Chapter 2:
Introduction to File Server Facilities

This chapter gives an introductory guide to use of the Econet® system on the BBC Microcomputer. Section 2.1 explains what a network is, and what it can do. The following sections then give simple instructions for logging on and using the network for filing operations, and go on to discuss the directory structure and accounting facilities provided on the File Server. The chapter concludes with explanations of printing and the other facilities available on the network.

Chapter 3.3 gives a full description of each filing system command, and also of some of the utility programs available to make your life easier. A complete reference list of Econet error messages is given in Appendix A.

Advanced programmers, and especially machine code programmers will want to refer to Section D.

2.1 What is a Network ?

A computer network is a method of connecting a number of computers together, so that they can communicate with each other. There are several considerable advantages in doing this:

* Users can *communicate* with each other, and pass messages.

* Expensive equipment like printers can be put on the network, so that all users have access to them.

* A *network filing system* can be set up, using a central piece of equipment called a File Server. Again, this is cheaper than having a separate disc drive for each computer, but also it allows --

* File sharing, where many users can use the same program without needing separate copies. It is possible to have files which can be updated by several people independently, and other files which can be looked at but not changed by others.

The Econet network is designed to allow all these facilities on the BBC Microcomputer (and in fact on a range of other machines). The special electronic circuits to communicate with the network are built into the computer, and a special piece of software, the *Network Filing System*, is fitted in a read-only memory chip (ROM) to control the network electronics.

All computers have one or more filing systems built into them, if they are to be of much use. A filing system allows you to store away programs and data when you have finished working with them, so that you can use them another day without having to type everything in again from the keyboard.

The most common filing system is the tape cassette system, built into almost every microcomputer when you buy it. It allows you to keep *files*: that is to say collections of information whether they are programs, data, text or anything else that you wish to keep for another day. The tape cassette filing system usually allows you to give a *name* to a file, so that, when you want that piece of information back, you can tell the computer the name, and it will search the tape until it finds the corresponding name, and then proceed to retrieve that file.

A useful feature of a filing system is that you can use it to produce a *catalogue* of all the files. On the BBC Micro, this is done by typing ***CAT**. If you are using the tape cassette system, you will then have to start the tape, and the computer will print out each name as it comes to it.

There are two other filing systems which are also very common, the *disc* system, and the *network* system. Both require some extra circuitry and software in the computer. The disc system stores files on a *floppy disc*, which is a circular piece of plastic covered with magnetic coating (the same as on magnetic tape) in a cardboard sleeve. The floppy disc is inserted into a special drive, which rotates the plastic disc, and reads or

writes information through a special pickup head which can be moved radially to cover different areas of the disc.

The Econet network system uses a central computer called a *File Server*: this is a computer equipped with sufficient mass storage (usually floppy discs or larger hard discs) for the needs of all the users of the system. Other microcomputers, called *Client Stations* are connected to this File Server with cables, along which data is passed. The central machine runs programs to pass files back and forth when required, and keep track of all the files on the discs and who owns them. There is no restriction on the number of File Servers in a network.

2.2 Logging On and Simple Filing Operations

2.2.1 Starting Up the Econet System

Switch on the BBC Microcomputer and the monitor, and the following message should be displayed, if your station is connected to the network.

```
BBC Computer 32K

Econet Station nnn

BASIC

>
```

nnn is the number of your station on the network. If the message does not mention Econet (saying perhaps "Acorn DFS" if you have a disc interface as well), then hold down the letter N on the keyboard, and press and release the <Break> key.

If your default language is not BASIC, the third line of the message will be different (saying perhaps "VIEW" or "WORDWISE"). To change the language to BASIC, type:

```
*BASIC <Return>
```

and press and release the <Break> key. The message above should now appear.

The second line of the message may read:

```
Econet Station nnn No Clock
```

in which case there is a minor problem with the network. See Section 2.2.3 for what to do.

If you want to select the Econet filing system without pressing <Break> (for example when you are in the middle of a program or other work), then use the command:

```
*NET
```

This command may be used as part of a BASIC program, but it should be the last command in a program line (see under OSCLI in Section 3.2. for further details). Similarly, to use the disc or tape filing systems, type:

```
*DISC       (or)
*TAPE
```

Having selected the Econet filing system, you will now have to identify yourself to the File Server, called logging on; so that when it is asked about one of your files it knows where in its storage to look. You will not be able to use the network filing system for anything until you have done this -- all you will get is the message:

```
Who are you?
```

The person in charge of the network -- the official title is System Manager -- will have given you a *User Identifier* and perhaps a password as well. Normally your User Identifier will be your name or your initials, and your password will be some random characters.

The usual method of logging on is to type the command:

```
*I AM <user identifier> [<password>]
```

If you have not been given a password you should just type <Return> after the User Identifier; otherwise leave a space between your User Id and your password and type <Return> at the end. For example:

```
*I AM DIANA <Return>    (or)
*I AM TONY WOMBAT47 <Return>
```

The computer should reply with a > after a short pause. The prompt may be a different character if you are not in BASIC. If there is a pause followed by a message, then there is a problem -- see Section 2.2.3 for an explanation.

The system manager can set up an alternative method of logging on, which performs ***I AM** automatically and may disable the normal command. If this is the case, after turning your station on you should hold the <Shift> key down, press and release the <Break> key, and then release the <Shift> key. This will cause the screen to clear and you will be prompted for your User Id, and password if necessary. The process might go, for example:

```
User Id :JOHN <Return>
Password:KITTEN <Return>
```

This method should work in exactly the same way as *I AM. Note that if the system is not set up to do automatic logging on, typing <Shift-Break> may change your filing system, depending on the defaults set up by the system manager.

If the network you are using has more than one File Server, or if the station number of the File Server is not 254, as is assumed by the BBC Microcomputer, you may need to type the File Server station number before your User Id. For example, if the File Server station number has been changed to 235:

```
*I AM 235 DIANA HUNGRY <Return>
```

The system manager should tell you if you need to include a File Server number. If your network contains *bridges* onto other networks, these other networks are identified by a network number. To reach a File Server on one of these networks, you will need to give the *full station number* of the File Server, which will be of the form **<network number>.<station number>**. For example, to log on to the File Server at station 200 on network 5, type:

```
*I AM 5.200 MARY
```

If the memory of your BBC Microcomputer has become corrupted, the default network number or File Server station number may have been changed to an inappropriate value. In that case you will need to re-specify the full station number before you will be able to log on. Note that the local network for your station is always referred to as network number **0**, and not by its global number. Thus:

```
*I AM 0.254 STEPHEN 123GO
```

will restore the selections to your local network and File Server number 254.

