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Title:

User Guide for BBC Micro X-TALK Version 2.2

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Synopsis

This Note describes the program X-Talk, running in a BBC micro, which allows the BBC micro to be used as a terminal to a host, as well as to transfer files to and from it.

Keywords

BBC micro, software library, X-Talk

Copyright

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1 INTRODUCTION

1.1 Overview

The name X-Talk properly refers to a communications protocol - a file transfer protocol developed by the ERCC some time ago. However, popular usage is that X-Talk refers to a program running in a microcomputer (in this case, the BBC micro), which allows the micro to be used as a terminal to a host, as well as to transfer files to and from it. In this document, the latter meaning is intended.

The X-Talk program for the BBC micro has gone through various stages of development. Before version 2.0, X-Talk was disc-based, and therefore could only be used on BBCs with attached disc drives. Versions greater than 2.0 are supplied as 'sideways ROMs'; in other words as 'chips' which are installed inside the BBC micro. Version 2.2 and above are also available as ROM images on disc, suitable for use in sideways RAM.

First of all, X-Talk provides a terminal emulation capability. It allows the BBC to be used as an ordinary asynchronous terminal, capable of operating at a variety of baud rates. Rather than emulating an existing terminal, the BBC is treated as a new terminal type, so that all the text and graphics capabilities of the micro are available for use by the host. There is some supporting software on EMAS for graphics display on the BBC using X-Talk. Like some other terminals, X-Talk permits output from the host to the terminal to be echoed to an attached (parallel) printer.

Secondly, X-Talk provides file transfer capability to and from the host to which it is connected (provided there is appropriate supporting software on the host). Files can be transferred to and from floppy discs attached to the BBC micro, or to and from cassette tape, or to and from the BBC memory (RAM). The latter facility is designed mainly to work with Basic programs and text files used by the "Wordwise" text processor ROM. It enables users who have a BBC micro but no local main storage device such as disc or tape, to develop Basic programs, or to download and edit text files locally.

Thirdly, there is a 'screendump' facility, which sends an image of the screen to an attached dot-matrix printer. This facility is available from any programming language, and can also be invoked when X-Talk is being used as a terminal.

One other facility provided in the ROM is a printer driver which allows the BBC to be used with a serial printer (or any other serial device) using XON/XOFF flow control protocol. This also enables the BBC to drive a remote printer, when both BBC and printer are connected to a PAD.

In this guide, references to the BBC Micro Users Guide are to the 1982 edition. Where the page or chapter number is different for the October 1984 edition, the new reference follows in brackets.

1.2 Recommended Configurations

The minimum BBC micro configuration required for this software is:

- BBC micro model B or BBC micro Plus or BBC Master
- Monitor (monochrome or colour)

The BBC micro operating system should be version 1.2 or later. Type *FX 0 to determine the version number you have.

You will also, of course, require a connection to the host computer, either a direct wired-in connection, or via a modem. It will be advantageous (but not essential) to have some form of local mass storage, such as a tape recorder or floppy disc drive.

There are a large number of add-ons which can be purchased for the BBC micro, and X-Talk will work with most of them. Specifically, it will work with:

- Econet systems
- Acorn 6502 second processor
- Most other ROMs, including other terminal emulator ROMs
- Parallel printers

Some peripherals which will *not* work with X-Talk are:

- Second processors other than the Acorn 6502. Note that this only applies if the second processor is switched on.
- Serial printers when X-Talk is being used to communicate with a host computer, because the BBC micro has only one serial communications port.

1.3 Availability

The ROM version of the software is available from ERCC Administration. The disc version of the software is available free of charge (on receipt of a suitably formatted BBC disc) from the ERCC Service Support Unit (George Square). Also available is a serial interface cable suitable for connecting the BBC micro to a modem or an ERCC network access point.

Real money charges are made for the ROM and cable, which can only be supplied against an official order form or internal transfer form. Current prices for the ROM and the cable are available from the ERCC Administration.

If you already have a previous version of X-Talk for the BBC on ROM, it may be exchanged free of charge for the new version *provided* your old version is on a 16K chip. Such chips have the number 27128 printed on the top, whereas 8K chips have the number 2764. These numbers are underneath the sticky label. If you have a combined X-Talk and Sussex chip, this will be a 16K chip, but by exchanging it you loose the 4010 and VT52 emulations which the Sussex Workstation gives you. (Unfortunately, the new version of X-Talk is too large to fit onto the same chip as Sussex.) In these circumstances, you are recommended to buy the Termulator chip as a replacement for the Sussex Workstation. (Contact ERCC Administration for details of the cost.)

The addresses for the various departments of the ERCC which handle X-Talk are given in Appendix V.

X-Talk is available in four options, depending on the default file transfer option you require - see section 3.2.2, File Transfer Type for details. The ROM type number you should specify in your order is constructed from the version number (currently 2.2) appended with "D", "T", "B", or "W" depending on the default transfer type. Thus for instance a chip defaulting to tape file transfer would be specified as "XTALK2.2T". If you have discs, you should opt for XTALK2.2D.

1.4 Installation

To install X-Talk, you should have:

- X-Talk chip or disc image
- Function key strip
- Serial connecting lead between BBC micro and host computer
- This User Note

Your X-Talk chip may be placed in any spare 'sideways ROM' (paged ROM) socket in the BBC, subject to one or two restrictions. If you do not feel confident about installing the chip yourself, contact ERCC Service Support Unit (King's Buildings), and they will make arrangements to install it for you. See Appendix III, Installing the Chip, for details of how to install the chip, and for a discussion of the question of priority.

The serial connecting cable should be plugged into the RS423 socket at the back of the BBC micro. Unfortunately, the 5-pin DIN socket is such that the plug can be inserted in two orientations. No damage will occur if the wrong orientation is tried (so long as it is not left connected for long periods). The correct orientation is with the screw on the plug body towards the video output connectors at the back of the case. The other end of the cable is provided with a 25-way plug which mates with the host computer terminal outlet.

Installing X-Talk in sideways RAM from a disc image is usually done with the *LOAD command if you have a BBC model B with sideways RAM, or with the *SRLOAD command if you have a BBC Plus 128 or BBC Master. You will need to press BREAK (or control-BREAK on a Master) after loading the disc image.

Sections 2.1 and 2.2, opposite, describe how to use X-Talk in terminal emulation mode, and no further installation procedure is required if this is all you wish to do. However, in almost all cases, you will be going to transfer data to or from the host computer. It will then be necessary to arrange access to the appropriate software on the host which controls data transfer. This guide describes how to do this on EMAS. For other hosts, examine your local documentation or contact your system manager.

On EMAS 2900, the following two commands must be issued:

```
Command: OPTION SEARCHDIR=MICROS.EMASLIB
Command: OPTION ITINSIZE=16
```

On EMAS-3, the following two commands must be issued:

```
Command: SEARCHDIR MICROS:EMASLIB
Command: OPTION ITINSIZE=16
```

These need only be issued once, and will remain in effect until specifically altered, even if you log off and then log on again. Finally, if you are logged onto EMAS through a TCP, you will need to issue the command:

```
SETMODE FLOW=ON
```

This ensures that the TCP acts on the XON and XOFF flow control codes sent by X-Talk. Note that this setmode command does not remain in effect after you log off, so you should re-enter it whenever you log on, or else include it in a list of startup commands. This setmode command is not required for PADs. On EMAS-3, X-Talk does not work through a TCP.

2 TERMINAL EMULATION

2.1 Starting X-Talk

X-Talk is started with the 'star' command *XTALK, which may be given in upper case, lower case, or a mixture. If *XTALK is issued with no parameters (nothing following the command) the display mode used for terminal emulation is the current display mode. (A list of the eight available display modes is given in the BBC Micro Users Guide, page 301 (269).) Thus if *XTALK (with no parameters) is issued immediately after turning the micro on, mode 7 will be used. It is for this reason that if X-Talk is installed as the highest priority language in the machine, it will come up in mode 7 automatically when the machine is switched on.

