BRITISH BROADCASTING CORPORATION

MICROCOMPUTER SYSTEM

Teletext System
USER GUIDE

The BBC Microcomputer Teletext System User Guide

WARNING: THE TELETEXT ADAPTER MUST BE EARTHED

Important: The wires in the mains lead for the Teletext Adapter are coloured in accordance with the following code:

Green and yellow	**Earth**
Blue	**Neutral**
Brown	**Live**

As the colours of the wires may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

The wire which is coloured green and yellow must be connected to the terminal in the plug which is marked by the letter E, or by the safety earth symbol ⏚ or coloured green, or green and yellow.

The wire which is coloured blue must be connected to the terminal which is marked with the letter N, or coloured black.

The wire which is coloured brown must be connected to the terminal which is marked with the letter L, or coloured red.

If the socket outlet available is not suitable for the plug supplied, the plug should be cut off and the appropriate plug fitted and wired as previously noted. The moulded plug which was cut off should be disposed of as it would be a potential shock hazard if it were to be plugged in with the cut off end of the mains cord exposed. The moulded plug must be used with the fuse and fuse carrier firmly in place. The fuse carrier is of the same basic colour* as the coloured insert in the base of the plug. Different manufacturers' plugs and fuse carriers are not interchangeable. In the event of loss of the fuse carrier, the moulded plug MUST NOT be used. Either replace the moulded plug with another conventional plug wired as previously described, or obtain a replacement fuse carrier from an authorised BBC Microcomputer dealer. In the event of the fuse blowing it should be replaced, after clearing any faults, with a 3 amp fuse that is ASTA approved to BS1362.

*Not necessarily the same shade of that colour.

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IMPORTANT

IF YOU ARE RECEIVING TELETEXT ON AN ORDINARY
TELEVISION RECEIVER, YOU ARE COVERED BY YOUR
EXISTING TELEVISION LICENCE, WHICH OF COURSE MUST
BE VALID. IF YOU DO NOT HAVE A TELEVISION RECEIVER
BUT ARE RECEIVING TELETEXT WITH THE AID OF A VIDEO
MONITOR UNIT, YOU MUST HAVE A COLOUR OR BLACK AND
WHITE TELEVISION LICENCE DEPENDING ON WHETHER
YOUR MONITOR IS COLOUR OR BLACK AND WHITE.

1 About this User Guide

This User Guide contains all the information you need to use the BBC Microcomputer Teletext System. Whilst it is essentially an operating manual, the User Guide contains certain technical information which will help you to understand generally what Teletext is all about and gain some appreciation of the future potential offered by this system.

Chapters 2 and 3 are introductory. Chapter 2 explains briefly what Teletext is all about and chapter 3 deals briefly with the various ways in which you can use your BBC Microcomputer with the Teletext service.

Chapter 4, as its title suggests, gets you started. It explains how to connect up the system, tune into Teletext and quickly run a Telesoftware program.

Chapters 5, 6 and 7 contain the detailed instructions for using the system in the three modes of operation: Terminal, Telesoft and assembly level.

Chapter 8 explains how to select, as the current system, the various filing systems (including Telesoft) which may be available on your computer.

Chapter 9 contains information which will probably be of interest to the more technically minded user, but which is not essential for using the system.

2 What is Teletext?

Teletext is a service offered by the BBC and IBA which makes available a wide variety of information through the medium of television. This information could be share prices on the stock market or the latest football results; the possibilities are almost endless.

Teletext information is transmitted from BBC and IBA television transmitters and can be received on a commercial television receiver suitably equipped with a Teletext Adapter unit. The transmitted signal however, unlike a normal television signal, is in digital form which makes it additionally suitable for use with the BBC Microcomputer.

The total amount of Teletext information is too large to be displayed on a television screen at any one instant and for this reason it is transmitted in 'pages' rather like the pages of a book. Only one page at a time can be displayed on a television screen.

A page of information may contain text, symbols or a mixture of both; it depends on the type of information and how the broadcasters decide to present it.

Because of the amount and variety of information available, transmitted Teletext pages are organised and numbered in such a manner so as to enable you quickly and easily to locate and display specific items of information.

3 What does the BBC Microcomputer Teletext System do?

3.1 Introduction

The BBC Microcomputer Teletext System gives you most of the facilities of an ordinary Teletext receiver and, in addition, the service known as Telesoftware.

Telesoftware is a service similar to Teletext and is transmitted in the same manner, that is, in pages. However, these pages contain computer programs. A program will consist of one or more pages, depending on the program length, and each program has its own file name by which it is identified. These programs, once received, are decoded by the Teletext Adapter and thereafter are available to the computer for display, storage on disc/tape or immediate execution.

It is emphasised that your television set does *not* require a Teletext decoder. This function amongst others is performed by the Teletext Adapter.

There are three main ways in which you can use the system: in Terminal mode, in Telesoft mode or at assembler level. The following is a brief description of the facilities offered by each.

3.2 Terminal mode

'Terminal mode' is a program which Acorn has supplied to give you easy access to Teletext pages. It also lets you use some more sophisticated features which only an 'intelligent' receiver can offer. These features include asking for pages in advance, having pages stored by the system *before* you ask for them (see the section on linked pages), and being able to save pages onto any available filing system for later examination.

You can also use Terminal mode as an easy way of finding and loading 'Telesoftware' computer programs.

You cannot write programs whilst in Terminal mode. In addition, if you are using a television receiver, you cannot display Teletext pages and television programmes simultaneously.

3.3 Telesoft mode

An important feature of Teletext transmissions is the ability to send programs, or 'software', with the Teletext service. In keeping with the philosophy of BBC Microcomputer products, Acorn has produced a filing system interface as the means of accessing Telesoftware files.

IT IS IMPORTANT that you appreciate that Telesoft is a *filing system*, and not an applications program such as Terminal mode. With Telesoft selected you will not be able to save programs as the system thinks you are trying to save data to the television channel!

You may think of Telesoft as a 'read-only' tape; it is quite a good analogy.

In addition to Telesoftware, you can also display and store Teletext pages. However the full range of Terminal mode commands is not available and it is therefore probably more convenient to return to Terminal mode should you wish to handle Teletext pages.

You can write and run your own programs whilst in Telesoft mode, but to store these programs you should select the appropriate filing system, ie disc or tape. See section 8.

3.4 Assembler level

Assembly code level allows you to control the Teletext system using programs written in Assembly Language. You can enter these into the computer from the keyboard or from file. There are two main areas of control: one is concerned with the filing system, and the other with the Teletext Adapter.

The filing system function allows the storage and retrieval of Telesoftware files. You can control this by the standard interfaces to the Machine Operating System, which are independent of the filing system.

The Teletext Adapter functions, which control the conditions under which a file is stored and executed, can be accessed via the general purpose Machine Operating System calls.

4 Getting started

Before proceeding further, check that you have the following items:
- A Model B BBC Microcomputer fitted with a BASIC ROM.
- A Teletext Adapter with the following items attached:
   A power cable with a 13A 3-pin plug fitted to it.
   A 'ribbon' cable terminating in a 34-way plug.
- A coax cable fitted with a phono plug and a UHF plug as supplied with the BBC Microcomputer (if you're using a normal television receiver), or a coax cable fitted with the appropriate connectors (if you're using a video monitor).
- A Teletext ROM (TELEROM).

You will not need a new aerial lead, as the existing television aerial lead can be used.

If any of the above are missing, contact your local supplier quoting the order number which was given to you when you first placed your order. This number also appears on the dispatch label on the outside of the packing case.

4.1 Connecting up the units

The first thing to do is to make sure that the ROMs are correctly positioned on the microcomputer circuit board and then to fit the TELEROM. The instructions for doing this are in Appendix 1, however if you do not feel sufficiently confident, take your microcomputer and TELEROM to an authorised dealer who will do it for you.

Next, refer to Fig 4.1 which shows the microcomputer and Teletext Adapter connected together and connect up the system as follows:

1. Connect the 34-way socket on the Teletext Adapter 'ribbon' cable to the plug labelled 1 MHz BUS on the computer.

Caution: This socket may fit both ways round – the correct way is with the arrow at one end of the socket aligned with the arrow next to the '1 MHz BUS' label. IF THE SOCKET WILL NOT GO RIGHT IN EXAMINE THE PLUG AND SOCKET FOR DAMAGE AND OBSTRUCTIONS. DO NOT USE EXCESSIVE FORCE.

2. Disconnect the aerial lead from the back of your television set and reconnect it to the standard television aerial socket on the back of the Teletext Adapter.

Note: An aerial which stands on top of your television set does not generally provide a strong enough signal. You will in all probability need a loft or externally mounted aerial. If you think your aerial may not be good enough refer to Appendix 2 which may assist you, or consult your dealer.

3. Connect up whatever storage units you are using (ie disc or cassette) to the computer.

4. Connect the computer UHF OUTPUT socket to the aerial socket on your television set using the phono plug/UHF plug cable, or connect the computer VIDEO OUT or RGB OUT socket to the input socket on the video monitor.