When you want to finish your session at a particular station, log off by typing the command:

```
*BYE <Return>
```

If you do not log off in this way, other people will be able to use your file space and interfere with your files,

using the station at which you are logged on. It is however possible for you to be logged on to the same File Server from more than one station on the network, if you wish.

Further details of the ***I AM** and ***BYE** commands are given in Section 3.3

2.2.2 Simple filing operations

After you have logged on, you will be in your own personal area of the File Server storage space. This area will contain a list of the programs stored within it -- this is called a *directory*. To obtain a *catalogue* of this directory, type the command:

```
*CAT
```

and you will be given a display of directory information, explained in Section 3.3 under ***CAT**, of the form:

```
DIANA     (000)   Owner
MAIN-IV           Option 00 (Off)
Dir.DIANA         Lib.LIBRARY
```

It is likely that no files will be listed after this information, as you will not have stored any programs on the network filing system yet. We will do that now, by typing in the following BASIC program and saving it:

```
10 REM Hello there!

SAVE "TEST"
```

Now typing ***CAT** will list the program name after the directory information, as:

```
TEST      WR/r
```

The letters after the program name refer to the access rights of the file and are discussed in Section 2.4. From this directory, typing:

```
LOAD "TEST"
```

will put this program back into the memory of the BBC computer. The command **CHAIN** will both load and run a program. When you have finished with the program, typing:

```
*DELETE TEST
```

will erase it from the File Server disc and remove its name from the directory. The name of an existing program can be changed, for example:

```
*RENAME TEST MESSAGE
```

will change the filename of a program from TEST to MESSAGE.

If, when using **SAVE**, you specify a filename that already exists in your directory, the new program will overwrite the old one. You can protect files against being overwritten (see Section 2.4., in which case the letter **L** will appear in the access letters for the file. Such a file cannot be deleted, renamed or overwritten until its protection has been removed.

If you press **<Break>** or **<Ctrl-Break>**, the current program will be cleared from your station's memory. The program can be recovered by using the BASIC command **OLD** immediately. If you SAVE the program before recovering it, an empty file will be created, overwriting any previous unprotected file of that name. It is thus a good idea to check that a program is there, perhaps by listing part of it, before saving it. The system manager may also have set up an option to prevent such short SAVEs.

Note that SAVE, LOAD and CHAIN are BASIC commands and the filenames specified for them must be enclosed in quotation marks. Filing system commands, which always start with the character *****, do not in

general need quotes around filenames, although they can be put in if you like.

The commands ***SAVE**,***LOAD** and ***RUN** are commands used with machine code programs and are described in Section 3.2..

2.2.3 Common Error Messages with Econet

The "No Clock" Message

The most likely cause of this message is that the your station is not plugged into the network. Check that the Econet plug in the back of the computer is plugged in firmly, and that the other end of the lead is plugged into the wall socket or cable adaptor that connects to the network. Then press N and <Break> together and see if the "No Clock" message goes away.

If it does not, tell the system manager, and try to log on at a different station. If you are the system manager, look up the "No Clock" error in Section A.1 and read Section 9.4.

Fault messages after *I AM or other Filing Commands

There are several likely messages, including "Not listening", "Line jammed" and "Net error". A full explanation of all error messages is given in Appendix A.

The **"Not listening"** message happens when the station to which you are trying to talk is either non-existent, or switched off, or busy. This may occur if the File Server station number used in your log on command, or assumed by the BBC Microcomputer, does not correspond to a File Server on the network. Check the station number, network number and current status of the File Server to which you wish to log on. See Section 3.3. under ***I AM** for more details.

The **"Line jammed"** or **"Net error"** messages may be cured by pressing <Ctrl-Break> or turning the power to your station off and on again, and then attempting to log on again. If this does not work, inform the system manager (who should refer to Chapter 9) and try logging on at another station.

2.3.The Econet Filing System

A *file* is the name given to any collection of information that can be stored by the system. The system does not make any distinction between data, program, text or any other files -- it simply stores them as sequences of binary digits, and the significance of them is determined purely by the user and what he does with them. Each file must have a name, so it can be referred to when it is created, read, deleted, etc -- there can be up to 10 alphanumeric characters in an Econet filename (exact specifications are given in Section 3.1.2).

A *directory* is a piece of information kept by the system, so that it can administer files. The directory will contain the names of files in it, and information for the system such as where to find a file on the disc, its length, and so on. Directory names obey the same restrictions as filenames. You can *catalogue* a directory, which means printing out the names of files and other information about them.

2.3.1 Hierarchical Directories

In the Econet system (and in many other sophisticated filing systems), directories are themselves files in the system. A directory may contain the names of other directories as well as of files.

This means that a user FRED may have a directory which contains some files (for example BASE and DATA), and also the directories PROGRAMS and LETTERS. The directory LETTERS may contain files GASBOARD and BANK, and perhaps the further directory FRIENDS. Figure 2.1 shows this diagrammatically, as well as some other files.

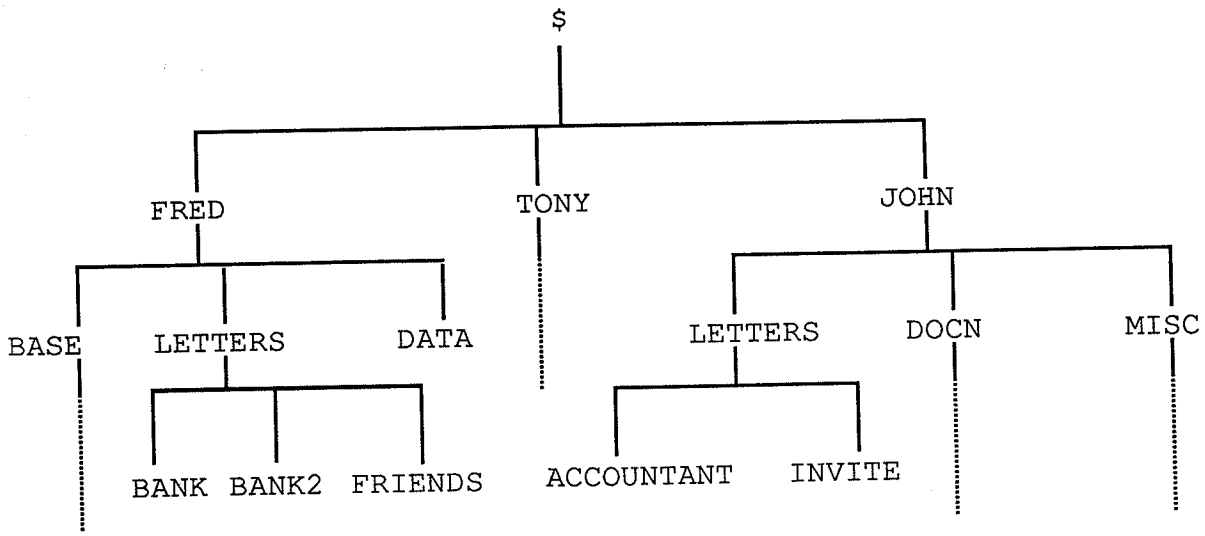

Fig. 2.1 A Directory Tree

This arrangement builds up a *hierarchy* of directories, or if you prefer, a *directory tree*. (Trees in computing almost invariably have their root at the top, and this one is no exception).

