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User Note 73

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Title:

Data Backup for Microcomputer Users

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Synopsis

This Note contains hints and ideas on precautions which will reduce the risk of losing data, with schedules for backup of different microcomputers.

Keywords

Backup, data safety

These notes are for guidance only; they contain hints and ideas on precautions which will reduce the risk of losing data. Neither ERCC nor the authors of this Note can be held responsible for data loss even if these notes are followed.

General Points

1. Keep a backup copy of important data away from the machine and separate from your day to day working discs - for example keep a copy at home, or send a copy to the ERCC filestore or a mainframe. Try to ensure that there is always one copy of the data in a separate location, in case of fire.
   Any sensitive personal data should, however, be stored in accordance with the requirements of the Data Protection Act.

2. *NEVER* turn the computer off while a disc is being accessed; never remove a disc from the drive during access (a red light is usually lit during disc access). Turning the computer on or off with a disc in the drive is less dangerous but can corrupt the disc especially if the drive door is shut.

3. Keep discs away from magnets (for example electromagnets in monitors or VDUs), tea, coffee, orange juice etc., temperature extremes (below 10°C or above 50°C), dust, cigarette smoke, radiation sources, telephones. Colour monitors, VDUs and television sets are particularly destructive to discs when being switched on or off.

4. If anything does get spilt onto a disc *DO NOT* put that disc in the disc drive as this may damage the drive as well as the disc, but *DO* throw the disc away. If corruption occurs due to physical damage of the disc (for example by dust landing on it), this too could damage the drive heads. When discs give read or write errors, it may be cheaper in the long run to adopt a policy of throwing such discs away rather than trying to reformat and re-use them.

5. If you find you are suddenly unable to read several discs, your disc drive may have gone out of alignment. The discs which were formatted or written to with the misaligned drive will probably not be readable by the repaired drive, so any data on them could be lost.
   You can try to save the disc contents as follows (consult the ERCC Advisory service if you are in doubt). Before getting the faulty drive re-aligned try to read the data from these discs using the misaligned drive, and if this does not work try as many drives as possible, on the chance of finding one that will read your discs. Copy all you can to ERCC filestore or mainframes, or to a good drive containing a newly formatted disc. The discs that you formatted or wrote to before the drives lost alignment should be readable by other drives or by the repaired drive.

6. The frequency of backup should reflect the value of the data, the effort required to reinstate data if it is lost, the use of the machine and the reliability record of the machine. Where several people use a machine, they should each be encouraged to take copies of their own work rather than relying totally on whoever is responsible for backup.

7. It is a good idea to have two separate backup cycles on the go; a day to day backup as detailed later in this Note, and also a monthly backup; the monthly backup should use several discs or tapes, so that each one is rewritten alternately every two months or more. In this way damage to the normal backup discs or tapes will not be completely disastrous.

8. The most secure form of backup is to send files to the ERCC filestore or mainframes. This is strongly recommended for important data or programs, particularly for long term storage. Floppy discs or tape cartridges may

deteriorate and become unreadable over the course of time. ERCC makes back up copies of Filestore and cherished EMAS files at 24 hourly intervals, so files stored here are very secure.

9. Maintain a log-book of hardware faults or problems, maintenance checks etc; this could also be used to record backup sessions. The general backup rule is always to write today's backup on to the oldest existing backup version.

Mainframe Backup

When sending files to EMAS, note that XTalk will not overwrite an existing EMAS file so you must either rename or destroy an existing EMAS backup file before using XTalk. It is better to rename the existing EMAS file rather than destroy it before sending your latest microcomputer version in case the file transmission fails for any reason beyond your control, leaving you with no EMAS backup.

User Notes 74, 78, 79 and 91 describe XTalk and Kermit; these and application forms for you to become an accredited user of the ERCC filestore may be obtained from the ERCC Advisory service.

If you are considering storing your files on your departmental machine, check with your departmental computing officer that communication between micro and mini is practical and that files on the departmental machine are backed up.

Backup for Microcomputers with Floppy Discs or Borsu Unit

VERY IMPORTANT - WRITE PROTECT THE MASTER DISC (the disc you are about to back up) BEFORE STARTING THE BACKUP PROCEDURE.

VERY IMPORTANT - if a working disc is corrupted, then *IMMEDIATELY* put write protection onto all the backup discs!

- On 5.25" discs use the write protect label,

- on 3.5" discs slide the write protect tab to reveal the hole,

- on 8" discs remove the write enable label,

- on Borsu units move the write protect tab towards the 'no entry' sign.

Each working floppy should have at least two backup copies. The first backup should be made to disc A, the second to disc B, the third to disc A and so on. In this way, if something goes wrong during backup, such that the master and backup disc are both corrupted, you still have the previous backup. Three backup copies are even better than two. Daily backup is necessary if the disc contents are changing daily. See Appendices 1 and 2 for sample.