If *XTALK is followed by a single digit from 0 to 7 inclusive, the corresponding display mode will be used. If no data is going to be transferred into or out of the micro's memory, it is usual to select mode 3, a 25 line by 80 column mode, using the command:

```
*XTALK 3
```

When it is desired to transfer into or out of the BBC's own memory, it may be necessary to use a different display mode which takes less memory. The most flexible mode for this purpose is mode 7, which leaves most of the memory available to transfer data into or out of. Section 4.5, Memory Transfer, gives further details.

2.2 Using X-Talk for Terminal Emulation

Having started X-Talk as described in the preceding section, the BBC micro will enter terminal emulation mode. Typing return several times, or the space bar several times, should wake up the PAD or TCP, allowing you to log on as normal. Note that it may be necessary to alter the baud rate before you can wake up a TCP.
See section 3.2.1, Baud Rate, for further details.

All the alphabetic keys and numeric keys work as you would expect in terminal emulation mode. The remaining keys (function keys, arrow keys, COPY key and BREAK key) have special functions.

BREAK — This key has its usual function of resetting the BBC computer, and restarting the current language (in this case X-Talk) in mode 7. The baud rate will remain at its previous value, but all other parameters will revert to their defaults. In combination with the control key, BREAK will reset the BBC micro to its state when first powered on - in other words, control-break is equivalent to switching off then switching on again.

FUNCTION KEYS — These keys when used by themselves generate the strings with which they have been programmed with *KEY commands (see BBC Micro Users Guide chapter 25). When used in combination with the control key, they invoke functions specific to X-Talk, as described in section 2.3, Using the Function Keys.

ARROW & COPY — The function of these keys is controlled by a configure option (see section 3.2.5, Cursor Keys Menu). When X-Talk is started, these keys behave just as they do in Basic - in other words, they are used to split the cursor and copy characters from anywhere on the screen to the current input line. Page 29 (22) ff in the BBC Micro Users Guide describes the action of these keys if you are unfamiliar with them. They are very useful in terminal emulation mode, where for instance a mistake has been

made in typing in a long command line. The line can be copied from its screen position to the current input line, and the error can easily be corrected without having to retype the whole line.

Characters received from the host are displayed on the screen. See Appendix II for details of the terminal emulation codes.

When listing a file to the terminal, the output can be suspended temporarily by sending control-S, and restarted by sending control-Q. Alternatively hold down the shift and control keys together.

2.3 Using the Function Keys

All the red function keys are used in combination with the control key to invoke the various functions of X-Talk. This section describes them all in turn. Note that these functions are only invoked when X-Talk is in terminal emulation mode. When transferring a file or entering a star command, these keys have no effect.

2.3.1. f0 and f1 - File transfer keys

Control-f0 initiates file transfer from the host to the micro, and control-f1 initiates file transfer from the micro to the host. The use of these keys is described fully in section 4, FILE TRANSFER.

2.3.2. f2 - Local Star Commands

Typing control-f2 places the cursor at the bottom of the screen, selects inverse video (in the two-colour display modes) and displays a * prompt. You may then enter a line of text, terminating it with return, and this line is then processed as an ordinary star command. Note that you should not precede your command with a *, as you would when issuing the command from Basic, for instance. You can think of the prompt as providing the initial *.

Using control-f2 allows you, for instance, to obtain a directory listing of a disc (*CAT), or to copy a disc (*COPY), or to enter another language (e.g. *WORDWISE). You can even execute a machine code program such as a disc formatter, provided the program is 'well behaved'.

This facility to issue star commands is very powerful, and like all powerful facilities it can be used destructively. Many of the *FX commands (BBC Micro Users Guide chapter 42 (43)) are used by X-Talk, and issuing these with control-f2 will cause problems. If you are unsure which FX commands you are free to use, do not use any.

One other * command which should never be used from X-Talk is *BASIC. Although any *other* language can be entered from X-Talk with a * command, Basic must always be entered with control-f6. (If you are interested, the reason is that *BASIC does not act through an OSBYTE 142 call.)

2.3.3. f3 - Configure key

The use of this key is described fully in section 3, CONFIGURING X-TALK. It allows you to set the baud rate, file transfer type, and certain other parameters.

2.3.4. f4 and f5 - Printer control keys

These two key combinations switch a local printer on and off. Control-f4 turns the printer on, so that anything which subsequently appears on the screen will also appear on a printer connected to the BBC micro. Control-f5 will switch the printer off again. Using a local printer in this way is often useful, for instance to obtain a hard copy of a file without having to direct it to one of the host's printers and wait for the output. Note that attention is paid to the printer type as set by the *FX 5 command (BBC Micro Users Guide page 423 (401)). The printer type should be parallel (*FX 5,1) or network (*FX 5,4). Attempting to use a serial printer type will result in disaster, since the BBC's only serial port is used for connection to the host. If you are using a network printer on a BBC connected to an Econet, characters will be lost unless you use a baud rate of 1200 baud or less (see section 3.2.1). Note that if no printer is connected, using control-f4 will cause the BBC micro to 'hang' once the printer output buffer is filled up. Press the BREAK key to escape from this condition.

2.3.5. f6 - Return to Basic

Control-f6 results in a controlled return to Basic. Note that this route *must* be used to return to Basic rather than issuing *BASIC - see section 2.3.2 for details.

2.3.6. f7 - Send a Line Break

Control-f7 generates a line break for about one second. On PAD connections, this will bring up the *PAD>* prompt. On some terminal exchanges, one or two line breaks will wake up the exchange.

2.3.7. f8 - Screendump

Control-f8 will initiate a screendump to an attached printer, which must be either a parallel printer (*FX 5,1 - the default) or a networked printer (*FX 5,4). Attempting to use serial printer types will result in disaster. Note that the printer must be "Epson compatible". Provided the screen has not been scrolled since the last screen clear operation, an image of the current screen contents will appear on the printer. This facility is designed to provide hard copy of graphical screen displays, rather than text output. Use control-f4 and control-f5 to obtain hard copy of text files. One other restriction is that the screendump works only in modes 0 to 6 inclusive. Note that this screendump facility is also available from other languages, using a star command. See section 5.1, Screendump.

A point to watch is that the screendump routine uses zero page locations from &70 to &8F. This has the side effect of destroying any Wordwise text held in memory, so do not do a screendump if you are using Wordwise.

On the BBC micro Plus and the BBC Master, the screendump works correctly whether you are in shadow mode or not.

2.3.8 f9 - Monitor Mode

The control-f9 key toggles the BBC into and out of 'monitor mode'. Pressing control-f9 once puts you in monitor mode; pressing it again takes you back to normal mode. In monitor mode, instead of acting on the control characters sent by the host as though it was executing VDU statements (see Appendix II), all control and top-bit set characters are displayed on the screen as special two-letter characters. Appendix IV lists these characters against the control characters they represent.

Note that the DEL character (hex 7F, decimal 127) is displayed as a diamond or rhombus. Any characters which have the top bit set are displayed in inverse video.

You should use monitor mode in display modes 1 or 6 (i.e. start X-Talk with *XTALK 1 or *XTALK 6), since these 40-column modes make the control characters most legible.

3 CONFIGURING X-TALK

3.1 Using the Configure Menus

Control-f3 will display the 'configure screen'. This screen consists of five 'configure menus' which allow the user to set up certain communications parameters for file transfer and terminal emulation. Each configure menu consists of two or more 'configure options', only one of which may be selected in each menu.

To select an option first move the cursor to the menu containing that option. This is done by pressing the TAB key until the menu required is highlighted (or coloured cyan). The cursor will be positioned at the currently selected option within the selected menu. To change this press the SPACE bar until the desired option is highlighted (or coloured white). Repeat the use of the TAB and SPACE keys until the desired configuration is achieved. To leave the configure option screen press the ESCAPE key, which returns you to terminal emulation mode.