5. Connect the television, storage unit, microcomputer and Teletext Adapter to the mains supply, if possible using adjacent sockets for Teletext Adapter and computer.

6. Switch on television/video monitor, Teletext Adapter unit, micro-computer and storage device (disc or cassette) if fitted. IT IS IMPORTANT THAT THE TELETEXT ADAPTER IS SWITCHED ON BEFORE THE MICROCOMPUTER. Your television screen should now display the following message:

BBC Computer 32K

Acorn TFS

BASIC

$>$ __

The current filing system is Telesoft (TFS).

Note 1: If **Acorn TFS no power** appears, check that you have connected the adapter correctly and that it is switched on at the rear. Press **BREAK** before continuing. If this still fails to produce the start-up message, check the position of the ROMs on the microcomputer circuit board (see Appendix 1).

Note 2: The Teletext software incorporates a 'power-down' mode so that if, when you switch on the microcomputer, the Teletext Adapter is switched

off, the message **Acorn TFS no power** will be displayed. This means that
the Teletext software is inactive and therefore the memory space it
would normally occupy is free to be used for running large programs.

If you switch on the Teletext Adapter after the microcomputer, the
Teletext software is not automatically activated; you must press the
BREAK key first.

If you switch off the Teletext Adapter whilst the microcomputer is 'on',
the Teletext software is not automatically de-activated; you must press
the **BREAK** key first.

Note 3: If the positioning of the ROMs is such that Telesoft is not the
default filing system, press the **T** key, hold it down and press **BREAK**,
then release **BREAK** then **T**. This will cause the correct start-up
message to be displayed without re-positioning the ROMs as detailed in
Appendix 1.

Once the correct start-up message is displayed you can now go ahead and
tune the Teletext Adapter.

Fig 4.1 Connecting the Teletext Adapter
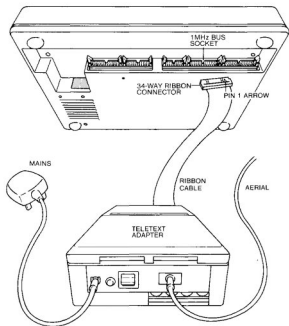
4.2 General information on the format of commands

Note 1: Most of the commands are put into the computer by pressing one of the ten red keys labelled f0 to f9, either on its own or together with the **SHIFT** key. In the latter case it is important that you press the keys in the following manner otherwise the command will *never* go into the computer:

- Press the **SHIFT** key, keep it held down and press the red function key.
- Release the **f** key, then release the **SHIFT** key.

If you do attempt to input a faulty command the computer will usually tell you, with a message on the screen, what to do and how to get back to a normal situation.

Note 2: Throughout the guide there are many instructions on how to type in commands to the computer and what the correct response is. The following applies to these instructions:

- Where you see a word in brackets thus, <word>, this is describing what you have to type in, eg <file name> means you have to type in the name of a file. Do *not* type in the brackets.
- Where you see a word 'reversed out' this means you have to press a specific key, eg **TAB** means press the TAB key.
- Where the text is an actual message displayed on your monitor screen it is shown in computer typeface, eg the message *****Waiting** is displayed. Likewise in a command the characters in computer typeface are to be typed in exactly as shown, eg type in ***EXEC**.

4.3 Tuning in the Teletext Adapter

There are four channels built into the Teletext Adapter and assigned numbers 1 to 4. We recommend that you allocate these channels as follows:

Channel 1 – BBC1
Channel 2 – BBC2
Channel 3 – ITV1
Channel 4 – ITV2

The procedure for tuning in the system to receive each channel is as follows:

1. Type in ***TELETEXT** then press the **RETURN** key.
The message *****Waiting for page** is displayed.

2. Press the **f4** key.
The prompt **Channel** should now appear on the screen.

3. Type in **1** (to select channel 1), then press the **RETURN** key.
The message *****Waiting for page** is again displayed.

4. Press the **SHIFT** and **f4** keys together.
Your screen will display a station tuning scale (see Fig 4.3). On top of the
tuning scale sits a tuning bar which indicates the strength of received
Teletext. Maximum signal strength is when the tuning bar is as long as
the scale (100%).

5. Turn the number 1 tuning control on the rear of the Adapter (Fig 4.2)
to one end of its travel (this is indicated by a 'clicking' as you turn the
control). Now *very slowly* turn the control over its full travel. You will see
the tuning bar suddenly increase in length as you tune in to a BBC or ITV
Teletext channel. This is accompanied by the channel and page numbers
at the top of the screen. When you have found the longest tuning bar
together with the messages **CEEFAX** and **CH1** you are correctly tuned in to
channel 1. REMEMBER YOU CAN RECEIVE ALL FOUR TELE-
TEXT CHANNELS ON EACH TUNING CONTROL SO MAKE
SURE YOU GET THE RIGHT CHANNEL.

6. Press the **SPACE BAR** on your keyboard and repeat steps 2 to 5 for
channels 2, 3 and 4. The only differences are:

– In step 3, type in the appropriate channel number (2, 3 or 4).
– In step 5, rotate the appropriate control number (2, 3 or 4).

7. When you have tuned in all four channels press the **SPACE BAR**. This
will remove the tuning scale and a Teletext index page will be
automatically displayed. This is the default page and is discussed in
section 5.2.

Now that your system is working we suggest that you have a go at running
one of the Telesoftware programs being transmitted, the procedure for
which is given in the next section (4.4). You will need to use only a few
Terminal mode commands and it should give you confidence to use the
full range of features which are explained later in the guide.

Fig 4.2 Rear view of the Teletext Adapter

ON/OFF SWITCH   AERIAL SOCKET

MAINS LEAD   CHANNEL 1   TUNING KNOBS
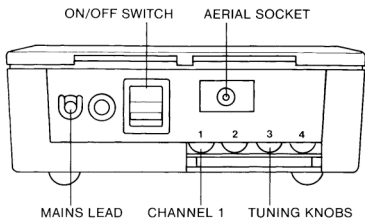
Fig 4.3 Tuning picture format

Ch1 CEEFAX 119 Wed 2 Jan 16:5Ø/47

BBC 1 Teletext 165Ø47

Ø%   5Ø%   1ØØ%
Receiving Teletext
✱ ✱ ✱ Space to continue
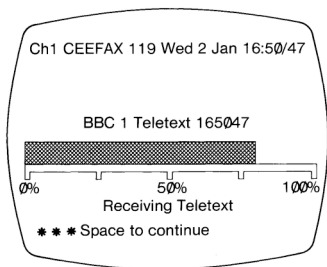
4.4 A first attempt at Telesoftware

Assuming that you're carrying on from the previous section your screen should be displaying an index page. If on the other hand you've just switched on the equipment then you must enter Teletext by typing in ∗TELETEXT then pressing the `RETURN` key. The CEEFAX channel 1 index page will be displayed.

Next select a channel (any channel) by first pressing the `f4` key. This results in the message **Channel** being displayed. Then type in the channel number (1, 2, 3 or 4) and finally press `RETURN`. The message ∗∗∗**Waiting for page** will be displayed until it is replaced by the index page for the channel you've selected.

Do this a few times to get the idea, then try selecting a page.

You can select a page by pressing the `f9` key, then typing in the page number you want (three digits) then pressing `RETURN`. You may have to wait a short while before the page you have selected appears. Again we suggest you try this a few times to get the idea.

When you feel confident, select channel 1 then page 700. This will display a list of the currently transmitted Telesoftware programs and the page on which each can be found. Decide which program you want, then select the page it is stored on.

The next thing to do is to download the program, that is, load it into the computer ready to be run. To download the program, press the `SHIFT` and `f9` keys together. What happens next may not make a great deal of sense and so deserves some explanation.

As you are probably aware programs can be structured in two very different ways and this affects what happens when they are downloaded.

Programs structured in numbered lines can be loaded in any order since the computer will organise the lines into the correct numerical sequence prior to running the program. A program structured in such a way is said to be a disordered file.

A program structured as merely a series of statements (with no numbered lines) must be loaded into the computer starting at the first statement and exactly in the order in which it has been written. This is because there are no numbered lines for the computer to organise as there are for disordered files. Such a program is said to be an ordered file.

Another point to bear in mind is that whilst programs are listed as being on consecutively numbered pages, almost always a program will be longer than one page. For example there are currently several programs being transmitted on page 7Ø2 onwards, however they are all longer than one page.

Let's assume that the program listed under page 7Ø4 is in fact 12 pages long. This means that it will take 12 transmissions of page 7Ø4 to get the entire program into the computer and this can take quite a long time. It follows therefore that the earlier in the transmission sequence you try to download the program, the longer it takes to get round to page one again and this can significantly affect how long you have to wait before an ordered program is loaded (see below).

What happens during downloading depends on whether the program is ordered or disordered and is explained in the following:

Downloading a disordered program

As soon as the **SHIFT** and **f9** keys have been pressed, the message **Searching** is displayed. This tells you that the system is looking for a page in the program.