Each disc on the File Server has a special *root* directory on it, called **$**, which contains all the other directories as *sub-directories*; some of which may be several levels down the hierarchy, as entries in other directories. Each directory or file can be specified by a *pathname* from the root directory; this lists the path down the directory tree taken to reach the entry, with each step separated by the . character. In the above example the pathname for the file BANK would be:

```
$.FRED.LETTERS.BANK
```

Two items in the network filing system can have the same name, providing they are in different directories (in the diagram there are two directories called LETTERS). However no two items may have the same pathname (attempts to create the second will simply overwrite the first).

Whenever you log on to the File Server you will be put into your own personal directory, called your *User Root Directory* and rapidly abbreviated to **URD**. This should have been set up for you by the system manager. The next section explains how you can use other directories.

2.3.2 Selecting Directories and Using Pathnames

The command ***DIR** can be used to move between directories in the hierarchy; in general you will need to specify the full pathname of the directory you wish to select next, for example:

```
*DIR $.JOHN.DOCN.LETTERS
```

After a *DIR command, the directory chosen (if it exists) will become your *Currently Selected Directory* at that station, abbreviated to **CSD**. It will become the default directory for all directory commands such as *CAT, and the default area used by filing commands such as SAVE, when pathnames are not used with the commands. Some commands will only be permitted if you have sufficient access to the appropriate file or directory (see Section 2.4.)

There are several ways of simplifying pathnames: the most important being that, to select a directory below the CSD, you need only specify the pathname starting from the CSD. Thus you can select the sub-directory LETTERS of the directory DOCN, when DOCN is your CSD, with the command:

***DIR LETTERS** (missing out the $.JOHN.DOCN)

The *wild card* specifiers, *, # and . can be used in filenames and pathnames in order to save typing, or if you are only sure of part of the name. * will match with any number of characters in a name, so that, for example, PROG* could stand for PROG, PROG1, PROGRAM or PROG57B. # will match with any single character, so that FILE# could refer to FILE1 or FILEA; and . can be used at the *end* of a pathname, with the same effect as *. Wild card specifiers cannot be used when you are giving a name to an entry, as the filename for a SAVE command.

When used in directory names, wild cards that match with more than one possible directory will select only the first matching directory (alphabetically). For filenames, wild cards will specify either the first matching file or all matching files, depending on the operation being carried out on the file.

Note that care should be taken when using *DELETE with a wild card, as all matching items will be deleted. The System Manager may have set up an option to protect you against deleting too many files, in which case you will have to type *ENABLE before using a wild card *DELETE (see Section 3.3).

Full information about wild cards is given in Section 3.1.3. Note that * commands can be shortened by using the character '.', for example *DE. will be read as *DELETE and *. as *CAT. Rules for these contractions are given in Section 3.1.1, but they should not be used in programs as additional commands may be added to the system, making the abbreviations ambiguous.

There are other special symbols that can be used in pathnames: & stands for the pathname of your User Root Directory, @ for the Currently Selected Directory, and ^ refers to one level up the hierarchy from the CSD (^.^ gives two levels up). $ can be used with a disc name to refer to another disc on the File Server, and : is an exact synonym of $. These symbols are discussed in Section 3.0.2 and disc names are covered in Section 3.0.4.

Commands which are used with a filename, such as SAVE and LOAD, can be used with a pathname in order to specify files which are not in the CSD. For example:

```
LOAD "&.^.^.*"
```

will load the first file from the grandparent of your URD, assuming that you have sufficient access to the relevant file or directory (see Section 2.4).

Commands which operate on a directory, such as *CAT, can be used with a pathname in order to find out about directories other than the CSD. Using *DIR without a pathname will return you to your User Root Directory. You may need to use @, when using programs which ask for a directory, to specify your CSD.

The command ***PATHNAME** will print the pathname of your CSD, including the disc name of the currently selected disc, for example:

```
*PATHNAME
:MATHS-DISC.$.FRED.CHOCOLATE.BISCUIT
```

The command ***CATALL** will catalogue a complete tree of directories and files, starting from the CSD. This command can also be used with a pathname.

The command ***CDIR** can be used to create a new sub-directory, if you have sufficient access to the parent directory. Unwanted sub-directories can be removed with ***DELETE** used with the directory pathname, provided that they contain no entries and are not locked.

A full description of all these commands is given in Section 3.3.

2.4.Accounts and Access

All network filing systems need to store information about who should be allowed to read, alter or delete any given file; and how much disc space may be taken up by each user. Econet filing systems allow you to define access rights for each file, which specify what operations on the file are permitted to two levels of users -- owner and public. SJ Research File Servers also support a system of accounts, which clarify the concept of owner access and control the allocation of space on the disc.

2.4.1 The Accounting System and Getting Information about Files

There are 1024 accounts on an SJ Research File Server, numbered in hexadecimal from 0 to 3FF. Each file and directory will be associated with a *main account* ; and the storage space taken up by the file will be debited from that account. When the item is deleted, or transferred to another account, credit will be restored to the old main account. Each user will be allocated one or more accounts by the System Manager, who will also control the maximum amount of disc space available to each account, by using the commands ***CREDIT** and ***DEBIT**.

The command ***STATEMENT** will give a list of all the accounts to which you have access, and the credit balances for each. The credit balance of an account is in units of 1 kilobyte (K), and represents the amount of space available for files (or directories) with the corresponding main account number. If your File Server has more than one disc, you will have access to the same accounts on each disc, and a separate statement will be given for each disc. For example:

```
*STATEMENT

Disc     0
Account  Balance
    23       252k          7D      1296k
    A1    bankrupt         F0        45k

Disc     1
Account  Balance
    23      1296k          7D    bankrupt
    A1    bankrupt         F0       318k
```

This user has access to accounts 23, 7D, A1 and F0, but he will not be able to create any new files or directories in those accounts which are bankrupt: e.g. account A1 on disc 0.

Every file or directory also an *auxiliary account* as well as a main account; and any user with access to either the main or auxiliary account of a item is given **owner access** to that item. Any other user will be given **public access** only. An item does not use any credit in its auxiliary account.

It is necessary to have owner access to a directory in order to create a new item in that directory; and this new item will be given the same main and auxiliary accounts as the directory in which it is created.