3.2 The Configure Menus

This section describes each of the configure menus in turn, in the order they appear on the configure screen. Each menu has a default option, which is selected when X-Talk is entered.

3.2.1 Baud Rate

The baud rate is the speed at which a serial data link transfers data between two devices. The baud rate of the two devices (BBC micro and host computer) must be matched before data transmission can take place. X-Talk offers a selectable symmetric baud rate between 75 and 19200 baud and an asymmetric 75(transmit)/1200(receive). The latter is suitable for talking to Prestel through a modem. The default setting, on power up, is 9600 baud - suitable for a PAD or VAX connection. If a different baud rate is required it must be selected before attempting to communicate with the host. If the baud rate is changed then the new value will become the default baud rate until a hard reset (control+BREAK) or power up, when it will revert to 9600 baud. (However, the default baud rate may be changed on the BBC Master with the *CONFIGURE command.)

3.2.2 File Transfer Type

The selection made from this menu determines the type of file transfer when using control-f0 (get file from host) or control-f1 (put file to host) functions. The default option is dependent on the version of X-Talk fitted to the machine, as described in section 1.3.

The five file transfer modes which may be selected are: disc transfer, tape transfer; and three transfer modes which operate directly into or out of memory: Basic program transfer, Wordwise text transfer, and arbitrary memory block transfer.

Note that no X-Talk ROM is available with the last-named mode as the default option, since it is rarely used. A full description of these options is given in section 4, FILE TRANSFER.

The selected file transfer option will remain in effect until X-Talk is re-entered or the BREAK key is pressed.

Note that selecting any of the three memory transfer options will prevent the 'protocol' and 'data mask' options from being set. Although the selected options on the screen will remain unchanged, when the ESCAPE key is used to exit the configure screen the 'protocol' is forced to 'binary' (for Basic and Memory transfer - 'text' for Wordwise) and the 'data mask' to 8-bit. You can see this by selecting (say) Basic transfer, exiting with ESCAPE, and then pressing control-f3 again. The 'protocol' and 'data mask' options will have changed, and it is impossible to set them without first altering the file transfer mode.

3.2.3 Binary and Text Modes

Files can be considered as one of two types, either 'text' or 'binary'. A text file is a file containing lines of printable characters terminated by a newline character or characters. For instance, the spooled output from Wordwise is of this type. BBC micro programs which use text files normally use either a CR or a CR LF combination to represent a new line. EMAS on the other hand always uses a LF only, and other hosts may have different conventions. Therefore when a text file is sent to or received from the host, the newline character must be converted to an appropriate form. With the text mode option selected (the default option) the BBC micro will carry out part of this newline translation, and the host will do the rest. If the file is a 'binary' file where the CR and LF characters do not necessarily mean 'take a new line', then no newline translation is required.

3.2.4 Data Mask

This option allows the user to strip the top bit off incoming characters before they are processed by the VDU drivers. The main use of the 7-bit option is to allow hosts which add a parity bit to outgoing characters to be used sensibly. However, many of the facilities which the VDU drivers in the BBC provide cannot be used in this mode, and for this reason the 8-bit mode is the default. 7-bit mode is never used when logging on through a PAD or TCP to EMAS.

3.2.5 Cursor Keys Menu

The BBC micro has four cursor control keys and a copy key, the function of which is determined by the option selected from this menu. The default setting is 'local' and in this mode the keys function as the local BBC editor (see BBC Micro Users Guide page 29 (22) ff). If the 'remote' mode is selected these keys will generate ASCII codes 135 to 139 unless the base value has been changed with *FX 225. The 'program' option permits the keys to be programmed in the same way as the user-defined function keys.

4 FILE TRANSFER

One of the principal facilities of X-Talk is to provide the user with a file transfer capability. X-Talk can transfer files to and from three storage media available to the BBC micro. X-Talk supports file transfer with disc, tape and the BBC's own memory.

The memory transfer supports Wordwise and Wordwise Plus text, BBC Basic programs, and a user definable memory block.

4.1 Selecting File Transfer Mode

Before commencing a transfer, you should check that the correct file transfer mode is selected. Control-f3 displays the configure screen, and the currently selected file transfer mode is highlighted in the corresponding menu. Alter it if required as described in section 3. You should also select either 'binary' or 'text' transfer, as appropriate for the file you are transferring, but note that selecting one of the memory transfer modes will automatically select the correct protocol.

4.2 General Operation

This section describes features which are common to all file transfer modes.

To initiate a file transfer, press control-f0 (transfer from host to micro) or control-f1 (transfer from micro to host). You will be reminded of the file transfer mode and direction by a message such as *Disc >>> Host*, and then prompted for the filenames. If you have made a mistake and need to go back to terminal mode to change the transfer mode, pressing the ESCAPE key in response to the filename prompt will get you out.

The first prompt is usually for the source filename (the name of the file which is to be transferred), and the second prompt is for the destination filename (the name which will be given to the new file on the destination machine). If the transfer is to or from the BBC's memory, only the host filename is required, either as source or destination.

If more than one file is to be transferred, you may specify a list of filenames separated by commas, and the files are transferred one after another, the source and destination filenames being associated according to their positions in the list.

When a transfer starts, the source filename is printed on the screen. To indicate progress, a greater than sign (>) is displayed for every 256 bytes transferred. At the end of the transfer the destination filename is printed, and either the next transfer commences, or X-Talk returns to terminal mode.

When a transfer is in progress, you may abort it prematurely by pressing the ESCAPE key. If an error occurs, the transfer will be aborted and an error message printed. Error messages are described in Appendix I, Error Messages.

4.3 Disc Transfer

This facility is only available to users with a machine fitted with a disc drive unit and the Acorn DFS (Disc Filing System) or ADFS (Advanced Disc Filing System), and to Econet users. The disc file transfer option allows the user to transfer any file held on a BBC formatted disc to or from the host computer.

To transfer a file or files, follow the procedure in section 4.2. The main point to watch is that when transferring from host to micro, if you specify a destination filename which already exists on the BBC micro, you will be asked if you wish to overwrite the contents of the existing file. Respond with a Y or N.

4.4 Tape Transfer

In this mode, X-Talk will transfer BBC format cassette tape files to and from a host computer. It will not transfer copy protected tapes.

If the machine is fitted with a disc interface you should select the cassette filing system before initiating a transfer. This is done by pressing control-f2 (to enter local commands) and entering TAPE followed by a return in response to the * prompt. A second return will return to terminal emulation mode (see section 2.3.2). No error message is given if the tape filing system is not selected when a tape transfer is attempted, and the behaviour of the system in such circumstances is unpredictable.

The general procedure for transferring tape files is as described in section 4.2.

The filing system has no way of knowing where files are on the tape and therefore cannot access or load a file unless the tape is correctly positioned. This means that you must ensure before initiating a transfer to the host that the tape is positioned before the start of the file you wish to transfer. When saving files to a cassette you should note the tape counter reading so that files can be located easily in the future.

When sending files to the host, you may specify a list of files as described in section 4.2. As the tape filing system only supports sequential access to files, the order of the list must be identical to the order of the files on the cassette. It is important to note that if the tape file does not exist on the cassette no error will be returned. The only exit from this condition is to press the BREAK key, which will re-enter X-Talk and reset the default options. Note that X-Talk does not support the use of a null filename when reading a tape file.

When receiving files from the host you may also specify a list of files to be transferred. The files from the list are transferred in the order specified and placed on the tape in that same order. You should ensure that the tape is positioned at the start of a free section before the transfer is initiated, and that sufficient tape remains to accommodate the files. You will be prompted with the message *RECORD then RETURN* at the start of every file during the transfer. Press the record and play buttons on the recorder and then press return. When several files are being transferred, this message will appear before each transfer, so a multiple transfer from the host to BBC micro cassette tape cannot be left unattended. (The BBC's cassette filing system insists on this.)