Immediately a page (any page) in the program is received, the message disappears and the contents of the page 'scroll' up the screen as they are loaded into computer memory.

When the page has been completely loaded, the message **Searching** is again displayed until another page in the program is found.

This process continues until the program is completely loaded, whereupon the message **Loaded** is displayed and an audible 'bleep' sounds.

During downloading the normal transmitted Teletext page headers are displayed to indicate (during waiting) that your Teletext Adapter is still functioning.

When the decoder is loading Telesoftware, it checks the validity of data on each page it receives. If this check shows up an error, you will see the message **Bad data. Retrying. . .**

This usually means you will have to wait until this page comes round again in the transmission cycle, but you may be lucky if the bad page was one you have already received or if it was a title page with no software on it. If you wait long enough you will always be able to load a Telesoftware program, unless your reception is particularly bad.

Downloading an ordered program

When the **SHIFT** and **f9** keys have been pressed, the message **Searching** is displayed to indicate that the system is waiting for the first page of the program. This may take a little time – it depends on whereabouts in the program transmission sequence you have selected the program (as explained above). When this happens, the message **Searching** disappears and the page contents 'scroll' up the screen as they are loaded into the computer memory.

As soon as the first program page has been loaded, the message **Searching** is once again displayed. When the second program page is received, the message **Searching** disappears and, as before, the page contents are loaded into memory.

This continues until the entire program has been loaded whereupon the message **Loaded** is displayed and a 'bleep' sounds.

During downloading the Teletext page headers are displayed.

If the message **Bad data. Retrying . . .** is displayed the load will not continue until the previous page is subsequently re-captured without error.

If you now type in **RUN** and press **RETURN** , the computer will run the program and the results will be displayed on your TV screen.

We hope this first attempt at using the system has been successful and has given you some confidence. You should now be able to use the full range of commands given in section 5.2.

5 Using the system in Terminal mode

5.1 Introduction

We recommend that you spend a few minutes using the *select a page* and *select a channel* commands, before going on to the rest of the commands.

You may find it a good idea to read first section 9.1 which explains in some detail how Teletext pages are numbered and how the entire Teletext transmission is structured. This may help you to understand the various commands you are about to use.

5.2 Terminal mode commands

First enter Terminal mode by typing in ***TELETEXT** and pressing the **RETURN** key. A default channel, BBC1 CEEFAX, is selected and a default index page is displayed. In addition to news and information, the following standard items are usually displayed on your screen:

- Channel title and page number (header), eg CEEFAX XXX, at the top left.
- The page number you have selected at the top far left.
- The changing page number at the left of centre.
- The date and time at the far right.

Selecting a channel

Press the **f4** key.

The prompt **Channel** is displayed.

Type in **1**, **2**, **3** or **4**.

This number appears after **Channel**.

Press **RETURN** (to select the channel).

The only thing which happens immediately on the screen is that the channel title and changing page header now correspond to the newly-selected channel. A default index page for the new channel is displayed as soon as it is received.

Fine tune

This is the same function you used when tuning the Teletext Adapter (see 4.3). You can use it anytime to display the tuning scale if the quality of the displayed Teletext page deteriorates.

Press the **F4** and **SHIFT** keys together.

When you have finished tuning, press the **SPACE BAR** to inhibit the tuning routine and display the page.

Select a page

To display a transmitted page:

Press the **F9** key.

Type in the page number which can be three digits or seven digits (see section 9.1 on page numbering).

Press the **RETURN** key.

Note: Make sure you have selected a page which is being transmitted.

Until the selected page is reached, the previous page and the message *****Waiting for page** is displayed.

Keep a page

This function allows you to store the displayed page in computer memory. Thereafter, every time this particular page is received, it updates the stored page. In this manner, a 'kept' page is continuously updated and can be displayed immediately by using the normal 'select a page' command. You can 'keep' a page before it has actually arrived and select another page while you are waiting. In this way you can ask for more than one page at a time. To keep a page:

Press the **F3** key.

The message **Page kept** is displayed at the bottom of the screen.

Note: When you attempt this command, the message **Buffer full – please release a page** may appear. This means that all available memory for keeping pages is used up and you must first release a page, before trying to keep a page. The following explains how to release a kept page.

Release a kept page

This function causes the displayed page to be lost provided it is a *kept* page. To release the kept page:

Press the **SHIFT** and **f3** keys.

The message **Page released** is displayed.

Select the last explicit page

If you are displaying linked pages (see 5.3) you can quickly return to the last page which was displayed by the explicit typing in of its number. This is usually the first page in the linked structure.

Press the **f1** key.

The last explicitly selected page is displayed.

Select index page

You can return to the default index page which was automatically displayed when you first entered the current channel.

Press the **f1** and **SHIFT** keys together.

Note: If no default index page number is being transmitted on your current channel, then page #∅∅ will be selected instead (see 'Select wild card').

Reveal and conceal

Some pages are transmitted with certain text 'hidden', ie concealed as spaces. For example, the answers to a quiz. Any page with hidden data will display a message something like **Press the REVEAL key**. To reveal this hidden text:

Press the **f2** key.

The hidden text appears, and the page itself is 'held' so that it cannot be updated by subsequent transmitted pages.

To conceal the text and cancel the 'hold' state:

Press the **SPACE BAR**.

To conceal the text but retain the page 'hold' state:

Press the **SHIFT** and **f2** keys together.

Save a page to file

This function allows you to store the displayed page under any file name onto the currently selected filing system, such as cassette or disc.

Press the **f7** key.

The message **Save file** is displayed.

Type in <the file name> and press **RETURN**.

The page is stored in a file. When storage is complete, the page is displayed with the file name under which you have just stored it, together with the message **Press space to continue**.

When you press the **SPACE BAR**, the same page continues to be displayed, but the file name is removed, and the changing headers are again displayed.

If you attempt this with Telesoft as your currently selected filing system, the message **Illegal operation** will be displayed. (This is due to the fact that Telesoft is a 'read only' filing system, therefore you cannot save anything to this filing system.)

To recover from this situation, press the **ESCAPE** key. Now select another filing system such as disc or tape by using the **Enter * command** facility described below. You can now save the data to this filing system as described immediately above ('Save a page to file').

Load a page from file

This function allows you to display any page which is currently stored under a file name.

Press the **f6** key.

The message **Load file** is displayed.

Type the file name of the page for display, then press **RETURN**.

The page is then displayed, together with its file name.

Note that the page headers stop changing and the message **Press space to continue** is displayed.

When you press the **SPACE BAR**, the file name disappears and the page headers again start to change.

Hold page

This function holds any displayed page and prevents it from changing. This is a useful function to have if you are saving or loading rolling pages or wild card pages (which are likely to change very quickly). To hold a page:

Press the **f8** key.

The displayed page is held in its current state.

To cancel the 'hold' state:

Press the **SPACE BAR**.

The page is now free to be updated.

Enter * command

This allows you to remain in Terminal mode and at the same time use those * commands which relate to the operating system. These commands are shown on page 416 of the *BBC Microcomputer System User Guide*. In addition, you have available for use all commands associated with the particular ROMs fitted to your microcomputer, eg the disc filing system. To enter a command:

Press key **f5**.

The prompt * is displayed at the bottom of your screen.

Type in the appropriate command and press **RETURN**.

The message **Press space to continue** is displayed.

If you wish to enter other * commands, ignore the **Press space to continue** message and repeat as above.

To return to the last displayed page press the **SPACE BAR**.

Exit to previous language

Press the **f9** key.

The start-up message for the language previously selected (from which Teletext was entered) is displayed and the system is now controlled by this language ROM.

Note: If you have pressed the **BREAK** key whilst in Terminal mode, your previous language will be Teletext Terminal mode and the **19** key will cause this to be re-entered.

Exit to Telesoft mode

If you select a page containing a Telesoftware program, this function puts the system automatically into Telesoft mode and causes the program to be loaded into computer memory page by page. You can then go ahead and run the program. To exit to the Telesoft filing system and execute a program:

Press the **SHIFT** and **19** keys together.

The program will start to load into computer memory as soon as the first page is received. If you start this function say halfway through the program transmission then it may be a few minutes before the program starts to load (see section on ordered/disordered loading).

Select wild card

This enables you to select specified sequences of numbered pages for display (including their sub-pages, if any). We know that each page has a three-digit number. The function allows you to specify any combination of one or two of these three digits as part of a page number to be displayed. The unspecified digit(s) can be any number, ie completely 'wild'. For example, if you specified 34#, all page numbers whose first digit is 3 and whose second digit is 4 will be displayed. Theoretically this would be 340, 341, 342 etc to 349. But bear in mind that not all pages are transmitted.

To select a wild card press the **19** key (as you would do when normally selecting a page) then type in three characters (which may be any combination of digits and #s), then press **RETURN**.

The specified wild card pages will be displayed as and when they are received, with a small built-in delay between consecutive pages to give you time to hold a page.