The main or auxiliary account number of your **URD** will have been set to an account that you own. The command ***INFO** will give complete information about your currently selected directory, including the accounts to which it belongs. (If your station is fitted with the advanced version of the network filing system ROM, you will need to use ***INFO @** to have the same effect.) For your URD it will give a display of the form:

```
Diana      Entries=3      Default=WR/r
D/       07jan86  today   11:53 23 (00)
```

Reading from left to right, this tells you the name of the directory, the number of entries that it contains, some information about its access rights (see Section 2.4.2), the date that the directory was created, the date and time at which the contents of the directory were last changed, and finally the account numbers associated with the directory. The auxiliary account number is shown in brackets.

*INFO can also be used followed by a pathname to find out about a file, or a directory other than the CSD.

Slightly different information is given for files, with load and execute addresses, and the length of the file in hexadecimal replacing the number of entries and the default access status given for directories (see Section 3.3 for more details). For example:

```
*INFO $.JOHN.DOCN.LETTERS.MOTHER

Mother    00000000 FFFFFFFF      002723
WR/r      08jan86 10feb86 20:45 04 (FF)
```

The command ***EX** used with a directory name will give the same information as *INFO for all the entries in the specified directory, preceded by the same header as for the ***CAT** command.

If you have owner access to a file or directory, you can change the main or auxiliary accounts of that item with the ***ACCOUNT** command. You can change the auxiliary account number to any value desired (note that you can lose your owner access this way), but you must own any new *main* account. This is because when the main account number is changed, the cost of the item is transferred from the old main account to the new one.

For example, to change the accounts of an item GEORGE, in the CSD, to main account 25 and auxiliary account 66, you would type:

```
*ACCOUNT GEORGE 25 (66)
```

This would work if you had owner access to GEORGE and also owned account 25. Main and auxiliary access can be changed separately by leaving out the irrelevant parameter, for example:

```
*ACCOUNT TEST 23
*ACCOUNT DOCN (47)
```

Note that to change the accounts of the CSD, you must move up a level in the hierarchy with ^, as otherwise the system will look for an entry in the CSD of the appropriate name and not find it.

2.4.2 Controlling Access to Files

A system of access control is needed for every network filing system, so that unauthorised users cannot read, alter or delete confidential or important files. On an Econet File Server, two levels of access are recognised: i.e. **owner** and **public** access, as defined by the account structure. Each entry in the hierarchical directory structure has a set of access letters associated with it, which specify the access rights; the character '/' separates owner access from public access. These access letters are printed after the item's name by commands such as *CAT, *EX and *INFO. The system will give the access letters that apply to the current user in capitals, and the others in lower case.

The following letters may appear in either *owner* or *public* access strings, and apply only to users in the appropriate category:

No letter	No access to the file is permitted until access is changed
R	Read access only -- e.g. LOAD but not SAVE
WR	Read and write access -- but you can only use *DELETE on an item that you own
W	Write access only -- useful for append only files

The following letters describe general attributes of the item:

L	Locked item: protected against accidental deletion or renaming by the owners (public access will never allow these operations)
P	Private item: Invisible to all users except owners. If a non-owner attempts to look at the appropriate directory using *CAT or *EX, these items will be listed as **...Private**, and no operations can be performed on them.
D	Item is a directory. This access letter cannot be changed, and can only be combined with the letters P and L.
/spl	Item has been spooled to the print queue, and is waiting to be printed (see Section 2.5.6). This access code cannot be changed, and can only be combined with the letters P and L. All print queue files have read access to their owners and no access at all to public users. It is not possible to write to a print queue file. Note that the ownership of a file is altered when it is submitted for printing.
/prt	Item has been submitted to the print queue by *PRINTOUT (see Section 2.5.6), and is waiting to be printed. This code works in a similar manner to /spl.

Users with owner access to an item can use the command ***ACCESS**, followed by an item specifier, to change the access status within the permitted range for the item. Any letters after the character / will apply to public access. For example:

```
*ACCESS DATA WR/R
```

will change the access status of the file DATA to read and write for the owners, and read access only for non-owners. Wild cards are allowed in the item specifier, and will cause the command to apply to all items for which it is appropriate. So the command:

```
*ACCESS FRE* L
```

will lock all the items in the CSD beginning with the letters FRE, which can be either files or sub-directories. The characters + and - can be used as many times as desired to add and subtract letters from the access string, instead of re-typing it. For example:

```
*ACCESS PROG* -/W
```

will disallow write access to non-owners of all files in the CSD beginning with PROG, without affecting any other access letters. This command will not affect directories, as they cannot have an access of W.

The characters **D** and **-D** can be used as special codes to restrict the range of *ACCESS commands to only directories or files respectively. Thus:

```
*ACCESS *A01 -D+P
```

will make private all files ending with A01, but will not affect any matching directories, as they do not match the specification -D.

When a new file is created, its access status is set to the *default access* of the directory that it is created in. This status is listed as **Default=** when the commands *EX or *INFO are used on the directory, and is inherited by any sub-directories. Default access strings can contain the characters W, R, P, L and /. They can be changed with the command ***DEFACCESS**; for example:

```
*DEFACCESS PWR/
```

will cause all subsequently created files in the CSD to have access **PWR/** and subsequently created sub-directories to have access **PD/**.

*DEFACCESS can be followed by a directory pathname, and the characters + and - can be used in the same way as with *ACCESS.

2.5 Stations and Printing through the Network

In a network system, it is unlikely that individual stations will have their own printers. Instead shared printers will be connected to the network, via a *printer server*. This will be a station on the network, usually the SJ Research File Server, or a BBC Microcomputer.

It is useful to know what kinds of printer server are provided on your network before talking about printing, and so the next section discusses the various commands that give information about the stations on the network.

2.5.1 Different Types of Station

The command ***STATIONS** will list all the machines connected to the Econet network which are currently switched on, giving their station number, type and network ROM version number. It does not show the station you are using. For example:

```
*STATIONS

Station  Type
  254    SJ Research File Server   03.42
  045    BBC Micro                 03.60
  002    BBC Micro                 03.34
```

The command ***FSLIST** will list all the *active* File Servers on the network, with their types and version numbers. If the installation has multiple networks, File Servers on other networks will be displayed, preceded by their network number. For example:

```
*FSLIST

File Servers/Type

    254   SJ Research File Server ver M.97/HDFS
064.200   SJ Research File Server ver 0.91/FDFS
```

The command `*PSLIST` can be used to find out the station numbers of the printer servers present on your network. Only printer servers that you are allowed to use will be listed (see Section 3.3). Most networks will have one SJ Research File Server, and will use that as the printer server; but some may use a BBC Microcomputer instead or have several printer servers. After each station number, further information about the printer server will be given. So, for example, you might get:

```
*PSLIST
    254 Ready
            simple
            fancy
            nobann
    250 Offline
064.200 Busy with 064.100
```

The previous commands will tell you if these printer servers are SJ Research File Servers or BBC Microcomputers. 250 is not shown on *FSLIST, as it is an BBC Microcomputer, and does not respond as a File Server.