4.5 Memory Transfer

This facility allows the user with no local backing storage to transfer data to and from a host computer. Local data is held in the BBC micro's RAM area. X-Talk supports three types of memory transfer: Wordwise (or WordwisePlus) text held in memory, a Basic program in memory and a user definable memory block. The first two are designed to be easily used by all users and the latter is a 'no extra cost' facility for the more experienced BBC user.

4.5.1 Basic Program Transfer

The Basic program transfer mode provides the user with the opportunity to use a host computer to store their Basic programs. This mode will transfer Basic programs in 'tokenised' form to and from the host.

Transfer is initiated as described in section 4.2, except that no local filename is required. The transfer proceeds as usual, except that where the local filename would appear on the screen, it is replaced by the string *.Memory*.

The usual sequence of events would be to type in a program using the Basic interpreter, and then to invoke X-Talk, select Basic to host transfer mode, and initiate the transfer with control-f1.

The program is transferred to the host in 'tokenised' form (see BBC Micro Users Guide page 483 (473)), so before it can be listed to an output device, it must be 'detokenised'. A utility to do this has been provided on EMAS (see section 5.6.1, DETOKENISE). Once detokenised the program will be a plain ASCII text file and can be listed on the terminal or on a line printer in the normal way. However, there is currently no utility available to 'tokenise' an ASCII file into a BBC Basic file. The only way to do this is to transfer the ASCII file from the host to disc or tape, and use the *EXEC command to load it into the BBC micro (see BBC Micro Users Guide page 394 (364)).

To transfer a Basic program from the host to the BBC, select Basic file transfer mode using the configure screen, then press control-f0. When prompted for the remote filename, enter the name of a 'tokenised' BBC Basic file on the host. The transfer will then proceed as described in section 4.2 except that the local filename will be replaced by the string *Memory* on the screen. Once the transfer has successfully completed, you can log off from the host if no further use is anticipated, and then re-enter Basic using control-f6. The Basic program can be recovered by entering the command OLD and then the program can be LISTed or RUN.

The program will be transferred into the BBC micro at the value of PAGE which was in force before entering X-Talk. If the program is of a length that would exceed the Basic variable TOP then the transfer will be aborted with an appropriate error message. A full description of the variables PAGE and TOP are given in the BBC Micro Users Guide. Note that when re-entering Basic, PAGE is reset to its default value, so that if you transferred the Basic program at a different value of PAGE, you will need to set it to its previous value before entering OLD to recover the program.

4.5.2 Wordwise Text Transfer

To use this facility there must be a Wordwise or WordwisePlus ROM installed in the BBC micro. It is primarily designed for users of BBC micros as public area terminals, and allows Wordwise to be used sensibly on these machines. Wordwise text can be loaded and saved on the host, and hard copy can be obtained on a local printer connected to a PAD using the XON/XOFF printer driver described in section 5.2, Using XON/XOFF Serial Printers. It also gives users the opportunity to edit host text files using Wordwise without having to have any local storage.

This document assumes the user is familiar with the operation of Wordwise or WordwisePlus. The file transferred to and from the host must be either in Wordwise File.Format (a file containing embedded Wordwise commands) or a plain ASCII text file.

Before initiating a transfer from the host using control-f0, you *must* enter Wordwise(Plus) with *WORDWISE (or an abbreviated form). (This is so that the BBC's main memory area and certain zero page locations are correctly set up ready for transfer.) You can then leave Wordwise(Plus) from the main menu by entering *XTALK. (Note that no parameter may be given after *XTALK, as the mode *must not* be changed. This restriction is inapplicable on the BBC Plus and BBC Master in shadow mode only.) A file transfer can now be initiated using control-f0, and will proceed as described in section 4.2. As with the Basic program transfer, *Memory* is used on screen instead of the local filename. On completion of the transfer the text can be recovered by re-entering Wordwise(or WordwisePlus), and (in the former case) entering "Y" in response to the *Old text?* prompt. You may now proceed as if the text had been loaded from disc or tape.

Wordwise(Plus) text held in memory may be transferred to a host computer using control-f1. Before initiating the transfer, you *must* position the Wordwise cursor at the top of the text before returning to the main menu. Enter *XTALK without any parameters to avoid changing mode, and proceed as for the Basic file transfer.

If you are using Wordwise to enter text for subsequent processing on the host, you should be aware of the way that Wordwise handles its text. If you do not use any of the Wordwise embedded commands, the text transferred to the host will be an ordinary ASCII file, apart from having no newlines except at paragraph breaks. There are two ways round this: the first is to use an editor on the host to reformat the text into a more acceptable form (the L command in EDIT on EMAS is suitable for this), or specifically to press return at suitable points in the file when in Wordwise. The former method is suitable for textual material and the latter for program source.

4.5.3 Memory Block Transfer

This section details the operation of the memory block transfer. This utility is intended to provided the experienced user with the full flexibility of the memory transfer. It permits the transfer of data into or out of any valid memory address within the BBC micro. Before initiating a memory block transfer to the BBC micro you should fully understand the internal memory layout of the BBC micro. The BBC Micro Advanced User Guide is a good reference book for this purpose, or for the BBC Master, the BBC Master Reference Manual Part 1.

A memory block transfer is initiated with control-f0 or control-f1 and proceeds as described in section 4.2. The only difference is that instead of the local file name prompt, you are asked to specify a "memory address string". If you are transferring from the BBC to the host, you must specify (in hexadecimal) a starting address and a length. If downloading from the host to the BBC, only a starting address need be given.

The format of the address string is:

start address ; length

The start address must be a 4 digit hexadecimal number (including leading zeros if necessary) followed immediately by a semicolon. The length (if present) must be a 4 digit hexadecimal number (including leading zeros if necessary). If the length is not present, the start address must still be terminated by a semicolon. Any other format will result in a "Memory image data error". The address plus the length must not exceed FFFF(hex). Note that if a file being transferred from the host would overrun the end of memory then the transfer is aborted.

The following are valid strings:

1900;2000
0900;00FF
0E00;7AFF

whereas these strings will generate errors:

190H;2000
900;00FF
0E00;FFFF

because the first contains a non-hex digit, the second has a digit omitted from the start address, and the third exceeds the memory size.

Note that on the BBC micro Plus and Master, the memory transfer works to and from the main system RAM, rather than the auxiliary (shadow) RAM.

4.6 Recovery from Malfunctions

No problems should be encountered in terminal emulation mode if the instructions in this document are adhered to. If any problems do arise, pressing BREAK should always get you out of trouble.

If the BBC hangs repeatedly when you are logged on through a TCP, make sure you have done a SETMODE FLOW=ON as described in section 1.4.

If by mistake you list a file to the terminal which contains a range of control codes (such as a tokenised Basic program), you will probably find that your terminal will change mode, colour, will turn on the printer, and/or will just hang. The only way out of this is to press BREAK, followed by control-Q to release the data flow.

If a problem occurs during file transfer, X-Talk will print an explanatory error message and close the transfer down gracefully. Sometimes, it will leave a part-file at the transfer destination, which should be destroyed before the transfer is reattempted. If however the transfer appears to be stuck, or if the BREAK key is accidentally pressed, it will be necessary to take action as follows:

1. If the transfer is stuck, wait at least 5 minutes before interfering. Then press the ESCAPE key in an attempt to abort the transfer. If nothing happens, press the BREAK key.

2. Having pressed BREAK, press return or the space bar several times (depending on whether you are logged in through a PAD or a TCP). If there is no response, you should proceed as below according to the direction of the file transfer which was in progress when the problem occurred.