5.3 Accessing linked pages

Now that you know how to display any transmitted page of Teletext, we will explain how you can display pages which, because of their information content, are related to each other. These are known as linked pages.

A Teletext page displays 24 rows of text or graphic information. However more rows may be transmitted which are not displayed on the screen but which contain information for the Teletext decoder. In particular, row 27 contains information in the form of numbers which point to related (linked) pages. These numbers are called links.

Take a look at Fig 5.1. The headlines page has four links, each pointing to a lead page. In this case row 27 of the headlines page would contain four link numbers, link 1 pointing to lead page 1 and so on. You will see also that each lead page has links, each of which points to page 1 of a related story. For example, lead 3 has three links pointing to page 1 of stories 3A, 3B and 3C, so row 27 of lead 3 would contain link numbers 1, 2 and 3. This system of links extends to the last page in each story then back round to the first page as is shown by stories 3A and 1.

The microcomputer looks at row 27 of the page, detects the link numbers and loads as many of the linked pages as it can fit into memory. Although you cannot see these pages, they are being continuously updated. If for example you selected the headlines page on Fig 5.1, the microcomputer would load the four linked lead pages into its memory and these would then be available for display.

Let's suppose you are currently displaying the headlines page which can be done using the 'select a page' method previously discussed. The headlines page will show four links. To select one of the links, type in the link number (1, 2, 3 or 4). The message **Link n** (where n is the number you typed) will be displayed. Now press the **RETURN** key. The message **Waiting for link n** will be displayed until it is replaced by the selected linked page. Suppose you select lead 3 for display. This has three links pointing to three story pages, and again you can select any one.

Only link numbers 0-23 are valid and the system will reject an invalid number by sounding a 'bleep'. If you select a link number which, although valid, is not shown on the current page, the message **No such link** will be displayed when you press the **RETURN** key. If the current page has no links, the message **No links present** will be displayed.

Fig 5.1 Linked pages
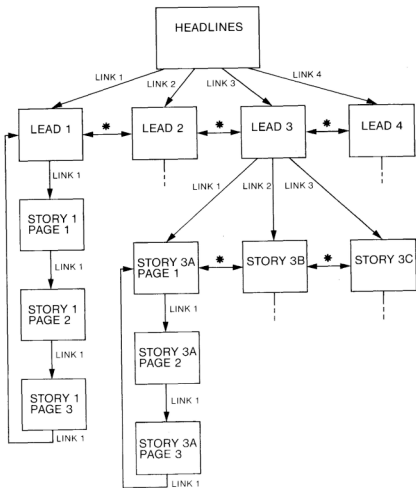
Let's assume that by using the links you have arrived at a page with only one link. This could be lead 1 or page 1 of story 3A. You can now use the key marked ⬆ to 'step' forwards through the story, page by page. You can also step back *one* level by using the ⬆ key, but to return to the top-level index page you need to use the 'last explicit page' key ⬛.

If we look again at Fig 5.1 there are routes marked *. These connect together adjacent pages at the same level in the structure. You can easily display an adjacent page at the same level by pressing the ⬅ or ➡ keys (whichever is appropriate). For example if you are currently displaying lead 3 and you wish to display lead 2, simply press the ⬅ key. This is useful if you wanted only to glance at the leader of each story but not go to any depth. The thing to remember is that, unlike links, these routes are not displayed, so you must remember how many links the page immediately higher in the structure has and this will tell you how many adjacent pages there are. For example if you are displaying page 1 of story 3A the fact that lead 3 has three links tells you that there is a total of three adjacent pages.

You may see the messages **Cannot go left** and **Cannot go right** when using the ⬅ and ➡ keys. This will happen if the current link is ∅ or 23 respectively, since you are in fact requesting an invalid link.

6 Using the system in Telesoft mode

6.1 Introduction

This mode provides a series of commands for dealing specifically with Telesoftware as distinct from Teletext. Some of the commands, eg 'select a page', are much the same as in Teletext mode, however commands are not available in this mode for specifically dealing with normal Teletext pages, such as the 'reveal' command and the commands to save pages to another filing system and select linked pages. You can if you wish view normal Teletext pages in this mode but it is more convenient to do so in the Terminal mode. You should only enter Telesoft mode when you wish to deal with Telesoftware files.

You will recall that in chapter 4 we suggested that as a first step, you try to run one of the Telesoft programs before going on to use the full range of Terminal mode commands. We suggest that you now do something similar before going on to use the full range of Telesoftware commands.

What follows is a simple procedure which tells you how to get a Telesoftware program running using some of the Telesoft commands. To the home computer user it is quite often unclear just why certain commands are necessary at certain times and what they do. In the following simple procedure we have attempted to go at least some way to correcting this problem by putting in explanations as and where we felt it would help you.

The first thing to do is get into Telesoft mode. You can do this by typing in:

*TELESOFT and pressing **RETURN**.

The prompt > __ is displayed.

The Telesoft mode is now the current filing system until another is entered (see chapter 8: Changing the filing system).

While in Telesoft mode, the computer will understand and respond to the commands discussed in this chapter. Apart from these commands, the computer will behave in the same way as before entering Telesoft mode: thus you can still write programs while in Telesoft mode.

Now select BBC1 channel by typing in:

∗BBC1 and pressing **RETURN** .

As before the prompt $>$ __ will be displayed.

Once you have selected the channel you want, you can then go on to select the page you want, 7ØØ in this case, by typing in:

∗PAGE 7ØØ and pressing **RETURN** .

After typing this command, page 7ØØ will become the currently selected page and will be subject to all subsequent commands until a new page is selected (page 7ØØ is currently the Telesoftware index page).

The next step is to get the page you've just selected into memory. Until this is done you can't display it. However, you first need to make sure that you do not overwrite a program already in memory. The command you will use to put the page in memory is TRANSFER. You will cause the page selected to be loaded in an area of 96Ø bytes immediately before HIMEM (HIMEM defines the start of screen memory). Page 414 of the *BBC Microcomputer User Guide* explains how RAM is allocated and 415 shows where spare memory is located. To find the address in memory at which you can start loading the page, type in:

HIMEM = HIMEM − 96Ø and press **RETURN** . Then type in **PRINT ∼ HIMEM** and press **RETURN** (where $\sim$ indicates a hexadecimal value).

The address displayed (which is in hexadecimal) is the one you will need to use in the TRANSFER command (next).

Next, transfer the page into memory by typing in:

∗TRANSFER $<$ **address** $>$ and press **RETURN** .

When the prompt $>$ __ appears, the page has been captured and stored in memory at the address specified.

Now display the page, by typing:

∗DISPLAY $<$ **address** $>$ and pressing **RETURN**

where $<$ address $>$ is the one used in the ∗TRANSFER command.

The page will be immediately displayed, listing the file name of each Telesoftware program being transmitted, together with the page number on which each can be found. When you have decided which program you want to run, select the page using the ∗PAGE command described previously, then type in:

∗EXEC $<$ **file name** $>$ and press **RETURN** .

Refer to 4.4 of this manual which explains what happens when you download a program. Having downloaded the program, you can now run it by typing in:

RUN and pressing **RETURN**.

The program will now run.

This completes the introductory procedure. The full range of Telesoft commands is in the next section.

6.2 Telesoft mode commands

The Telesoft filing system provides a number of commands which allow you to control the Teletext Adapter and manipulate the captured program.

All the commands can be typed in from the keyboard or included in a BASIC program. Each command is described separately under the following headings:

Description	What the command does in functional terms.
Syntax	The actual command words and the order in which commands and data are arranged.
Example	An example of a string of commands including the one described.

Note: As with any other BBC Microcomputer filing system, Telesoft allows you to type abbreviations for its commands, such as *TE. for *TELETEXT, or *TELES. for *TELESOFT.

*BBC1
*BBC2

Description
These commands are used to select channels 1 and 2 for Teletext reception.

Syntax
*BBC1
*BBC2

Example
*TELESOFT
*BBC2

This will cause channel 2 to be selected. The appearance of $>$ __ confirms the selection.

Notes
It is up to the user to ensure that channel 1 is tuned to BBC1 and channel 2 is tuned to BBC2 for this command to produce the expected results.

*CH1
*CH2
*CH3
*CH4

Description
These commands are used to select one of the four available channels for Teletext reception.

Syntax
*CH1
*CH2
*CH3
*CH4

Example
*TELESOFT
*CH3

This will cause channel 3 to be selected.

Notes
These commands are alternatives to the *BBC and *ITV commands and should be used where the channels are not tuned to the recommended stations, ie channel 1 to BBC1 etc.

*DATE

Description
This command causes the date, as transmitted by the television service
data packet (see 9.5), to be displayed.

Syntax
*DATE

Example
*TELESOFT
*BBC1
*DATE

Notes
Date information is extracted from the television service data packet
(TSDP). If the TSDP is not transmitted or the data is corrupt on
reception an error message is displayed.

*DISPLAY

Description
This command is used to display any Teletext page which has previously
been transferred into memory with a *TRANSFER command.

