTRL)	^	RS	030	1E	>	062	3E
(CTRL)	—	US	031	1F	?	063	3F

✻ (ctrl) $\frac{y}{2}$ NUL oo oo

Char	DEC	HEX	Char	DEC	HEX
@	064	40	£	096	60
A	065	41	a	097	61
B	066	42	b	098	62
C	067	43	c	099	63
D	068	44	d	100	64
E	069	45	e	101	65
F	070	46	f	102	66
G	071	47	g	103	67
H	072	48	h	104	68
I	073	49	i	105	69
J	074	4A	j	106	6A
K	075	4B	k	107	6B
L	076	4C	l	108	6C
M	077	4D	m	109	6D
N	078	4E	n	110	6E
O	079	4F	o	111	6F
P	080	50	p	112	70
Q	081	51	q	113	71
R	082	52	r	114	72
S	083	53	s	115	73
T	084	54	t	116	74
U	085	55	u	117	75
V	086	56	v	118	76
W	087	57	w	119	77
X	088	58	x	120	78
Y	089	59	y	121	79
Z	090	5A	z	122	7A
[	091	5B	(	123	7B
/	092	5C	|	124	7C
]	093	5D	)	125	7D
⌃	094	5E	~	126	7E
_	095	5F	DEL	127	7F

Abbreviation for control key functions:

NUL — Null	DC1 — Device control 1
SOH — Start of header	DC2 — Device control 2
STX — Start of text	DC3 — Device Control 3
ETX — End of text	DC4 — Device control 4
EOT — End of transmission	NAK — Negative acknowledge
ENQ — Enquiry	SYN — Synchronous idle
ACK — Acknowledge	ETB — End of transmission blo·
BEL — Bell	CAN — Cancel
BS — Backspace	EM — End of medium
HT — Horizontal tab	SUB — Substitute
LF — Line feed	ESC — Escape
VT — Vertical tab	FS — File separator
FF — Form Feed	GS — Group separator
CR — Carriage return	RS — Record separator
SO — Shift out	US — Unit separator
SI — Shift in	SP — Space
DLE — Data link escape	DEL — Delete

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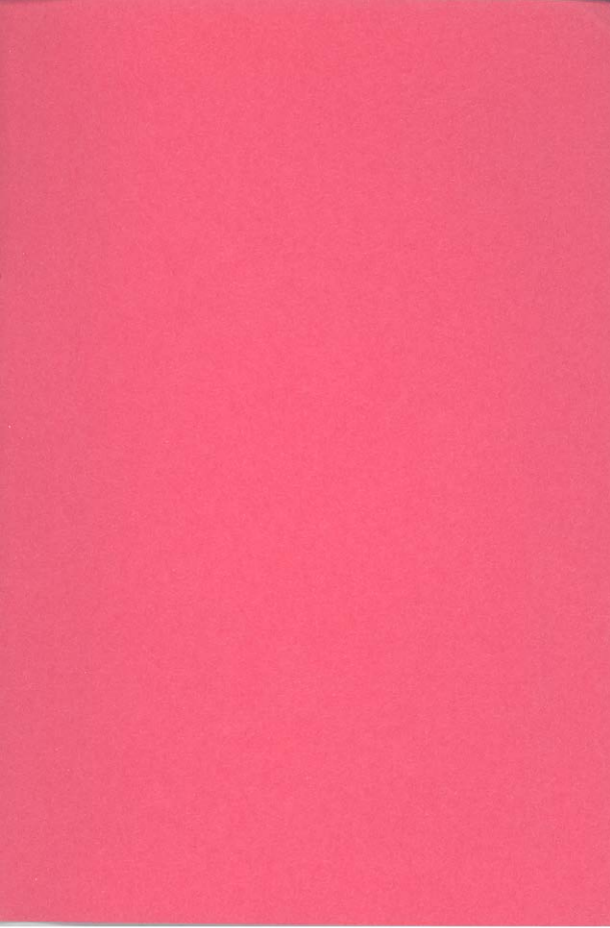Name ....

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