3. If the transfer was from micro to host, type a question-mark (?) followed by two returns.

4. If the transfer was from host to micro, type a control-Q followed by ESCAPE, "A", return, return.

5. Repeat from stage 2.

6. If all else fails, please contact the ERCC Advisory service; or - out of hours - ring the host operators and ask them to log you off.

If you have continuing problems, please contact the ERCC Advisory service.

5 OTHER FACILITIES

5.1 Screendump

The same screendump routine which is invoked by control-f8 (section 2.3.7) is available through the command:

```
*SCREENDUMP
```

This command can be issued from any language, for instance Basic or Pascal. The restrictions mentioned in section 2.3.7 still apply.

5.2 Using XON/XOFF Serial Printers

When the BBC Micro is first switched on, it assumes that any output from a program to a printer will be directed to an attached parallel printer. You can change this with the *FX5 command (BBC Micro Users Guide page 423 (398)). Thus, to select a serial printer which uses hard-wired handshaking, type *FX5,2. To select a printer linked to your BBC micro via an Econet, type *FX5,4. To select a 'null' printer, which just throws away any output sent to the printer, type *FX 5,0. Finally, to re-select a parallel printer, type *FX 5,1.

Most printers which connect to the serial port of the BBC micro can use hard-wired handshaking, meaning that when the printer becomes busy (usually because it has been sent enough data 'to be getting on with'), it activates a 'busy' signal, which is wired to the BBC micro. However, some printers do not use this handshaking method. Instead, when they become busy they send an XOFF character to the micro, and when they are no longer busy and are ready to accept more data, they send an XON character. This is known as XON/XOFF flow control, and the BBC's operating system does not normally understand it.

When the X-Talk ROM is installed, it is possible to use XON/XOFF printers on the BBC's serial port by issuing the *FX 5,3 command. This initialises a 'user printer driver' in the X-Talk ROM. The printer will then work as normal, and any XON or XOFF codes it sends will be acted on by the printer driver.

One or two tips on using the *FX 5,3 command. The printer driver maintains a note of whether the last command from the printer was XON or XOFF. (It actually keeps this information in the User Flag accessed by *FX 1.) Every time a *FX 5,3 is issued the printer status is set to not busy. It is best to issue a *FX 5,3 every time the printer is switched on, in case it was busy when last switched off. Never issue a *FX 5,3 or *FX 5,2 when you are in or about to enter terminal emulation mode. Software which makes use of the User Flag may not work correctly if *FX 5,3 is selected.

5.3 Using a Printer on a PAD

The XON/XOFF printer driver can be used to output data to a printer connected to a PAD when the BBC micro is connected to the same PAD through its serial port. Some PADs have a printer attached to one of their ports instead of a terminal. The printer can be used by any microcomputer or terminal on the PAD, but only by one at a time. To obtain access to the printer from your BBC micro, bring up the *PAD>* prompt by hitting return several times. Type CALL TTY10. This connects you to PAD line 10, which is normally the one with the printer. Successful connection will be indicated by an *Incoming call* message appearing on the printer - nothing will happen on the BBC's screen. If the printer is busy, or otherwise unavailable, a *Call cleared* message will appear on the BBC micro.

Having established a connection to the printer in this manner, you may now leave X-Talk and proceed to use the printer. You should issue a *FX 5,3 to select the XON/XOFF printer driver, but it is not necessary to set the baud rate using *FX 7 or *FX 8, because X-Talk has already done this. (This baud rate is maintained over a BREAK, but it reverts to the default value after a CTRL-BREAK.) If in Wordwise, use option 6 to print your text as normal. In Basic, use control-B and control-C (or VDU2 and VDU3) to switch the printer on and off.

When you have finished printing, it is *imperative* that you clear the connection between your terminal and the printer. If you do not do this, then no one else will be able to access the printer. Re-enter X-Talk in terminal emulation mode and type control-P followed by A. The *PAD>* prompt should appear, and you should type CLEAR. A *Call Cleared* message will appear, and the connection between your micro

and the PAD will be broken.

5.4 X-Talk and the 6502 Second Processor

X-Talk works on the 6502 second processor, but you may find that it runs slightly more slowly. The *SCREENDUMP and *FX5,3 commands still work.

Note that a ROM image of X-Talk on disc cannot be loaded into the second processor's memory, as is possible with some other ROMs. This is because part of X-Talk must always exist in the I/O processor memory. Of course it may be loaded into sideways RAM and executed from there, even if the second processor is switched on.

5.5 BBC Micro Software Library and Bulletin Board

There is a software library for the BBC Micro on EMAS, which is accessible by typing:

Command: VIEW MICROS.BBCSOFTLIB

It contains instruction for using the library.

There is also a BBC Users bulletin board, for the exchange of information relating to the BBC Micro. Enter the following commands to subscribe to the bulletin board:

Command: MAIL
Mail: BB BBCUSERS

5.6 Supporting Software on EMAS

The support software on EMAS for users of X-Talk on the BBC micro falls into two categories. There is the software which primarily performs a function on EMAS and interacts with the user through X-Talk terminal emulation (e.g. DRAWPICTURE), and there is software provided to perform tasks specific to the BBC Micro. Only the latter software is described here. Documentation for DRAWPICTURE can be found in ERCC User Note 75.

All the software described in this section is contained in the directory MICROS.EMASLIB on EMAS 2900, MICROS:EMASLIB on EMAS-3. The once-only command to install this directory in your search list is described in section 1.4, and should be given before the commands and routines documented below can be used.

The software described below falls naturally into two categories: commands and routines. The former are normally entered from the keyboard, whereas the latter are called only from within a program.

5.6.1 Commands

STAR — The command STAR invokes the BBC Micro's operating system command line interpreter. It accepts the parameters which an ordinary BBC * command line expects. Thus, to obtain the catalogue of a floppy disc from within X-Talk, you could type "control-f2 cat <return>", or (in response to the *Command:* prompt from EMAS) just "star cat <return>". Similarly, you can copy a file from one drive to another:

```
*COPY 0 1 FILNAM          from Basic, or
STAR "COPY 0 1 FILNAM"    from EMAS.
```

(Note that this operation will overwrite any data currently held in memory.) Where the parameters for the star commands contain spaces, as above, they should be enclosed in double quotes, to ensure that the spaces are passed to the BBC micro correctly. This facility can be used to program the function keys, and it would be possible for instance to have a startup file on EMAS which would include the necessary star commands to program the function keys. For instance you might have:

```
STAR "KEY 0 FILES|M"
STAR "KEY 1 ANALYSE"
STAR "KEY 2 DESTROY"
STAR "KEY 3 QUIT|M"
STAR "KEY 4 |PB"
STAR "KEY 5 |PA"
```

Note that control characters are entered by preceding the corresponding letter with a vertical bar. Thus, in the above example, f5 brings up the *PAD>* prompt, and f4 the *Int:* prompt when you are working through a PAD. Remember that your function key settings are cleared if you power off the BBC micro or if you hit control-break. A maximum of 80 characters may be passed to the BBC's command line interpreter using this command. A further point is that if you are logged in over a PAD, you will need to make sure that either 'noprintmask' is set, or you are in 'transparent' mode. Refer to your PAD users guide for details.

Clearly, the STAR command can be executed by an IMP program, just as any other EMAS command.