Syntax
*DISPLAY <address>

where <address> is the hexadecimal address used in the *TRANSFER
command.

Example
*TELESOFT
*BBC2
*PAGE 200
*TRANSFER 7000
*DISPLAY 7000

This will cause BBC2 CEEFAX page 200 to be displayed on the screen.

Notes
The address specified must be in hexadecimal and should correspond exactly to an address used for a previous *TRANSFER command. Several pages may be transferred to separate memory locations before display.

*EXEC

Description
This command is used to execute a stream of ASCII characters from a Telesoftware file as though they have been entered from the keyboard. These ASCII characters may be a BASIC program or keyboard commands.

Syntax
*EXEC <file name>
*EXEC ""

Example
*TELESOFT
*BBC1
*PAGE 7Ø4
*EXEC "WELCOME"

This will cause the Telesoftware program WELCOME on BBC1 CEEFAX page 7Ø4 to be executed.

Notes
If the file name is given as a null string then the first program found on the selected page will be executed.

Beware: If you have specified a non-existent file name the system will wait for ever trying to find it.

*HELP

Description
This command is used to display useful information about Telesoft mode, Terminal mode or the computer system in general.

Syntax
*HELP (For general computer system information)
*HELP TELETEXT (For Terminal mode information)
*HELP TELESOFT (For Telesoft mode information)
*HELP OPT (For information about user-definable options)

Example
*HELP TELETEXT

This will display a list of all Terminal mode commands, together with a short description of each and the function keys used to call up the command.

Notes
If the Teletext Adapter is not switched on, help on the Teletext system will not be available.

*ITV1
*ITV2

Description
These commands are used to select channels 3 and 4 for Teletext reception.

Syntax
*ITV1
*ITV2

Example
*TELESOFT
*ITV2
*PAGE 4ØØ

This will cause page 400 of channel 4 to become the currently selected page.

Notes

It is up to the user to ensure that channel 3 is tuned to ITV and channel 4 to CHANNEL 4 for this command to have the expected results.

*OPT0

Description

This command sets all options to their default values.

Syntax

*OPT0

Example

*TELESOFT
*BBC2
*PAGE 220
*OPT0
*EXEC "PROG"

Notes

The default settings are:

*OPT1,128
*OPT2,1
*OPT3,0

*OPT1

Description

Telesoftware files can include information which is displayed whilst the file is being loaded. This displayed information, as well as 'searching' messages, can be controlled with the *OPT1 command as follows:

*OPT1,Ø	No messages displayed
1,1	Title displayed
1,2	Language and title displayed
1,3	Computer type and all above items displayed
1,4	Date of file publication and all above items displayed
1,5	Source or author of file and all above items displayed
1,128	'Searching' messages and all above items displayed

Syntax

*OPT1,

Example

*TELESOFT
*BBC1
*PAGE 7Ø3
*OPT1,2
*EXEC""

This will cause a load of the first program transmitted on BBC1 CEEFAX page 7Ø3 to be executed, and the program language and title to be displayed.

Notes

The default setting is *OPT1,128, ie all messages are displayed.

The title is a concise description of what the file contains. This is not necessarily the same as the file name which is merely a label to identify the file.

*OPT2

Description

This command controls the steps taken when the system encounters an error whilst reading a Telesoftware file. *OPT2,Ø causes the system to ignore errors, *OPT2,1 causes the system to retry for a page until it has been received correctly and *OPT2,2 causes the system to abort the downloading if an error is detected.

Syntax

*OPT2,

Example
*TELESOFT
*BBC1
*PAGE 7Ø8
*OPT2,1
*EXEC ''''

This used the first Telesoftware file found on page 7Ø8 of BBC1 CEEFAX to be executed, and in the case of a reception error for the page to be re-loaded.

Notes
Errors may be encountered in the checkbytes (see section 9.2) of the page header, data parity or page CRC checks. In the first instance single bit errors are automatically corrected by the system. Parity or CRC errors can not be corrected and the system will retry for the page if *OPT2,1 is set. Pressing `ESCAPE` will cause the retries to abort.

*OPT3

Description
When a Telesoftware load is started all previously redefined protocol bytes are reset to their original values, but this feature may be suppressed so that a format may be learned from loading one program, then re-used for loading a second. *OPT3,1 disables this reset feature and *OPT3,Ø re-enables it.

Syntax
*OPT3,

Example
*TELESOFT
*BBC1
*PAGE 7Ø7
*EXEC "PROG1"
*OPT3,1
*EXEC "PROG2"

This causes the Telesoftware programs PROG1 and PROG2 to be loaded from BBC1 CEEFAX page 7Ø7. PROG2 is loaded with the protocol re-definition stored from the loading of PROG1.

Notes
The default setting is ∗OPT3,Ø. This command is only used occasionally and a full understanding of the Telesoftware format is needed to appreciate its function.

∗PAGE

Description
This command sets the specified page as the current page.

Syntax
∗PAGE <number>

Example
∗TELESOFT
∗PAGE 1ØØ

This selects page 1ØØ to be the current page.

Notes
It is possible to 'wild card' the page number as in Terminal mode:

∗PAGE 1ØØ is equivalent to page 1ØØ in Terminal mode.
∗PAGE 1Ø is equivalent to page 1Ø# in Terminal mode.
∗PAGE 1 is equivalent to page 1## in Terminal mode.
∗PAGE is equivalent to page ### in Terminal mode.

Page numbers may be up to seven digits long (see section 9.1) and all omitted digits are assumed to be 'wild cards'.

Warning: The system will wait for ever for a currently selected page which is not transmitted on the selected channel.

*TIME

Description
This command causes the time of day, as transmitted by the television service data packet (see 9.5), to be displayed.

Syntax
*TIME

Example
*TELESOFT
*BBC1
*TIME

Notes
Time information is extracted from the television service data packet (TSDP). If the TSDP is not transmitted or the data is corrupt on reception, an appropriate error message is displayed.

*TRANSFER

Description
This command transfers the current page to a given memory location.

Syntax
*TRANSFER <address>

Example
*TELESOFT
*BBC1
*PAGE 1ØØ
*TRANSFER 68ØØ

This transfers BBC1 CEEFAX page 1ØØ to memory starting at location &68ØØ.

Notes
The page must have been selected with the *PAGE command before issuing this command.

*TUNE

Description
This command invokes the fine tuning routine for the currently selected channel.

Syntax
*TUNE

Example
*TELESOFT
*ITV1
*TUNE

This will invoke the fine tuning routine for channel 3.

Notes
The fine tuning routine is the same as that entered by **SHIFT** and **f4** in Terminal mode, as described in section 4.3.

7 Using the Teletext system at assembly level

7.1 Teletext assembly level interface

This section describes the calls available at assembly level which give the advanced programmer more control over the Teletext Adapter than is possible in Terminal mode. These calls are available from both Assembly Language and BASIC.

The Teletext system is accessed through the general purpose routine 'OSWORD' whose entry point is address &FFF1 in the BBC Microcomputer Machine Operating System.

OSWORD calls in which register A contains the value 122 (&7A) are Teletext-specific calls – they are obeyed only when the Telesoft filing system is selected. A typical example of such a call (first in BASIC then in Assembly Language) is given below. This is the call to select the TV channel from which Teletext is received, which in this example is BBC1.

The description in the manual is a cryptic '[&8B, channel]'. This means that the parameter to OSWORD is a control block containing the two 1-byte values '&8B' and 'channel' respectively. The values of the registers on the call to OSWORD have a fixed significance:

- A is always the 'Teletext OSWORD number', ie &7A.
- X and Y are always treated as a concatenated value containing the 16-bit address of the control block in which the actual parameters are stored. (X is the low byte and Y is the high byte.)
- P is irrelevant (except that the processor should not be in decimal mode).

Control blocks have various formats – the only fixed slot being the first byte which serves a dual purpose:

- To identify the specific Teletext command wanted.
- To return the status of the operation (as a success/failure code, typically Ø meaning OK, or 17 meaning escape).

To allow for future enhancements of the Teletext system, control blocks should be declared as being exactly 16 bytes long.

Please note that the error codes are command dependent.

Example 1: Calling the Teletext system from BASIC

```
OSWORD = &FFF1
DIM parameter 15
parameter?Ø = &8B
parameter?1 = Ø :REM Ø -> BBC1, 1 -> BBC2 etc.
A% = &7A
X% = parameter MOD 256
Y% = parameter DIV 256
PYXA% = USR (OSWORD)
```

Example 2: Calling the Teletext system from Assembly Language

```
DIM CodeSpace 1ØØ
OSWORD = &FFF1
FOR Pass = Ø TO 2 Step 2
P% = CodeSpace
[OPT Pass
.SelectBBC1
Lda #&8B
Sta parameter
Lda #Ø \SelectBBC1
Sta parameter + 1
Lda #&7A
Ldx #parameter MOD 256
Ldy #parameter DIV 256
Jsr OSWORD
Rts
.parameter NOP:NOP
]
NEXT Pass
CALL SelectBBC1
```

The section below on Teletext OSWORD calls describes the calls available to you. Some entry points are used for internal Teletext filing-system operations and should not be called. Others are 'reserved for future expansion . . .'. Further information will be made available by Acorn in the form of a software applications note.