Never use a backup disc except for backing up and for making new copies of lost data.

If a backup session starts to go wrong and master or first backup is corrupted *STOP FOR COFFEE* or telephone Advisory while considering your next move. Do not carry straight on and possibly corrupt your second backup as well.

Very important files may be better stored on the ERCC Filestore or one of the ERCC mainframes.

Backup for Microcomputers with a Hard Disc Unit

Borsu units are the most convenient form of backup for hard discs up to 10 Mb capacity, but tape streamers are usually less expensive to buy.

Backup the hard disc every week, using a different tape or Borsu cartridge each week for 2 or 3 weeks; in this way you will be able to recover data even if you discover that corruption occurred weeks ago! A verify pass should always be carried out after any backup. If you are doing a lot of work which it would be inconvenient to lose, more frequent backups may be advisable, using more tapes or cartridges if needed. Tape backup should always be carried out file by file (not as a full disc image back up). See Appendices 2 and 3 for details.

A full disc backup will take only 3 to 5 minutes using a Borsu unit, and another 1 to 3 minutes for verification. A full disc backup could therefore be carried out several times a week if necessary. A full tape backup takes about 20 minutes including the verify pass, so several full backups a week would be tedious. The best system to follow with a tape streamer is to carry out a full backup once a week, then append incremental backups (i.e. copying only data which has changed since the last backup) onto the same tape several times during the week.

It is essential to maintain a log of the tape, disc or cartridge used for each full or incremental backup in order that you can find files when you need them. We also recommend taking a directory of each full backup.

Floppies can be used as backup to hard disc, but are not recommended! Backup will be slow and very tedious. It needs up to 9 doubled sided 1.2 Mb floppies to back up a 10Mb Sirius hard disc, up to 16 double sided 720K floppies for a 10Mb Apricot, and up to 32 double sided 360K floppies for 10Mb IBM XT hard disc. The minimum backup would be two sets of floppies, with weekly backups carried out on alternate sets. Incremental backups can be done as well but if 4 incremental backups were carried out, then the complete hard disc could only be restored by a full backup followed by all 4 of the incremental backups. It is a good idea to keep a printout of which files are backed-up onto which discs!

Monthly Backup Cycle

You should also carry out a full backup once a month using a different set of floppies, tapes or cartridges each of which will only be rewritten every 2 or 3 months. Very important files may be better stored on the ERCC Filestore or a mainframe.

Maintaining Data on Hard and Floppy Discs

If you abort a program, or if a program 'hangs' and you reset the machine, or if you switch the machine off, while a program is still running, files may be left open or partially allocated. This may cause a muddle in the disc directory. Bad blocks on the disc surface can also corrupt the directory.

One file held on hard disc may physically be spread out over several separate parts of the disc surface. Under MS DOS, PC DOS and the DOS-hosted p-System, the computer writes each new file on to the first space it finds available and as old files are deleted space may become available at sites all over the disc surface. The disc directory has to keep a record of all the deletions and additions, and in extreme cases may get into a muddle, which may lose data.

You can check the state of the directory by using the CHKDSK program which is provided as part of the MS DOS and PC DOS systems. CHKDSK can be included in

the AUTOEXEC file so that a check is done every time the machine is switched on. CHKDSK will report on the number of non-contiguous areas on the disc surface occupied by a nominated file. You can instruct CHKDSK to fix any corrupt files it may find, or just to report the state of the disc so that you can fix it later. CHKDSK will also collect together lost 'allocation units' and put them into a file which you can read to see whether the information contained is important.

The file segmentation described above is one reason why ERCC does not recommend image backup tape streamers. A file by file backup collects all the pieces of one file together and writes the file to tape as one single entity.

An image tape backup is a jumble of fragmented files which is alright if you want to restore a complete hard disc, but if you only want to restore one file from the tape then this may be slow since the tape drive may need to jump backwards and forwards through the tape to find all the pieces. Also, if part of the tape is damaged the whole tape may be unusable, whereas if part of a file-by-file tape is damaged, the rest is usually alright.

Borsu cartridges should be verified regularly. During verification the whole disc is scanned in read-only mode and bad areas on the disc are identified, hopefully before they manifest themselves as read errors. Once bad areas are identified, the data can be moved to another cartridge.

A word of warning about early versions of PC DOS: versions before 3.2 all have a tendency to re-FORMAT the hard disc(!) if the operator is less than vigilant. The FORMAT command in PC DOS version 2.0 and 2.1 chooses to format the currently selected disc if no drive is specified, thus obliterating any programs or data on it. The currently selected disc is usually the hard disc, and the only message received is 'Press any key to begin formatting C:'. If this happens to you, the best thing to do is to SWITCH OFF the computer. You could reset with Ctrl/Alt/Del keys, or hit the CONTROL/C keys; however if you mis-key while doing this, formatting will proceed..... Even hitting the Escape key will initiate formatting. Versions 3.0 and 3.1 give a warning if no drive was specified; version 3.2 gives the message 'Drive letter must be specified'.