DETOKENISE

This command will convert a tokenised Basic program into a form which can be listed on EMAS, edited, sent to a line printer, or generally handled like any other ordinary file of text on EMAS. Unless it has been *SPOOLed, a BBC Basic program file sent to EMAS from disc, tape, or directly from the BBC's memory, will be in 'tokenised' form. This means that the line numbers and keywords in the program are stored not as ordinary characters, but as 'tokens'. A list of these tokens is given in the BBC Micro Users Guide page 483 (473). (Note that when transferring a tokenised program you must use binary mode.) Since EMAS knows nothing of these tokens, listing the file or sending it to a printer will just produce garbage. Do not attempt to list a tokenised file on EMAS! It will do strange things to your BBC, and may lock it up completely! If you just wish to use EMAS to store your Basic programs, there is no need to detokenise them. If you do wish to send the program to a printer for instance, then you can create an ordinary EMAS text file from your tokenised program with the command:

Command: `DETOKENISE INFILE,OUTFILE`

where `INFILE` is the name of the tokenised input file, and `OUTFILE` is the name of a new file which will contain the output text of your program. Note that the inverse operation (creating a tokenised program from a text file) is not currently possible on EMAS. To do this, you must download the text of the program from EMAS to disc or tape, and then used NEW followed by *EXEC to load it into memory. This will entokenise the program, and a subsequent SAVE

will save it in tokenised form.

WORDWISE — This command is designed to take a Wordwise Format File (containing embedded Wordwise commands) and generate output for a document printer on the ERCC network. At the time of writing (2/5/86) it is not yet available.

5.6.2 Routines

The routines described here generate most of the escape sequences described in Appendix II. Note that the PAD *must* be in transparent mode (or have noprintmask set) for these commands to work.

Some of these commands (the USR and POKE commands in particular) are 'dangerous' in that they can cause X-Talk to crash if you do not know what you are doing.

Equivalent Basic Keyword: ENVELOPE
Imp Spec: %EXTERNALROUTINESPEC envelope (%INTEGER a,b,c,d,e,f,g,h,i,j,k,l,m,n)

Equivalent Basic Keyword: SOUND
Imp Spec: %EXTERNALROUTINESPEC sound (%INTEGER a,b,c,d)

Equivalent Basic Keyword: ADVAL
Imp Spec: %EXTERNALINTEGERFNSPEC adval(%INTEGER channel)
Explanation:
The value returned by the function is the value of the ADC channel. Note that because of the nature of a timesharing system like EMAS, and the nature of the comms network, it is impossible to use this call to sample the ADC at a regular rate.

Equivalent Basic Keyword: USR
Imp Spec: %EXTERNALINTEGERFNSPEC usr(%INTEGER address, c, y, x, a)
Explanation:
The values supplied by the calling program are loaded into the appropriate registers and a JSR to the given address is executed. On return from this subroutine call, the values of the flags, Y, X and A registers, are returned to the caller as the integer result of the usr function, the integer being formed from the registers in the order PPYYXXAA, just as in BBC Basic. You should be quite sure that the routine you are calling in this manner will eventually return, and will not cause havoc in the BBC's operating system.

Equivalent Basic Expression: ... =?address (i.e. PEEK)
Imp Spec:
%EXTERNALROUTINESPEC peek(%INTEGER address, count, %BYTEARRAYNAME x)
Explanation:
On return from this routine, the array x contains the values read from the BBC micro's memory, starting at the given address. The maximum number of bytes which may be read (i.e. maximum value of the count parameter) is 127 (a limitation introduced by the comms network rather than the BBC).

Equivalent Basic Expression: ?address= ... (i.e. POKE)
Imp Spec:
%EXTERNALROUTINESPEC poke(%INTEGER address, count, %BYTEARRAYNAME x)
Explanation:
The bytes in x are poked into memory starting at the address given. No more than 256 bytes may be poked in this way.

Appendices

I Error Messages

Most error messages produced by X-Talk are preceded by a double star. For instance, if an invalid star command is issued, the message *** Bad Command* will be printed. Most of the other errors which are produced by the BBC's operating system and disc filing system will appear like this whenever they occur.

X-Talk itself can generate a number of errors. Again, they are preceded by a double star. They are described individually below.

*** Checksum Faulty.* The checksum received by the BBC following a transfer from the host to the micro did not match the checksum calculated by the BBC itself. It is likely that the data received has one or more missing or garbled characters.

*** No Checksum.* Following a transfer from the host to the BBC, the host did not send a checksum. This message should never occur.

*** Transfer aborted by user.* This is not really an error message; it merely confirms that you have terminated the transfer prematurely by pressing the ESC key.

*** Transfer aborted by host.* The host has terminated the transfer prematurely - perhaps it has gone down.

*** Trigger character not received.* The host has not sent the appropriate start of file character. This message usually precedes an error message from the host.

*** Incorrect prompt from host.* This usually indicates that the support routines on the host have not been correctly set up. See section 1.4.

*** Unable to open local file.* The local file specified in a transfer from BBC to host does not exist. Check your spelling of the file name, and check that you have specified the correct disc drive, and that the correct disc is in the drive.

*** Null filename.* No filename was entered in response to a prompt, or ESC was pressed during entry of the name.

*** Memory image data error.* An invalid memory address specification was entered. See section 4.5.3 for details of how to specify a valid memory address.

*** Transfer aborted - file too large.* During a transfer from host to memory (section 4.5), the host file proved too large to transfer into the available memory space.

*** No Text.* An attempt has been made to transfer Wordwise text out of memory when there is actually no text in memory. This may arise if you have used a mode other than mode 7 since entering your text.

In addition to errors generated by the micro, the X-Talk host software can itself generate errors. They are described here as they appear on EMAS; other hosts will have similar messages.

*** Host: Illegal filename.* The remote filename specified is not a valid EMAS filename.

*** Host: File already exists.* A transfer from the BBC to the remote system has been initiated with a remote filename already used by an existing host file. Specify a different filename.

*** Host: PD file does not exist.* On EMAS, a PD file member has been specified as the remote filename, but the PD file itself does not exist.

*** Host: Abnormal termination. Checksum faulty.* Following a transfer from the micro to the host, the checksum transmitted by the micro did not match that computed by the host. One or more characters in the transmitted file are probably either missing or garbled. Re-transmit the file.

*** Host: No checksum.* The micro has not sent a checksum to the host at the end of a file transmitted from the micro to the host. This may happen for instance if an error occurs on the BBC during the transfer which causes the micro to abort the transfer. In such cases, only part of the file may appear on EMAS.

*** Host: File XXXX does not exist.* The file specified for transfer from the host to the BBC does not exist on the host. Check your spelling of the file name.

*** Host: File XXXX cannot be connected.* The specified file cannot be accessed by you. This may be for several reasons - check that you have read permission for the file.

*** Host: File XXXX is not a character file.* EMAS has several types of file, including DATA, CHARACTER, PARTITIONED and DIRECTORY. Only CHARACTER files can be transferred. Contact ERCC Advisory for information on the different file types.

*** Host Error PAD settings failed.* This error should never occur. If it does, please contact ERCC Advisory with all the relevant details.

*** Host Error PAD settings timed out.* This error should never occur. If it does, please contact ERCC Advisory with all the relevant details.

Other problems commonly encountered are:

- Disc drive set to wrong number of tracks. The symptom is a message of the form *** Disk fault nn at tt/ss.* If you are using 40 track/80 track switchable disc drives, check that the switch is set to the appropriate number of tracks for your disc.

- The transfer hangs for no apparent reason when you are using a PAD. Versions of X-Talk prior to 1.3 do not work through a PAD - you should contact ERCC Administration to order an up-to-date version.

II Specification of X-Talk's Terminal Emulator

This appendix describes the control codes used by the host computer to control the BBC micro when using X-Talk in terminal emulation mode. Note that future versions of the chip may have extended specifications. Check that this document refers to the version of X-Talk which you are using.

The basic philosophy is that whatever codes the host sends to the BBC micro are passed directly to the BBC's 'VDU drivers'. This means that whenever the host sends a series of ASCII codes m,n,o,p, ... to the BBC micro, the latter executes the 'VDU' statement VDU m,n,o,p, ... Printable ASCII codes are displayed on the screen, while control codes between 0 and 31 inclusive cause the actions specified in Chapter 34 of the BBC Micro Users Guide. This mode of operation is called 'Native Mode' (NM) terminal emulation, and it means that all the graphics facilities available on the BBC can be invoked by the host. It also means that using the ASCII control code 23 (equivalent to VDU23), alternative character sets can be downloaded into the Micro from the host, and can be displayed using codes greater than 127.