You can find out your own station number, and the File Server and printer server currently selected, with the command ***CV**. For example:

```
*CV
FS number 254
PS number 235
You are 001.003
OSARGS ver 001
```

2.5.2 Selecting a Network Printer

A Step-by-Step Guide

The BBC Microcomputer assumes that printer output is to be sent to a local printer, unless otherwise specified. The command ***FX5,4** will select the network printer, but uses a default printer server station number of 235, which may not be a printer server on your network.

Note that you will not be allowed to change the printer selection if there are still characters waiting to be printed on the previous printer. If you need to throw away the contents of the printer buffer, type **<Escape><Ctrl-C><Escape>**.

There are two possible ways to select a suitable printer server on the network. On most networks, there will be one SJ Research File Server and it will probably be used as the only printer server. In that case, you should use the command ***PRINT**, which will both select the network printer and change your printer server number to that of your current File Server. Each File Server can have up to two physical printers connected to it, although they may not both be available for user's output. The system manager will set up a default order in which these printers will be used.

When you are ready to start printing, you should type the character **<Ctrl-B>**, or use the command **VDU 2**. Any characters which appear on the screen will then also be sent to the selected printer server station. The message **Not listening** will be given if this station number does not exist, or is not running a printer server program. If all the printers that you are set up to use on the selected printer server are already busy printing, the message will be **No reply**.

On an HDFS or MDFS, output waiting to be printed will be stored in a special directory until a suitable printer becomes free; so the printer server will always be ready unless this directory is full, but your output may not be printed immediately. Details of this print spooling are given in Section 2.5.4.

Printing is concluded by **<Ctrl-C>**, or the command **VDU 3**, at the end of the printout. Until the user types <Ctrl-C>, a non-spooling printer will remain busy with the user's output and no-one else will be able to use the printer. Eventually the printer server's internal timer will finish the user's printout after a sufficient period of inactivity; in this case some of the characters sent to the printer may be lost.

If **<Ctrl B>** is active the user cannot then log off simply by typing *** BYE**. The printing job will not be closed and noone else will be able to use the printer. The user must type **<Ctrl C>** *BYE which can be done by ***LOGOFF** (a non syst.command).

So, to print a listing of the current program on a printer connected to your File Server, the process should go:

```
*PRINT <return>          (to select the printer server)
LIST <Ctrl-B> <return>
 ....listing of program on screen and printer....
<Ctrl-C>
```

See under ***TYPE** in Section 3.3 for how to list text files on the screen, and ***PRINTOUT** in Section 3.3 for a more sophisticated method.

To stop printing temporarily, do *not* use VDU 3 and VDU 2, since this will result on the print job being ended, then another one begun on a fresh page with another header. Refer to Section 2.5.3 for how to use ***FX3,<number>** to do this.

If you need to use another SJ Research File Server or a BBC Microcomputer as a printer server, you will need a command other than *PRINT. Instead you should use ***PS**, which selects the network printer and broadcasts for a printer server on the network. *PS can be used with a station number to select that station as the printer server; or on its own, where it will give a display of the form:

```
Printer 200 jammed
Printer 180 ready
Printer 180 selected
```

*PS will attempt to select a printer answering **ready** for preference, followed by **busy**, and finally **jammed**. If no suitable printer responds, then the message **No station responding** will be given. Printer servers which have no printers you are allowed to use will not respond to *PS.

If you select a printer server which has a different number from that of the File Server at which you are logged on it will attempt to log you on as ANONPRINT or if this option is not available as the default user. Some SJ Research File Servers, especially those with print spooling, will be set up not to allow printing by users who are not logged on to that File Server. These will not respond to *PS, and will give the **No reply** message if selected by station number. If you have a User Id on this other File Server, you can log on to it by typing:

```
*I AM <station number> <appropriate User Id and password>
```

You can then return to your original File Server by logging on to it again (remember to give the station number), and you will now be logged on to both File Servers, but only for the purposes of printing. Note that you will be returned to your URD on the original File Server with your default options.

Once you have selected a printer server with *PS, printing proceeds in the same way as for *PRINT. There are however two possible extra things you may have to be careful about.

The first is that the advanced network ROM (ANFS) contains its own version of *PS, which will be selected in preference to the network version. This ANFS copy does not perform the ***FX5,4** to select the network printer; so in this case you need to type ***/PS**, which will find the network version. The command ***HELP** will list all the ROMs fitted to your station, and will say **Advanced NFS** if appropriate.

However the ANFS ROM also contains the command ***FS**, which allows you to change the File Server number stored in the BBC Microcomputer. This can be used to change between two File Servers if you are logged on to more than one at once. This command is not available on earlier network ROMs.

The second problem is that some printers do an automatic line feed after every carriage return, and some do not. Your system manager will configure *PRINT and *PS to allow for this. However, if you have a mixture of printers on the network, it may still be necessary to type ***FX6,0** before sending output to certain printers, in order to get the right number of line feeds. You should be told if this is required.

A more detailed description

Initially the BBC Microcomputer will assume that the station number of the printer server is 235, and it will attempt to send output to this station if printing is requested. It will thus be necessary to change this printer server number to that of the station you wish to use.

SJ Research File Servers also allow two physical printers, one serial and one parallel, to be connected to the printer server. Each physical printer can have up to four *banners* defined for it; a banner is a text string set up by the system manager to identify each user's output. Thus a typical banner will contain form feeds and such information as user identifier, time and date of printing. Each physical printer/banner combination is set up as a *logical printer*.

Thus two parameters control the network printer selected; the printer server selected and the matching logical printer selection.

The printer server station number is stored in the BBC Microcomputer, and will not be checked until printing is attempted. This number can be changed with the commands ***PRINTER**, which sets it to your currently selected File Server number, and ***PS <number>**, which sets it to the number specified. The

command ***CV** will show your current printer server number. This number can include a network number, so that a printer server on another network can be specified.

If printing is attempted to a station that is not running a printer server program, the message **Not listening** will be returned after a pause. This message can also be given if the printer server is unable to print your output for any reason. This case may also give the message **No reply**.

The logical printer selection for each user is stored on each File Server for the appropriate printer server. BBC Microcomputers running printer server programs have only one logical printer, called PRINT, so they do not need to store a selection. A default selection is set up by the system manager, and this is given to users when they log on. This default selection is the only one available to users who are not logged on to the File Server.