If you are using an early version of PC DOS you can rename FORMAT as KILLDISC, which may remind you of the gravity of the command. Alternatively you can put FORMAT into a batch file which will fail if no drive is specified; see Appendix IV for an example of a batch file.

Comparison of Borsu and Tape Streamers as Backup Units

Tape streamers can contain up to 25 Mb of data per streamer cartridge, while Borsu cartridges hold only 10 Mb. Tape streamers however do not offer directly accessible removable storage and are slower and less reliable. A Borsu backup takes 4 to 8 minutes including a verification while tape streamer backup takes about 20 minutes including a verify pass.

On the IBM PC/XT the tape streamer uses the floppy disc controller and so does not require an expansion slot or card, while the Borsu needs a short interface card.

On the Apricot, Borsu units and tape streamers require an interface card.

Care of Computer Equipment

All computer equipment should be kept clean and dust free. Cigarette smoke particles can corrupt discs.

Thunderstorms can be hazardous to computers; it is best to disconnect electric power from microcomputers, backup units, printers etc. during storms. It may be prudent to disconnect equipment from EDNET since lightning strikes (not necessarily of the building the equipment is in) can induce electrical spikes on the network which may damage equipment.

Cleaning Floppy Disc Drive Heads

Cleaning disc heads will increase the speed at which disc heads wear out. For this reason *ALWAYS* use a good cleaning kit with disposable cleaning discs; a few pounds saved on cleaning kit is not worth the hassle or the money if the cleaning kit damages the disc drive heads. A suitable kit is available from ERCC Stores. Cleaning once every few months, or simply when the disc drive gives an error or has trouble reading the disc, is sufficient for normal use. Even during very intensive use, disc drives need be cleaned no more often than once a month. A cleaning kit just for cleaning 5.25" disc drives costs approximately £15 (August 1986); a full microcomputer cleaning kit costs approximately £30.

Cleaning Tape Streamer Drive Heads

Some tape backup units give a count of recoverable errors. Less than one error per several backups is normal, but if the frequency increases then the tape heads may need cleaning or the tape cartridge may be nearing the end of its useful reliable life. If you use good quality tapes and never smoke in the computer room, you will extend the time before which you will need to clean the equipment.

Christie tape unit manufacturers advise the user to time a normal backup; if backups start to become slower than normal, a clean is recommended.

The tape drive cleaning kit can cost over £50. This cleaning kit can be ordered through ERCC Administration but will not be stocked by ERCC Stores.

Cleaning a Borsu Unit

There is an air-filter on the back of the Borsu which should be removed and cleaned once a week or when the filter looks dusty.

A special cleaning kit for Borsu drive heads can be ordered through ERCC Administration but will not be stocked by ERCC Stores. The manufacturer recommends cleaning every 3 months or after 500 hours usage, or whenever abnormal drive performance (such as frequent errors) is encountered.

Care of Hard Discs

Check the manufacturer's documentation before moving equipment. The following precautions should also be followed:

It is advisable to remove cartridges from the Borsu before the drive is moved.

Apricot hard discs: after using the Apricot wait for at least 5 seconds (count slowly to ten) before turning the power off. This will cause the heads to park (i.e. move off the disc). After 40 seconds the disc stops turning and the machine can safely be moved.

IBM with hard disc: use the Diagnostics disc before moving the computer, to prepare the disc for shipping.

Sirius with hard disc: the heads need to be parked before the machine is moved. This is done for the native p-System by using the Diskutil program.

Further Information

Borsu Units

User Note 93, The Borsu Disc Unit.

General advice:

ERCC Advisory	The King's Buildings	031-667 1081 ext. 2976 or 2977
	59 George Square	031-667 1011 ext. 2300

Will welcome personal visits, telephone, internal mail, or electronic Mail to 'ADVICE'.

Users with new requirements:

Service Support Unit	The King's Buildings	031-667 1081 ext. 2624 or 2641
CAST	1 Roxburgh Street	031-667 1011 ext. 4562

Telephone or electronic Mail to 'J.F.Livingstone'.

Information on purchasing:

Administration	The King's Buildings	031-667 1081 ext. 2613

Prices are on-line on BUSH and EMAS and can be inspected be issuing the command VIEW and then selecting the item PRICELIST. Alternatively you can log on as user VIEWER, hitting the return key when prompted for *Pass:*, and select item PRICELIST. If you need further information then contact J. Robertson by telephone at the number shown above, or by internal mail addressed to ERCC, KB.