7.2 Teletext OSWORD calls

RELOAD PAGE   [&8Ø]
The last page received must be re-fetched.

FETCH PAGE   [&85,p1ØØ,p1Ø,p1,s1ØØØ,s1ØØ,s1Ø,s1]
Request the page specified by the seven-digit page number given as the parameter. The sub-code is the time-code which is used for selecting a particular rolling page in a series of rolling pages. If any rolling page is acceptable, the sub-code digits should be set to &FF to denote that they are 'wild'. Page digits may also be set 'wild', and the page digits can be specified in either binary or ASCII hex. This call returns immediately. See TRANSFER for details of how to load a page into memory.

CHAINED PAGE   [&86]
Fetch the next page in the chain of pages of which the current page is part. The Telesoftware decoder uses this call to mean 'Get me the next block in the encoded Telesoftware file which I am loading sequentially'. If the current page is not part of a chain, the next rolling page to arrive is fetched instead.

HEAD OF CHAIN   [&88]
Follow the head of the chain round until you find the page which is marked as being the head of the chain. The Telesoftware decoder uses this call to mean 'Find me a page in which I can start looking for some encoded Telesoftware to decode' and also 'Get me the next block in the encoded Telesoftware file which I am loading in random order'. As with CHAINED PAGE, if the current page is not part of a chain, the next rolling page to arrive is fetched instead.

TEST ARRIVED   [&89, result]
Test to see if the last page requested has arrived.

Test succeeds: result = &FF
Test fails: result = Ø

The page in question is LOCKED against further update if the test was successful.

UNLOCK PAGE   [&8A]
If the TEST ARRIVED command has shown that a page has been captured by the decoder, the page will have been locked against further

update. To secure updated versions of the page (or following pages in a series of rolling pages), the page must be UNLOCKED.

Note that reading data from a page using BGET on channel 15 also causes the page to be LOCKED.

SELECT CHANNEL   [&8B, channel]
Select channel 'channel' in the decoder hardware. Channel numbers should be given in the range Ø to 3 (binary or ASCII).

Note: This is different from Terminal mode, where the range 1 to 4 was chosen for the benefit of first-time users.

READ TSDP   [&8D, 16-bit address]
The readable part of the television service data packet (TSDP) is written to the area of store defined by the 16-bit address. As usual for the 65Ø2, the address is passed in 'low, high' order. There is no interlock on this operation, as the packet is intended for direct display.

HAMMING DECODE   [&8E, encoded byte]
The 8-bit hamming-encoded byte is decoded, and the result returned in its place. A result of &FF means that an uncorrectable (more than 1 bit) error has occurred.

TRANSFER   [&8F, 32-bit address]
The current page is transferred to the address given. The address is 32 bits wide in order to allow data to be transferred to a site in the parasite processor.

The 32-bit address is stored in the form 'low, high, higher, highest'. The transfer waits if necessary until the page has been received. If this is not what you want, use the TEST ARRIVED call which lets you perform other operations while you are waiting. (This is the mechanism used by Terminal mode to poll for pages received.) TRANSFER automatically UNLOCKS a page after the data has been transferred.

HEADERS   [&92, 16-bit address]
The readable portion of all the headers being received will in future be written to the address given. This call is expected to be used for positioning the headers within the MODE 7 display.

WHAT CHANNEL   [&93, channel]

This call READS the currently selected channel number which it returns in the slot provided. As with SELECT CHANNEL, the result is in the range Ø to 3 (binary).

8 Changing the filing system

Your computer can have several filing systems available other than the Teletext system. The following commands are all used to exit from the current filing system into the one named.

*TAPE3	3ØØ baud cassette
*TAPE12	12ØØ baud cassette
*TAPE	12ØØ baud cassette
*NET	Econet filing system
*TELESOFT	The Telesoft mode of the Teletext system
*ROM	The cartridge ROM system
*DISC	The disc filing system
*DISK	Alternative spelling for above

Typing the command to enter the system you are already in has no effect. If you type the command to enter a filing system for which your computer is not equipped (ie you do not have the relevant filing system ROM) then the computer will respond with **Bad command** since it does not recognise the command.

9 Technical information

This is mainly for interest and is not essential to using the Teletext Adapter. However, some of the material may prove useful if you wish to make full use of the Teletext system at assembler level. The information in this section covers the Teletext signals in general and the specific Telesoftware signals.

9.1 The structure and numbering of Teletext pages

A page can stand alone or be linked to another page to form a chain. Also, a number of stand-alone pages and/or chains can be accessed at a common level known as a branch. In this way a 'family tree' of pages can be formed with branching occurring at many levels. An example of this tree structure is given in Fig 5.1 which shows one way in which the contents of a newspaper could be transmitted. The first page contains the headlines and could be the index page with branching occurring at level 1 to four lead pages.

Lead 1 is the title page of a story covering four pages whilst lead 2 and lead 4 are stand-alone single page items. Lead 3 could be a sub-index with branching occurring at level 2 to three separate stories.

The reason why Teletext uses such a structure is to enable you, by using simple commands, to find your way through the index/sub-index pages, branches and linked pages to the information item you wish to see.

Pages are numbered in groups of 1ØØ, called magazines, and a total of eight magazines are currently available for each broadcast channel although not every magazine and every page is necessarily transmitted. Each page is numbered with three digits, the first of which identifies the magazine it belongs to, and the second two the page number within that magazine. In addition, a further four digits are available for sub-page numbering, thus 4Ø7ØØØ6 would be sub-page ØØØ6 of page Ø7 in magazine 4.

Each magazine may have an index page which displays the magazine contents. This is usually the first page and is numbered 1ØØ, 2ØØ, 3ØØ etc depending on the magazine.

Page numbers are not normally reserved for specific items of information, so you must first display the index page to locate the correct page or sub-page number which can then be displayed.

If you select page 206, and page 210 is being transmitted at that instant, some time may elapse before the transmission sequence cycles back round to page 206.

Index pages are, in fact, often transmitted at a faster rate than other data pages. This is to minimise the time you must wait before the selected index page is displayed. Another point which deserves mentioning is that not all pages are necessarily used. For example, it may be that in magazine 4, only pages 420 to 450 are transmitted.

Finally, there are rolling pages. These are pages which contain different information but are numbered the same as sub-pages, eg 0001, 0002 etc. A different rolling page is transmitted each time, which allows a great deal of information to be sent without changing the page number. For example, the BBC Newsreel is transmitted on page 199 but on every transmission a different rolling page is sent which contains different information (1990001, 1990002, 1990003 etc). Suppose the rolling page was changed five times. This would give a series of five rolling pages numbered 1990001, 1990002, 1990003, 1990004, 1990005.

As mentioned previously, Teletext pages are numbered by up to seven digits, made up as follows:

A one-digit magazine number in the range 0 to 7.
A two-digit page number in the range 00 to 99.
A four-digit page sub-code in the range 0000 to 3979.

The magazine number is sent in the form of a single 3-bit binary number. The full range possible is thus 0 to 7 as used by the Teletext system.

The page number is sent in the form of two 4-bit binary numbers. This allows a range of 0 to 255, or 00 to FF hexadecimal, but at present the Teletext system only uses the range 0 to 99 – the numbers being in binary coded decimal (BCD). Page numbers outside this range may be used for other purposes, as yet undefined.

The page sub-code is sent in the form of four binary numbers, whose lengths are given below:

Most significant digit	– 2-bit binary number
Next digit	– 4-bit binary number
Next digit	– 3-bit binary number
Least significant digit	– 4-bit binary number

These binary numbers give a possible range of 8192 pages (0000 to 3F7F hexadecimal). At present, the Teletext system only uses sub-codes which have their 4-bit binary numbers lying in the range 0 to 9, and thus with the sub-code in the range 0000 to 3979. The use of 2- and 3-bit binary numbers explains the strange limits to the first and third digits.

The 2- and 3-bit binary numbers are a result of the fact that the last four digits were originally developed as a 'time code' and hence the full 0 to 9 range was not needed for these three digits.

The Teletext specification does allow for hexadecimal page numbering with the full range of 0000000 to 7FF3F7F, but this is not used for conventional pages.

9.2 Teletext signals

A conventional Teletext decoder displays pages made up of 24 rows of 40 characters per row (except for the first row – see below). The BBC Microcomputer Teletext System generates a 25th row for displaying system information, prompts etc. This 25th row displayed on the screen has nothing to do with the Teletext signals sent by the transmitter. The rest of this section deals with the general Teletext signals and the presence of this 25th row on the screen is ignored.