The commands ***PRINTER** <logical printer name> and*** PS** {<logical printer name>} can be used to change your logical printer selections. ***PRINTER** affects only the selection on your currently selected File Server; when used without a parameter it displays your current logical printer on that station. There are several reasons why you may not be allowed to use and hence to select a particular logical printer; these are discussed later in this Section.

***PS <logical printer name>** will broadcast for a printer server on the network which has that particular logical printer. Your internal logical printer selection will be set to this name on all the printer servers which respond, i.e. those which have a logical printer of the appropriate name which you are allowed to use. The printer server number in your station will be changed to match one of the stations which respond. The current status of the printers responding will determine which station is selected; the order of preference is first ready, then busy, and finally jammed. Note that the status of the printers may change before you get around to sending output. If no suitable station responds to *PS <name>, the message **No station responding** is given.

The command ***PS** with no parameter will work in the same way, except that no logical printer selections will be altered. The command ***PSLIST** will list the printer servers which will respond to ***PS**, with their logical printers and the status of your matching logical printer selection.

A particular logical printer may be unavailable for several reasons, including the following ones. A printer may be set to be non-existent; either because it has be disconnected, or because it is reserved for printing special system messages. The system manager may set up an option so that users without access to a particular account cannot use a certain logical printer. The default logical printer on a File Server can be set to only allow users who are logged on, so that anonymous users cannot use that printer server at all.

A logical printer that is not available to you cannot be your selection, unless it is the default, or the printer details have been edited since it was selected. Thus using *PS will find you a suitable printer automatically.

Logical printers on Modular Disc File Servers can be set up to be either *print-spooling* or *non-spooling* by the system manager. Non-spooling printers will only accept output when the matching physical printer is free.

When the physical printer for a print-spooling logical printer is busy, output directed to it is spooled as a *print job* file into the print queue directory on the File Server. Access to a file server account is required for output to be transferred to the print queue, and hence these logical printers are only available to users logged on to the appropriate File Server. Print jobs are printed later when a suitable physical printer becomes free. A full description of the print queue directory is given in Section 2.5.6.

There are two special logical printers, called **HOLD** and **AUTO**. **HOLD** will keep a job in the print queue indefinitely, until the logical printer selected for it is changed with the command ***REROUTE <print job name> <logical printer name>**. This command can be applied by users to any jobs in the print queue to which they have owner access.

AUTO is set up by the system manager to be the most suitable logical printer for users who have no preference. This option may select a sequence of logical printers; so that when printing is attempted, a search down the list is made for a permitted logical printer. **AUTO** and **HOLD** are common choices for the default printer on a File Server.

2.5.3 Turning the Printer On and Off

To start printing the user should print the character <Ctrl-B>, either by typing it, or by **VDU 2** from a program. The printer will usually be set up by your system manager to print a *banner*, which will be a series of characters designed to be easily visible, followed normally by the user's name, the station number, time and date.

The characters sent to the printer will then be printed. The BBC Microcomputer always filters one character value out, by default this is character &0A (line feed), so that printers that do an automatic line feed after every carriage return can be used. To change the character that is filtered, type ***FX6,<character>**. If the printer does not have auto line feed, then ***FX6,0** is a useful choice. The program *PS will perform this *FX6,0 automatically if the printer(s) in your network require it (the system manager will configure *PS to match the printer). If your network has two different sorts of printers, with different line feed defaults, then you will need to type *FX6,0 yourself for the non-automatic printer.

Printing is concluded by printing <Ctrl-C> (**VDU 3**) at the end of the printout. The printer will usually be set up to leave a blank page, and will then be ready for another user's output. Until the current user types <Ctrl-C>, the printer server will remain busy with this user's output unless its internal timer finishes the user's printout after a sufficient period of inactivity. Note that this if the printer server times out in this way, some of the characters sent to the printer will be lost.

To stop printing temporarily, do *not* use <Ctrl-B> and <Ctrl-C>, since this will result in the print job being ended, then another one begun on a fresh page with a fresh banner. Use ***FX3,<number>** to do this, where <number> is a single byte with each bit having the following effect:

Bit 0 (1)	1=enable RS423 (serial) output
Bit 1 (2)	1=disable output to VDU
Bit 2 (4)	1=disable printer output
Bit 3 (8)	1=enable printer (but it must have been started with <Ctrl-B>)
Bit 4 (16)	1=disable output to any *SPOOL file
Bit 5 (32)	no effect
Bit 6 (64)	1=disable printer output, except for characters preceded by <Ctrl-A>
Bit 7 (128)	no effect

For example, calling *FX3 with bits 3 and 1 set to 1's (*FX3,10) will disable the VDU and enable the printer, i.e. will print only. Calling with bit 2 = 1 (*FX3,4) will send output to the VDU only (even if <Ctrl-B> has been typed). Calling with no bits set (*FX3,0) will send output to both VDU and printer (this is the default setting).

For printing graphics to the printer only (where it is important that all characters, including the one specified in the *FX6 call, are printed), use the following in your program:

VDU2	start the printer
***FX3,0**	unnecessary unless you have previously called *FX3
VDU1,<character>	

VDU1 (<Ctrl-A>) sends the immediately following character to the printer only, but the VDU output must be active for it to work (!) The character following <Ctrl-A> will be sent to the printer, regardless of whether it is the character filtered out (set by the *FX6 call; see above)

For programs that do a lot of switching between printer only and VDU only, the following calls are recommended:

VDU2	start the printer
***FX3,64**	this disables printer, except for chars preceded by VDU1
VDU <character> or **PRINT <anything>**	sends to the VDU only
VDU1,<character>	sends to the printer only

This saves multiple vast numbers of *FX3 calls if there is a lot of switching between VDU and printer.

Please note that the documentation of *FX3 in the Advanced User Guide for the BBC Micro, page 119, is misleading. Line 7: in Econet it is always necessary to send <Ctrl-B> to start printing. Lines 18-20: untrue. You may use Osbyte &EC to read the current state of the bits, but Y will not work as a bit mask for Osbyte 3 !

Please use this *FX3 call rather than using VDU21 and VDU6 to turn the screen on and off. There are bugs in this part of the VDU driver which will cause undesirable results.

2.5.4 Direct Printing of files from the File Server

There is a facility available to print the contents of a file off-line, if desired. The command is *PRINTOUT, and there is a corresponding command *PRINTER to select the printer at which the output appears.

There are two advantages to the use of *PRINTOUT. First, the job can proceed without using any processing power of the BBC Microcomputer. Second, the system is not restricted by the defined printer protocol, and can therefore give much more information back to the user.

See the full description of these commands in the next Section.

2.5.5 Banners and Logical Printers

Usually a *banner* will be printed before each user's output: this is a text string set up by the system manager, which may also contain information (such as user identifier, time, date etc.) inserted into the string by the system.