Demonstration of backup procedures.

Microcomputer Demonstration Room	59 George Square	031-667 1011 ext. 2301

Three month schedule for Floppy Disc backup

6 discs are used, 1 work disc, 5 backup discs A,B,C,D,E. Discs A & B are for daily backup, discs C,D & E for monthly backup.

Month 1

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	A	B	A	B	A
Week 2	B	A	B	A	B
Week 3	A	B	A	B	A
Week 4	B	A	B	A	B+C

Month 2

Week 1	A	B	A	B	A
Week 2	B	A	B	A	B
Week 3	A	B	A	B	A
Week 4	B	A	B	A	B+D

Month 3

Week 1	A	B	A	B	A
Week 2	B	A	B	A	B
Week 3	A	B	A	B	A
Week 4	B	A	B	A	B+E

If you do not want to use a formal schedule like this one, keep two or three backup discs in use, and backup as necessary to the oldest disc. Daily backup is necessary if the disc contents are changing daily. This way you will have three or four versions always available to you, so that you should never lose more than one sessions work.

If you are going to follow a backup schedule based on this table, you should mark the backup days and discs to be used on a calendar, and tick them when the backup has been carried out.

Three month schedule for microcomputer with Winchester Disc sharing Borsu unit as backup device with other microcomputers, and for microcomputers with Borsu unit as main storage device

5 Borsu cartridges are used, A, B and C for weekly backup, D and E for monthly backup.

Month 1		
Week 1	Full disc backup and verify	A
Week 2		B
Week 3		C
Week 4		A+D
Month 2		
Week 1		B
Week 2		C
Week 3		A
Week 4		B+E
Month 3		
Week 1		C
Week 2		A
Week 3		B
Week 4		C+D

If you do not want to use a formal schedule like this one, keep two or three backup discs in use, and backup as necessary to the oldest disc. Daily backup is necessary if the disc contents are changing daily. This way you will have three or four versions always available to you, so that you should never lose more than one sessions work.

You may need to carry out more frequent backups in the course of day to day work. A full disc backup takes 3 to 5 minutes, with another 1 to 3 minutes for verification.

If you are going to follow a backup schedule based on this table, you should mark the backup days and discs to be used on a calendar, and tick them when the backup has been carried out.

Three month schedule for microcomputer with Winchester Disc using tape streamer backup

5 tapes are used, A, B and C for weekly backup; D and E for monthly backup.

Month 1

Week 1	A;	Full F+F+V
Week 2	B	"
Week 3	C	"
Week 4	A+D	"

Month 2

Week 1	B;	Full F+F+V
Week 2	C	"
Week 3	A	"
Week 4	B+E	"

Month 3

Week 1	C;	Full F+F+V
Week 2	A	"
Week 3	B	"
Week 4	C+D	"

Full F+F+V = Full file by file backup with verify pass.

If you do not want to use a formal schedule like this one, keep two or three backup discs in use, and backup as necessary to the oldest disc. Daily backup is necessary if the disc contents are changing daily. This way you will have three or four versions always available to you, so that you should never lose more than one sessions work.

A full backup takes approximately 20 minutes including a Verify pass. Backup should always be done file by file, not a whole disc at a time. Each new tape must be formatted before use; this takes approximately one hour. Maintain a log of the tape used for each full or incremental backup, and a directory of each full backup.

You may need to carry out more frequent backups of day to day work. An incremental backup (i.e. copying only those files which have changed) could be done several times during the week if necessary; a verification pass should be carried out each time.

If you are going to follow a backup schedule based on this table, you should mark the backup days and tapes to be used on a calendar, and tick them when the backup has been carried out.

BATCH file to make a safe(er) FORMAT command for IBM PCs using PC DOS versions earlier than 3.2

First rename FORMAT.COM as KILLDISC.COM, then use an editor to create a file containing the following, and call the file FORMAT.BAT.

```
echo off
if %1-==A:- goto KILLDISC
if %1-==a:- goto KILLDISC
if %1-==B:- goto KILLDISC
if %1-==b:- goto KILLDISC
echo Specify floppy drive A: or B:!!
goto exit
:KILLDISC
assign
KILLDISC %1 %2 %3 %4 %5 %6
:exit
```

There is a remote possibility that you might have defined the hard disc to be A: or B:. However the PC DOS command ASSIGN (held in file ASSIGN.COM) will reassign the hard disc as C: (the usual assignment) which is why it is included in FORMAT.BAT.

If you really do want to format the hard disc you will now have to type KILLDISC C:. This ensures that only people who understand the system can reformat the hard disc.

You can add /S, /V etc. to the FORMAT command, as usual, and the batch file will handle them correctly.