The terminal emulation actually provided with X-Talk is called 'Edinburgh Enhanced Native Mode' or EENM. It provides a superset of ordinary NM emulation as described above. In NM emulation, the <ESC> character (escape, ASCII 27) is null, in the sense that it is ignored if received. In EENM, <ESC> may be followed by one or more characters, requesting special action by the BBC Micro.

The 'escape sequences' currently supported by EENM are as follows.

<ESC> * All characters up to the next carriage return (CR) or line feed (LF) are passed to the BBC's Command Line Interpreter (OSCLI). If more than eighty characters are received before the CR or LF, no action is taken and the excess characters are printed on the screen. (This escape sequence is used by the EMAS "STAR" command.)

<ESC> <SUB> This sequence puts the BBC into "graphics input mode". A cross-hair cursor appears on the screen, and may be moved about by the cursor keys. Note that the cross-hair cursor appears in inverse video, so that if part of the cursor lies on top of a line, both cursor and line disappear in the overlap. This can sometimes be a little disconcerting. The cursor can be moved about using the arrow keys for small movements, or the arrow keys in combination with SHIFT for larger movements. Having positioned the cursor, the user may press any printable key (between ASCII 32 (space) and 126 (tilde) inclusive). The BBC then sends the key pressed, the X-coordinate and the Y coordinate to the host, terminated by a CR. It then ignores any output from the host until an echoing CR is received, so that the echo of the key pressed and the cursor coordinates do not disrupt the screen display. The cursor position coordinates are numbers between 0 and 1023 (Y) or 0 and 1279 (X), corresponding to the BBC's own graphics coordinate system. (Note that if the graphics origin has been moved, odd results will occur.) A coordinate is sent as two bytes, both of them printable characters:

coordinate = 32*(High byte -32)+(Low byte -32)

This is similar to the graphics input mode of Tektronix displays.

The following escape sequences take parameters which are sent in hex. Some of them will cause the BBC to respond with data, also in hex. When this is the case, the BBC will terminate the data with a <CR>, and will throw away the echo of the data it has sent.

<ESC> | E nn nn nn nn nn nn nn nn nn nn nn nn nn nn

Parameters: Fourteen bytes (each sent as two hex digits), as required for the ENVELOPE command in BBC Basic.
Explanation: The BBC executes an OSWORD 8 (i.e. ENVELOPE) command.
Example: An IMP program executes the call:

```
envelope(1,1,4,-4,4,10,20,10,127,0,0,-5,126,126)
```

EMAS sends the sequence:

```
<ESC>|E010104FC040A140A7F0000FB7E7E
```

The BBC executes the equivalent of the Basic command:

```
ENVELOPE 1,1,4,-4,4,10,20,10,127,0,0,-5,126,126
```

<ESC> | S nnnn nnnn nnnn nnnn

Parameters: Four four-digit hexadecimal numbers, which are the four parameters required by the SOUND command.
Explanation: The BBC executes an OSWORD 7 (i.e. SOUND) command.
Example: An IMP program executes the call:

```
sound(1,1,100,200)
```

EMAS sends the sequence

```
<ESC>|S00010001006400C8
```

The BBC executes the equivalent of the Basic command:

```
SOUND 1,1,100,200
```

<ESC> | A nn

Parameters: One two-digit hexadecimal number, being the channel number required by the Basic ADVAL statement.
Explanation: The BBC executes an OSBYTE 128 (ADVAL) with the supplied channel value in the X register. The values in the Y and X registers on return from the OSBYTE routine are sent to the host as hexadecimal numbers (Y first) and terminated by a <CR>. The echo of these characters is suppressed by the BBC.
Example: An IMP program executes the call:

```
i=adval(3)
```

EMAS sends:

```
<ESC>|A03
```

The BBC executes the equivalent of the Basic statement ADVAL(3) and sends the result (say 468 decimal) in hex to the host:

```
01D4<CR>
```

The IMP program assigns the value 468 to its variable i.

<ESC> | U nnnn cc yy xx aa

Parameters: nnnn is a four-digit hexadecimal address; cc is 01 or 00 indicating the desired value of the carry flag; yy, xx and aa are the hex values to be stored in the Y, X and A registers.
Explanation: The values sent by the host are loaded into the appropriate registers and a JSR to the given address is executed. On return from this subroutine call, the values of the flags, Y, X and A registers, are sent to the host as eight hex digits terminated by a carriage return, in the order PPYYXXAA. These numbers are formed together into a single integer which is returned by the USR function, just as in Basic. You should be quite sure that the routine you are calling in this manner will eventually return, and will not cause havoc in the BBC's operating system.
Example: To execute an OSWORD 1 (read clock) call, an IMP program makes the call:

```
i=usr(X'FFF1', 0, X'20', X'00', 1)
```

EMAS sends the sequence:

```
<ESC>|UFFF100200001
```

The BBC makes the call, and sends back the result:

```
31FF0A01<CR>
```

The echo of these characters is suppressed by the BBC. The IMP

program assigns the value 838797825 (=X'31FF0A01') to its variable i. (It will need to use the peek routine described next to actually examine the clock reading.)

<ESC> | ? nnnn cc

Parameters: nnnn is four hexadecimal digits giving an address. cc is two hex digits giving a byte count value.

Explanation: The BBC sends out (in hex) the contents of the bytes starting at the address indicated. The number of bytes read is equal to the count value supplied, except that a count value of 0 is interpreted as a request for 256 bytes. Note that the maximum number of bytes which may be read is limited by the length of the input buffer on the host system. For EMAS via a PAD, this limit is 255 characters, and since each byte takes two characters, the maximum number of bytes which may be peeked at one go is 127. Echoing of the data is suppressed by the BBC.

Example: An IMP program executes the call:

```
peek(X'2000', 5, x)
```

EMAS sends the following sequence to the terminal:

```
<ESC>|?200005
```

The BBC sends the following data to EMAS, discarding the echo:

```
0AF54C92D6<CR>
```

The IMP program finds the values X'0A', X'F5', X'4C', X'92', X'D6' in the first five elements of the array x.

<ESC> | P nnnn cc nn nn nn nn ...

Parameters: The first parameter is a four-digit hex address, the next a byte count byte, followed by the corresponding number of bytes.

Explanation: The bytes sent out are poked into memory starting at the address given. If the count value is 00, this indicates that 256 bytes are expected.

Example: An IMP program, after initialising the first five elements of the array x to 0, 1, 2, 3 and 4, executes the call:

```
poke(X'2000', 5, x)
```

EMAS sends the sequence:

```
<ESC>|P2000050001020304
```

The BBC puts the values 0, 1, 2, 3, 4 into addresses &2000, &2001, &2002, &2003, &2004.

III Installing the Chip

This section describes installation in terms of the BBC micro model B. The BBC micro Plus and BBC Master are slightly different internally, and the differences in procedure are described at the end. Read right through this appendix before starting work!

The sideways ROM sockets are located on the BBC's printed circuit board at the front right-hand side, inside the casing and just underneath the keyboard. To get to the board, turn the BBC micro and all attached peripherals off and disconnect them from the mains. Undo the four screws which hold the computer casing together. Two of these are underneath the computer, and the other two are at the back.

Having removed the top, release the bolts holding down the keyboard assembly. These are located at either side of the keyboard. Some machines have two bolts, others may have three.

There is no need to disconnect the keyboard completely, so the multiwire connector to the main board can be left in place. Carefully displace the keyboard, rotating it clockwise through about 20 degrees so that the front right-hand side of the main board is accessible.