Teletext data is sent as a stream of digital bits forming 8-bit bytes. Each row consists of 45 bytes. All rows carry a row address or number in the range 0 to 31. Rows 0 are the first row on any page and some of its 45 bytes are used to identify the page and to carry control information. This leaves 32 bytes for character codes. Rows 1 to 23 are the remaining 23 rows of 40 characters which, with row 0, make up the complete page. Rows 24 to 31 are often not transmitted. They are available to carry special information to the decoder.

The rows of 45 bytes are transmitted on the spare space between television picture fields. Four rows are currently sent between each picture field and a maximum of 16 is possible. The structure between the rows of bytes is discussed below.

Rows 1 to 23

These 23 rows have a structure as shown in Fig 9.1.

Fig 9.1 Byte structure of Teletext rows 1 to 23

| Clock run-in | Framing code | Magazine and row address | 4∅ character code bytes |
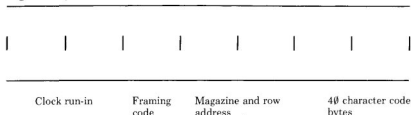
The first three bytes, the clock run-in (2 bytes) and framing code (1 byte) are used by the decoder for synchronising the row so that it can tell where one character byte ends and the next begins. The next two bytes, the magazine and row address bytes, give the magazine number (3 bits) and the row number or address (5 bits) arranged in such a way with the eight other bits to provide a means of error detection and correction. A discussion of the error protection is beyond the scope of this guide – it is dealt with in the reference given in section 9.4. The remaining 4∅ bytes are codes for the 4∅ characters which are to be displayed on corresponding rows on the television screen when the page is assembled. The codes are given in table 9.1.

Row ∅

Rows with address or row number zero have a special status as page-headers. They are made up of 45 bytes like any other row, but only 32 bytes are available for character codes. The first 13 bytes are information bytes. The first five bytes carry the same information as for any other row, that is, the clock run-in, framing code, and magazine and row addresses. Bytes 6 and 7 give the page number, units and tens respectively. Bytes 8 to 11 carry the sub-code, the four least significant digits of the page number. Bytes 12 and 13 are a series of control bits to give information and instructions to the decoder about the page. The remaining 32 bytes are the character codes for display on row ∅. All of the first 13 bytes are error protected as for the first five bytes of other rows.

When the Teletext decoder finds that it is receiving a row zero (by means of the information bytes at the start of the row) it interprets this as meaning that the previous row it received was the last one for the

preceding page and that the current row it is receiving is the start of a new page for that magazine. Each row zero is thus used to determine the start and finish of the pages within a magazine. The rows sent between row zeros can be sent in any order (for example, row 1, row 15, row 9 . . .) since they each have a row number or address amongst the first five bytes (see Fig 9.1). Several magazines may be transmitted simultaneously in unrelated order of rows. Blank rows need not be sent. If the decoder detects the completion of a page (by receiving the next page-header, row zero) it assumes that any row numbers not received for the previous page are blank rows.

To select a given page, the decoder examines the incoming rows of data until it finds a page-header with the correct page and magazine numbers. It then stores this row in its memory. The decoder continues to store each following row in the selected magazine until it receives the next page-header. It now has a complete page (bar blank rows) in memory and can decode the character bytes to display the characters on the screen in the right places by making use of the row addresses.

Rows 24 to 31

These are often not transmitted but are available for sending special information to the decoder. In particular, row 27 is used to tell the decoder whether or not a page has any branch or chain linked pages connected with it. Rows 24 and 25 have the same structure as rows 1 to 23 and may be used so that a page can contain 1K or 1024 bytes of information. A normal page can only contain $32 + (23*40) = 952$ bytes. The extra two rows provide another 80 bytes which is sufficient to bring the total up to 1024 bytes without having to use all the 32 row zero bytes. In fact, eight of the row zero bytes are left free and these are currently used for the time information.

Page check word (row 27)

Row 27 includes a 16-bit cyclic redundancy check (CRC) on the first 24 character bytes of row 0 and the 40 character bytes of rows 1-25 inclusive (a total of 1K bytes). For the purposes of this check word calculation any row not transmitted is assumed to carry 40 'space' bytes (hex 20).

Table 9.1 Teletext character codes

Bytes (b4 b3 b2 b1)	Col/Row	0 (000)	1 (001)	2 (010)	2a	3 (011)	3a	4 (100)	5 (101)	6 (110)	6a	7 (111)	7a
0 0 0 0	0	NUL①	OLE①	(sp)	▦	0	▦	@	P	—	▦	p	▦
0 0 0 1	1	Alphaⁿ Red	Graphics Red	!	▦	1	▦	A	Q	a	▦	q	▦
0 0 1 0	2	Alphaⁿ Green	Graphics Green	"	▦	2	▦	B	R	b	▦	r	▦
0 0 1 1	3	Alphaⁿ Yellow	Graphics Yellow	£	#	3	▦	C	S	c	▦	s	▦
0 1 0 0	4	Alphaⁿ Blue	Graphics Blue	$	▦	4	▦	D	T	d	▦	t	▦
0 1 0 1	5	Alphaⁿ Magenta	Graphics Magenta	%	▦	5	▦	E	U	e	▦	u	▦
0 1 1 0	6	Alphaⁿ Cyan	Graphics Cyan	&	▦	6	▦	F	V	f	▦	v	▦
0 1 1 1	7	Alpha② White	Graphics White	'	▦	7	▦	G	W	g	▦	w	▦
1 0 0 0	8	Flash	Conceal Display	(	▦	8	▦	H	X	h	▦	x	▦
1 0 0 1	9	Steady②	Contiguous Graphics②	)	▦	9	▦	I	Y	i	▦	y	▦
1 0 1 0	A	End Box	Separated Graphics	*	•	:	•	J	Z	j	▦	z	▦
1 0 1 1	B	Start Box	ESC①	+	▦	;	▦	K	←	k	▦	¼	▦
1 1 0 0	C	Normal Height	Black Background	,	▦	<	▦	L	½	l	▦	‖	▦
1 1 0 1	D	Double Height	New Background	-	▦	=	▦	M	→	m	▦	¾	▦
1 1 1 0	E	SO①	Hold Graphics	.	▦	>	▦	N	↑	n	▦	÷	▦
1 1 1 1	F	S1①	Release② Graphics	/	▦	?	▦	O	#	o	▦	▮	back space and delete

① These control characters are reserved for compatibility with other data codes

② These control characters are presumed before each row begins

Codes may be referred to by their column and row, eg 2/5 refers to %

Character rectangle

Black represents display code

White represents background

9.3 Character codes

Table 9.1 shows the available characters, their codes and also the control codes. These are the same characters which are available in mode 7 of the BBC Microcomputer – see chapter 28 of the User Guide for more details. The control codes can be sent in place of any character code anywhere in a row. The control codes are normally displayed as spaces (but see the section below on the hold graphics control). The fact that they can be used within a row enables one to change some aspect of the display part way through a row (for example, the display colour).

Display modes

There are three modes of display on the Teletext system – one alphanumeric mode and two graphics modes. The two graphics modes are called contiguous and separated. The difference is best shown by illustration, as in Fig 9.2.

Fig 9.2 Contiguous and separated graphics modes
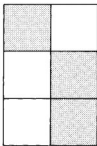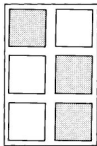
Contiguous   Separated mode

Colour

Seven different display colours are provided (white, yellow, cyan, magenta, red, green and blue). Fourteen control codes are available to select alphanumerics or graphics and the required colour simultaneously. This enables a change of colour and mode in one step.

The background colour can be any of the seven colours listed above, or black. Coloured background is selected by using the 'new background' control code. After this code appears, the new background colour will be the display colour in use when the 'new background' control was used.

Flashing and concealed characters

Two modes are provided in which the display characters appear as spaces some of the time. In flashing mode, a character appears alternately as a space and as the character at a rate determined by a clock in the computer. In conceal mode, the character appears as a space until revealed. The character is revealed by entering reveal mode which is done when the user issues the required command – such as the key **12** command in the Terminal mode of the BBC Microcomputer Teletext System.

Double height

Characters may be displayed at double height, in which case they take two rows. Thus the information sent in row n also applies to row n+1 in this mode. The decoder ignores row n+1 if it is sent.

Hold graphics control

The hold graphics control code allows a limited number of abrupt display colour changes. A control code is normally displayed as a space which thus causes a break in the display. In hold graphics mode, the character rectangle occupied by the control code is filled with a held graphics character. This can be used with any control code issued in the graphics mode. The held graphics character will be the most recent character with bit 6=1 in its code, provided that there has been no intervening change in either the alphanumeric/graphics modes or the normal/double height modes. In the absence of a suitable character, a space is displayed.

9.4 Reference

Broadcast Teletext Specification, Sept 1976
published jointly by
British Broadcasting Corporation
Independent Broadcasting Authority
British Radio Equipment Manufacturers' Association

9.5 The television service data packet

In addition to the above Teletext pages, a television service data packet is sometimes transmitted. If it is sent, it arrives once per second and carries the following information:

1. An initial page address which a terminal should select at start-up without further user action. This will be the page selected by the BBC Microcomputer Teletext System at start-up. (In the absence of a television service data packet, page #00 is selected by default.) The contents of this page are controlled by the sender.