An example of a banner is:

```
SJ Research File Server *** Station 5 (FRED) 08feb86 13:23:04 ***
```

The banner file also contains a standard string to be added at the end of each user's printout. An example could be a row of asterisks followed by a page throw.

Each physical printer on an SJ Research File Server may have up to four different banners available, and these are distinguished as different *logical printers*. Thus there may be up to eight logical printers on each SJ printer server, and their names are listed after the station number by ***PSLIST**.

Printer servers which are BBC Microcomputers will have only one logical printer, called **PRINT**, and this name will not be listed by *PSLIST. (*PS and *PS PRINT have an identical effect.)

There is a default for the logical printer selection on each File Server, set up by the system manager and selected for you from when you log on to a station until a particular printer is specified. The system manager will also set up an automatic printer selection, to be used by users who do not have a printer preference. This will select a printer and banner to be used, and may choose the other physical printer if the first choice is busy. The automatic and default printers will usually be the same, or the default printer may be set up to do nothing.

On print-spooling printer servers there are also two special logical printers called HOLD and AUTO. **AUTO** represents the automatic logical printer in the print queue, and **HOLD** keeps a file in the print queue indefinitely.

The command ***PRINTER** will tell you which logical printer is selected for your station on the currently selected File Server, and its current status. For example:

```
*PRINTER
AUTO    : with printer spooling
```

***PRINTER** can be used with a logical printer name to change the logical printer selection. This will change the banner printed with your text, and perhaps the physical printer it comes out on. Some logical printers

may not be available to general users, and so you will not be able to select them.

***PS** can also be used with a logical printer name. This will broadcast for a printer of that name and will work in the same way as *PS on its own. Logical printers with the same name on different File Servers should be identical, and preferably near each other.

Note that *PS <printer name> will change the printer selection on all File Servers that respond to it, as it is a broadcast message.

2.5.6 The Print Queue Directory

If your File Server is an HDFS or MDFS, it will be able to carry out *print spooling*. This means that output sent to particular logical printers will be stored in a special directory on the File Server if it cannot be printed immediately. It will then be printed when a suitable physical printer becomes free.

Each logical printer will be set to be either *spooling* or *non-spooling* by the system manager. Non-spooling logical printers will only accept output when the matching physical printer is free; this is the only kind of logical printer possible on the FDFS and RM380Z File Servers. Non-spooling printers are useful when the network is quiet if you want to print program output as it is produced.

The directory in which output is stored is called **%PRINTQ**, and is a sub-directory of the lowest numbered disc on the File Server. It is not necessary to specify the pathname or disc of this directory when referring to it. If this directory is not found, or is full, all logical printers will be treated as non-spooling.

When a print-spooling logical printer is busy, output sent to it is spooled as a *print job* file into the directory %PRINTQ; this file is labelled with system information and given a new name. These names are given sequentially, starting as AA00, AA01, AA02 etc. and going up to ZZ99. Thus the command *CAT, which lists files alphabetically, will show the order in which entries were submitted. When a physical printer becomes free, the file next printed is the first entry in the catalogue that is suitable for that printer. Thus print jobs are carried out in a sensible order.

The main account number of print job files will be set to that of the print queue directory, so as not to take up user's account credit. This main account will normally only be available to the system manager. When the job is submitted, the system will work out the user's *personal account*, i.e. the highest numbered account to which the user has access. The auxiliary account of the print job will be set to this personal account, so users will have owner access to their own print jobs. Account numbers can be changed in the usual way.

Print jobs are given a special access code of **/spl** to mark that they are waiting to be printed. This access cannot be changed, although the file can be locked or made private. Print jobs which are locked will not be printed until they are unlocked. Writing to print job files is not allowed, but they can be read and deleted by users with owner access. Files created with *PRINTOUT (see Section 2.5.4) are given access code **/prt**, and the same conditions apply to them.

The commands ***EX** and ***INFO** will give information about files in the print queue directory, and this will be of a different form to the information given for ordinary directories. For example:

```
*INFO %PRINTQ.AA23

AA23    DIANA    at Stn. 253 0003A6
L/spl    HOLD    today  12.02 01 (FF)
```

Reading from left to right, this tells you the name of the print job, the name and station number of the user who submitted it, the hexadecimal length of the file in bytes, the access code, the logical printer selected for the job, the date and time of submission, and finally the accounts associated with the file. If you cannot identify particular jobs from this information, you can use *TYPE to show them on the screen.

It is possible to change the logical printer selected for a print job to which you have owner access, using the command ***REROUTE <print job name> <logical printer name>**. For example:

```
*REROUTE AA23  NOBANN
```

would change the selected logical printer from HOLD to NOBANN in the above example. This will only work if you are allowed to use the new logical printer. The new printer could be non-spooling, in which case it would be treated as spooling with respect to this particular job.

The system manager, and other users with owner access to %PRINTQ, can use the command ***RENAME** to change the name of a print job, and thus its position in the queue. **!** is considered to be the first legal file name character alphabetically, and so is commonly used to start such priority print job names. When the File Server is turned off, the naming sequence is restarted at AA00, and so entries in the stored print queue may be renamed by the system manager.

2.6 Other Facilities Available on the Network

This chapter concludes with an introduction to some of the other features provided by the Econet network and the SJ Research File Server. A more detailed coverage is given in Chapter 3, and a complete list of error messages in Appendix A.

2.6.1 Passwords, Libraries and Boot Files

You will probably want to change your password from that given to you by the system manager, both to make it more memorable and to protect your files from unauthorised users. The command ***PASS <old password> <new password>** allows you to do this. For example:

```
*PASS qwerty breakfast
```

will change your password from **qwerty** to **breakfast**. If no password has been set, it is necessary to quote a null string "" as the old password. Passwords may contain up to 10 characters -- permitted characters are letters, numbers and ! - _. If security is important to you, do not use a password that is easy to guess, e.g. your telephone number or your boy/girlfriend's name.

The system manager may set an option to prevent you changing your password, for example if your User Id is shared between several people. If you forget your password, the system manager will be able to find it out for you.

Another directory selection is stored for each station by the File Server, as well as the URD and CSD. This is the *currently selected library*, which is an option set up for you by the system manager and shown in the third line of the header to the ***CAT** command. If a file was not found for a command like **LOAD "<pathname from the CSD>"**, the same search for the file will be made from the library directory. Files found there will be acted on as usual.

A complete list of the commands for which library searches are made is given in Section 3.3 under ***LIB**. Note that ***<file specifier>**, which loads and runs a machine code program, will search the library, and this is how many commands used on the File Server are stored. Those commands listed as programs in Section 3.2 are kept in the utilities library. However you may want to change your library directory at a particular station, perhaps to use a library with extended utilities provided for a Master Series machine, and you can do so using the command ***LIB**. For example:

```
*LIB $.NEWLIB
```

will select the directory NEWLIB as your current library directory. When you log on again, your library directory will be returned to the default selection.