Locate the row of five large sockets. The four right-hand sockets (identified on the board as IC52, IC88, IC100, IC101) are sideways ROM sockets. The fifth from the right is the operating system socket (IC51), and it should not be tampered with.

You should remove any previous version of X-Talk from the machine before installing a new one.

It is now necessary to decide which socket to install the X-Talk chip into. If all sockets are occupied, you must either do without one of the ROMs you have already installed, or buy a ROM extender board. Contact the Small Systems Unit for details. If you already have a ROM extender board, or if you have unoccupied sockets, you can proceed with the installation.

The sideways ROM sockets have an operating priority, each socket having a priority number from 0 (lowest) to 15 (highest priority). The four sockets on the main BBC micro board have priorities 12, 13, 14, 15 reading from left to right and excluding the leftmost (operating system) ROM, which is not a sideways ROM. If a ROM extender board is installed, consult the documentation which comes with it to determine the priority of all the ROM sockets.

When the BBC micro is powered on, it will initialise (i.e. come up in) the highest priority "language" ROM it finds. Basic is a "language", and for this purpose so are ROMs such as Wordwise and X-Talk. It is most usual to have Basic as the highest priority language, but any other language may assume this position if required, including X-Talk. However, if X-Talk is the highest priority language, it will come up in display mode 7, a 40 column mode which is not suitable for extensive terminal emulation use. It is therefore usual to place X-Talk in a socket which will not be initialised at power-on: in other words, not to make it the language ROM nearest the right-hand edge of the board.

Having decided on a socket to install the X-Talk chip in, you are now ready to insert it. Note that ROM chips are static-sensitive devices, and can easily be destroyed by a small static electricity charge. The chip is therefore supplied with packaging which reduces the risk, but you should take precautions to make sure there is no static charge on your body or on any surface on which the chip is placed.

If you have chosen a destination socket for X-Talk which requires that you must move or remove another ROM, the easiest way to do this (without a specialized

removal tool) is to prize it up one end at a time, bit by bit, with a small screwdriver.

Before removing it from its packaging, identify pin 1 on the chip. It is either marked with a dot on the top, in the corner of pin 1, or the semicircular notch at one end of the chip identifies the end of the chip nearest pin 1. With the notch held up, pin 1 is at the top left.

Hold the ends of the chip between forefinger and thumb, and line up all the pins over the destination socket. Pin 1 and the semicircular notch should be towards the back of the BBC micro. (If you find that the pins are splayed outwards and will not align over the holes correctly, hold the chip on its side with the pins against a flat surface and gently bend them back in.)

Now apply firm downwards pressure to the chip, but do not force it. Check that all the pins do enter the socket, and that none are bent out, or underneath. Check again that you have the chip oriented correctly, since powering on the BBC micro with the chip the wrong way round will destroy the chip.

Replace the keyboard and the cover loosely, turn on the micro and execute a *HELP command. If one of the output lines is XTALK 2.2, you can switch off again and replace the screws. If not, check that the chip is oriented correctly, and that no pins are bent underneath it.

If you are installing X-Talk in a BBC micro Plus, the procedure is slightly different. There is no need to remove the keyboard, since the ROM sockets are positioned at the left rear of the circuit board. There are six ROM sockets altogether (the two on their own nearest the keyboard are speech processor sockets and cannot be used for sideways ROMs). Reading left to right, the sockets have priority numbers 9, 11, 15 (back row) and 3, 5, 7 (front row). Sockets 11 and 15 are usually occupied by the DFS and Basic/OS respectively. Apart from the difference in location of the ROM sockets, installation should proceed as described above.

If you are installing X-Talk in a BBC Plus 128 or a BBC Master, you may choose to install it in sideways RAM by loading the X-Talk ROM image from disc.
The command to do this is (for instance):

```
*SRLOAD XTALK 8000 W Q
```

See the BBC Master Reference Manual Part 1 page G.7-4.

Alternatively, you can install the X-Talk ROM (in the Master), either in one of the three internal ROM sockets, or in a plug-in cartridge. The three ROM sockets are at the right-hand edge of the board. The ROM may be installed in the middle socket (priority 8) without altering anything on the board, but if this socket is already occupied, one of the other sockets may only be used at the expense of disabling two banks of 16k sideways RAM. To do this for the upper socket (priority 6), move link LK19 from the "WEST" to the "EAST" position. For the lower socket (priority 4), move link LK18 from the "WEST" to the "EAST" position. Doing this will disable sideways RAM pages W & X and Y & Z respectively. See the Reference Manual Part 1 sections F2, F5 and G7. If possible, you should avoid this way of installing ROMs, and use the middle socket or sideways ROM cartridges in preference.

IV Control Characters in Monitor Mode

The following list of control characters and their hexadecimal values shows how they are displayed on the screen in monitor mode.

N_L	NUL	00	V_T	VT	0B	S_N	SYN	16
S_H	SOH	01	F_F	FF	0C	E_B	ETB	17
S_X	STX	02	C_R	CR	0D	C_N	CAN	18
E_X	ETX	03	S_O	SO	0E	E_M	EM	19
E_T	EOT	04	S_I	SI	0F	S_B	SUB	1A
E_Q	ENQ	05	D_E	DLE	10	E_C	ESC	1B
A_K	ACK	06	D_1	DC1	11	F_S	FS	1C
B_L	BEL	07	D_2	DC2	12	G_S	GS	1D
B_S	BS	08	D_3	DC3	13	R_S	RS	1E
H_T	HT	09	D_4	DC4	14	U_S	US	1F
L_F	LF	0A	N_K	NAK	15	Rhombus	DEL	7F

V Contact Points for ERCC Services

The addresses for the various departments mentioned below are:

James Clerk Maxwell Building
The King's Buildings
Mayfield Road
Edinburgh
EH9 3JZ

or

59 George Square
Edinburgh
EH8 9JU.

The services are:

ERCC Service Support Unit (King's Buildings). Responsible for delivery and installation of microcomputer equipment, including X-Talk ROMs for the BBC micro. Contact George Logan. 031-667 1081 extension 2641 or 2635.

ERCC Service Support Unit (George Square). Responsible for distributing disc-based software written by ERCC, including X-Talk 2.2 ROM image on disc. Contact Kathleen Russell. 031-667 1011 extension 6408.

ERCC Advisory service. Deals with problems in the use of X-Talk, and in the use of the BBC micro in general. 031-667 1081 extension 2976/7; 031-667 1011 extension 2300.

ERCC Small Systems Unit. Deals with the support of the BBC micro at a more detailed level. Responsible for maintaining X-Talk. 031-667 1081 extension 2611.

ERCC Administration. Handles ordering. Prices can be seen at any time on BUSH or EMAS by issuing the command VIEW and then selecting the item PRICELIST. Alternatively log on as user VIEWER, hitting the return key when prompted for *Pass:* and selecting item PRICELIST. Finally contact J.Robertson by telephone, or by internal mail addressed to ERCC, KB. 031-667 1081 extension 2613.

ERCC Training Unit. Will demonstrate the use of X-Talk on the BBC Micro. 031-667 1011 extension 2303.

VI Differences from Previous Versions

The differences between version 2.2 and 2.1 are as follows:

V2.1 was not fully compatible with the BBC Plus (the screendump did not work in shadow mode) and the BBC Master (the XON/XOFF printer driver also did not work).

V2.1 had to be placed in a higher priority ROM socket than the default filing system for the XON/XOFF driver to work.

V2.1 did not have monitor mode (section 2.3.8).

V2.1 did not implement the remote ENVELOPE, SOUND, ADVAL, USR, PEEK and POKE facilities.

In V2.1 in graphics input mode, the cross-hair cursor always appeared at the centre of the screen, whereas V2.2 leaves the cross-hair cursor at its last position.

V2.2 will now receive files at 9600 baud to disc without a checksum error. (The BBC now sends an XOFF to the host before writing a block, and an XON when it has finished writing.)