It is also possible to set up a sequence of commands to be executed automatically when you log on. The command **OPT4,<number>** controls this, with the number between 0 and 3. Your current selection is shown in the second line of the header for the ***CAT** command, and is referred to as your boot option.

***OPT4,0** will give no action at log on, but the other options will search for a file called **!BOOT** in first your URD and then your library directory. **OPT4,1** will load this file into memory, **OPT4,2** will run it as a machine code program, and **OPT4,3** will read the file as though it were typed in at the keyboard. The last of

these is a useful option as it allows all types of commands to be included in the boot file.

If the only file !BOOT in the system is in the library, then a message of the day can be produced at log-on for every user with OPT4,3 set. The system manager may lock your boot option so that you cannot change it.

You can create a !BOOT file for use with *OPT4,3 for yourself, by using the command ***BUILD <file specifier>**, which creates a file of the appropriate name and then prompts for keyboard input, which is sent directly to the file. Pressing the <Escape> key will end the file. For example:

```
*BUILD !BOOT

0001 *| Hello Diana
0002 *CAT
0003 *CV
0004 <Escape>
```

will create a simple boot file. *| is the operation system equivalent of the BASIC statement REM, i.e. it causes the rest of the line to be ignored. Files built in this way can be edited using a suitable text editor such as WORDWISE.

The command used by *OPT 4,3 is ***EXEC <file specifier>**, which reads a text file as if it were typed in at the keyboard. This is useful for performing sequences of commands repeatedly, or for converting a text file into a BASIC program. BASIC programs are usually stored in a condensed form by the language system. Useful subroutines and procedures for facilities like graphics can be provided in *EXEC format, and you then use this command to add them onto your BASIC programs.

To convert a BASIC program to text, you can use the command ***SPOOL <file specifier>**, which sends all text from the screen to the specified file. Typing ***SPOOL** on its own will close the file. For example:

```
*SPOOL PROGLIST
LIST
.                       listing follows here
.
*SPOOL
```

will send a listing of the current program, preceded by a line saying LIST and ended by a line saying *SPOOL, to a text file called PROGLIST. *SPOOL may be useful with the command *PRINTOUT, and this is discussed in Section Whatsit.

Note that these commands send information over the network in single byte packets, which is inefficient. Running the utility program ***PUTGET** will collect these packets together into blocks of 64 bytes, which results in a considerable speed increase. The use of *PUTGET is thus normally recommended.

A more detailed description of all these commands is given in Section 3.3.

2.6.2 General Information Available on the Network

There are several other commands which provide information to users of the network, as well as those discussed earlier in this chapter. Again a complete list is given in Section 3.3, but the simpler commands are covered here.

The command ***TIME** prints out the time and date on the screen, from the *real time clock* contained in the File Server. There are also versions suitable for incorporating into users' programs, called *PTIME, *PDATE, *PDATE2 and *GTIME.

The command ***VERS** displays the version number of your currently selected File Server.

The command ***FREE** gives a list of all the discs present on the File Server, and the amount of storage space left on each disc.

The command ***USERS** lists all the users currently logged-on to the File Server, their station numbers and whether they have system privilege i.e. can carry out operations only normally available to the system manager. A user may appear on the list several times, if he is logged on with more than one station. The list is re-ordered every time a filing system operation occurs, so that the station that performed the operation is moved to the top of the list.

There are special users called ***-SPOOL-*** and ***-SYSTEM-*** which are given by *USERS: they are used by the system to carry out print spooling and other system operations.

The commands *PUSER and *GUSER can be used to incorporate the current User Id into users' programs. These are discussed in Section 3.3.

2.6.3. Copying Files and Directory Structures

If a file is to be *moved* between directories within one disc on a File Server, it is most convenient to use the command ***RENAME** with appropriate pathnames. However to copy a file, or move between discs or filing systems, the BASIC program **COPIER** is necessary. The program is started by typing:

```
CHAIN "COPIER"
```

The program will prompt for a source and destination filing system. To copy between two different filing systems, enter the names of the systems, e.g. ***DISC** and ***NET**. To copy between two File Servers, type ***I AM <File Server station number> <User Id>** [**<password>**] **<Return>**; and to copy between two directories, enter two directory pathnames.

You will then be prompted for the name of the file to be copied, and the new name required on the destination filing system. If directory pathnames have been specified they need not be given again. Typing <Return> when asked for the new file name will assume the name is unchanged. Note that only one level of sub-directories below the root is permitted by the disc filing system, and that these sub-directories must have single character names. Attempting to copy more complicated paths may cause problems with illegal file names at a later date.

The program will continue to prompt for files to be copied until <Escape> is pressed. The user must obviously have sufficient access to the files and directories involved.

There is also a BASIC program called **MULTICOPY** which can be used to copy entire directory trees between File Servers. This works in a similar way to COPIER and is explained in Section 3.3. A BASIC program called **ERAQ** is also described, which will delete all or part of entire directory trees. Note that this will delete files even if they are locked.

2.6.4 Communicating with Other Network Users

It is possible to use the Econet network to send messages to other users. One of the simplest ways to do this is with the command ***NOTIFY**. This can be used with a station number, for example:

```
*NOTIFY 4 Merry Christmas
```

This will cause the message ***| 023: Merry Christmas** to be printed on the screen, where 23 is the number of the station sending the message. The message will be accompanied by a beep.

***NOTIFY** can also be used with a User Id, in which case it will be sent to the station at which that user last performed a filing system operation. This will be the station listed first for that user by the command ***USERS**.

Attempting to send a message to a user who is not logged on, will give the error message **Not logged on**. Sending to a station which is not connected to the network will give the message **Not listening**. It is not possible to send a message to yourself.

If you do not wish messages from other users, you can use the command ***PROT** to prevent your station

from responding. ***UNPROT** will remove this protection.

The command ***VIEW** allows a user to make a complete copy of a remote station's screen. If the remote station is in a screen mode that uses more memory than your current selection, the error **Mode x** will be given, where x is the screen mode of the remote machine. The command prompt will be returned and commands can be entered as usual.

The command ***REMOTE** allows a user to take over a remote station, so the screen of the remote station echoes the screen of the controlling station. This is useful for demonstration purposes, but will interrupt any work in progress by the user of the remote station and so should be used with care. Ordinary users may not be given access to *REMOTE. The command ***ROFF** will turn off the remote control.

Both *REMOTE and *VIEW can be used with a station number or a User Id to specify the remote station. The same rules as for *NOTIFY are used to find the station appropriate to a User Id. ***PROT** can be used to prevent either of these commands from affecting your station; this is obviously essential if you are doing anything confidential. All these commands are discussed in greater detail in Section 3.3.