2. A program or network label.

3. An absolute time reference giving the time and date in a machine usable form.

4. A 20-character block of Teletext coded characters which are intended for direct display if the user requests a status report.

Byte structure of the television service data packet

The television service data packet (TSDP) is made up of 45 8-bit bytes. The first six bytes are for control, identification and synchronisation. The next 19 bytes carry information in machine usable form. The last 20 bytes carry information for direct display when a status display is requested by the Teletext system.

In more detail, the 45 bytes are used as follows:

Bytes	Content
1- 2	Clock run-in
3	Framing code
4- 6	TSDP identification code
7-12	Default Teletext page
13-14	Channel identification
15	Time offset
16-18	Modified Julian date
19-21	Coordinated universal time (UTC)
22-25	Television program label
26-45	Status display message

Bytes 1 to 6 – decoder information

These six bytes provide information to enable the decoder to identify the TSDP as such and to synchronise the following bytes so that it can tell where one byte ends and the next begins.

Bytes 7 to 12

These six bytes provide the Teletext decoder with the page number which it is to use to select a default page. These bytes are in machine readable form.

Bytes 13 and 14 – channel identification

These two bytes can be read by the machine to determine which channel is being received.

Byte 15 – time offset

This byte gives the offset in hours between the local clock time and the coordinated universal time (UTC). The first bit is always 1, the second bit gives the polarity of the offset. The last bit is also always 1. The other five bits are the offset. For example, the following offsets may be encountered in the UK:

During winter (GMT): 1ØØØØØØ1 – no offset
During summer (BST): 1ØØØØ1Ø1 – add one hour to UTC to get clock time

The five offset bits have the following weights: 8,4,2,1,½.

Bytes 16 to 18 – modified Julian date

These three bytes carry the modified Julian date which increments at UTC midnight. The first half byte is always Ø1Ø1. The remaining two and a half bytes carry the date. Each 4-bit binary-coded-decimal number (half byte) is incremented by one before transmission. For example the three bytes may be:

55   5A   81

which would decode to 4497Ø or 1 January 1982.

The following notes should enable one to decode the modified Julian date to the standard format. BBC BASIC operators have been used.

Symbols: JD – Julian date
           Y – year from 19ØØ
           M – month (January = 1)
           D – day of month
           W – day of week (Sunday = Ø, Monday = 1 etc)

To find calendar date (in range $1/3/1900$ to $28/2/2100$):

$Y1 = (100*(JD - 15078.2))$ DIV 36525

$M1 = INT((JD - 14956.1 - INT(365.25*Y1))/30.6001)$

$D = JD - 14956 - INT(365.25*Y1) - INT(30.6*M1)$

$M = M1 - 1 - 12*K$

$Y = Y1 + K$

where $K = INT(0.7 + (1/(17 - M1)))$ ie IF $M1 < 14$ $K = 0$ ELSE $K = 1$.

To find day of week:

$W = (JD+3)$ MOD 7

Bytes 19 to 21 – coordinated universal time

These three bytes give the time according to the UTC scale. Each 4-bit binary number in the group is incremented by one before transmission. The three bytes are hours, minutes and seconds respectively. For example:

1A   56   43

would decode to $09:45:32$.

Bytes 26 to 45 – status display message

These 20 bytes carry the information which will be displayed when a status display is called for. A status display will occur after issuing the Terminal mode tune command **SHIFT** **f4**.

9.6 The Telesoftware format

Names

This section deals with the format of the Telesoftware bytes which the Telesoftware decoder receives. The Telesoftware is sent as a string of 8-bit bytes in blocks of about 1000 bytes. The bytes actually sent are names of either individual program bytes or groups of bytes. Thus, before a program is sent by Telesoftware, all the characters, words etc are given a name. For example the word JSR used in a program might be given the name &45, while the letter 'A' might be given the name &C1. All the names are single 8-bit bytes. At first thought it may appear that this means that only 256 names are available. However, this is doubled to 512

distinct names by means of their classification into two types of names: lone-names and escaped-names. The two types of name are told apart by the preceding byte sent. If the preceding byte is the name of the escape operator, then the name is an escaped-name. If the preceding byte is not the name of the escape operator then the name is a lone-name. For example, if the name of the escape operator is &1B, and a string of names received is:

&56 &89 &1B &89 &67...

the first two bytes are lone-names, the third byte is the name of the escape operator and so the fourth byte is an escaped-name. The fifth byte is a lone-name.

When the Telesoftware decoder is first started up, it carries out an initialisation routine during which it sets up a table of names and their meanings in memory. The table set up contains the default meanings of the names. Entries in the table may be modified from time to time by incoming commands. The default table is given in table 9.2, the general Telesoftware table. The table set up by the BBC Microcomputer Teletext System will be somewhat different.

When the Telesoftware decoder is receiving Telesoftware, it looks up the names in the table and uses this to decode the Telesoftware.

Table 9.2 (i) Name tables – default entries (&ØØ to &3F)

Value (hex)	ASCII char	Meanings Lone	Escaped	Value (hex)	ASCII char	Meanings Lone	Escaped
ØØ	NUL	ØØ	\<ESC\>	2Ø	SP	2Ø	\<ESC\>
Ø1	SOH	Ø1	\<ESC\>	21	!	21	\<ESC\>
Ø2	STX	Ø2	\<ESC\>	22	"	22	\<ESC\>
Ø3	ETX	Ø3	\<ESC\>	23	£	23	\<ESC\>
Ø4	EOT	Ø4	\<ESC\>	24	$	24	\<ESC\>
Ø5	ENQ	Ø5	\<ESC\>	25	%	25	\<ESC\>
Ø6	ACK	Ø6	\<ESC\>	26	&	26	\<ESC\>
Ø7	BEL	Ø7	\<ESC\>	27	'	27	\<ESC\>
Ø8	BS	Ø8	\<ESC\>	28	(	28	\<ESC\>
Ø9	HT	Ø9	\<ESC\>	29	)	29	\<ESC\>
ØA	LF	ØA	\<ESC\>	2A	*	2A	\<ESC\>
ØB	VT	ØB	\<ESC\>	2B	+	2B	\<ESC\>
ØC	FF	ØC	\<ESC\>	2C	,	2C	\<ESC\>
ØD	CR	ØD	\<ESC\>	2D	-	2D	\<ESC\>
ØE	SO	ØE	\<ESC\>	2E	.	2E	\<ESC\>
ØF	SI	ØF	\<ESC\>	2F	/	2F	\<ESC\>
1Ø	DLE	1Ø	\<ESC\>	3Ø	Ø	3Ø	\<ESC\>
11	DC1	11	\<ESC\>	31	1	31	\<ESC\>
12	DC2	12	\<ESC\>	32	2	32	\<ESC\>
13	DC3	13	\<ESC\>	33	3	33	\<ESC\>
14	DC4	14	\<ESC\>	34	4	34	\<ESC\>
15	NAK	15	\<ESC\>	35	5	35	\<ESC\>
16	SYN	16	\<ESC\>	36	6	36	\<ESC\>
17	ETB	17	\<ESC\>	37	7	37	\<ESC\>
18	CAN	18	\<ESC\>	38	8	38	\<ESC\>
19	EM	19	\<ESC\>	39	9	39	\<ESC\>
1A	SUB	1A	\<ESC\>	3A	:	3A	\<ESC\>
1B	ESC	\<ESC\>	1B	3B	;	3B	\<ESC\>
1C	FS	1C	\<ESC\>	3C	<	3C	\<ESC\>
1D	GS	1D	\<ESC\>	3D	=	3D	\<ESC\>
1E	RS	1E	\<ESC\>	3E	>	3E	\<ESC\>
1F	US	1F	\<ESC\>	3F	?	3F	\<ESC\>

Table 9.2 (ii) Name tables – default entries (&40 to &7F)

Value (hex)	ASCII char	Meaning Lone	Escaped	Value (hex)	ASCII char	Meaning Lone	Escaped
40	@	40	<ESC>	60	`	60	<ESC>
41	A	41	<CET>	61	a	61	<DTL>
42	B	42	<TXT>	62	b	62	<DSB>
43	C	43	<TX8>	63	c	63	<DEB>
44	D	44	<VDX>	64	d	64	<DET>
45	E	45	<EMP>	65	e	65	<DSL>
46	F	46	<TXO>	66	f	66	<DSN>
47	G	47	<ESC>	67	g	67	<DNC>
48	H	48	<ESC>	68	h	68	<DST>
49	I	49	<ESC>	69	i	69	<DDT>
4A	J	4A	<ESC>	6A	j	6A	<DCO>
4B	K	4B	<ESC>	6B	k	6B	<DIG>
4C	L	4C	<ESC>	6C	l	6C	<DLA>
4D	M	4D	<ESC>	6D	m	6D	<DLR>
4E	N	4E	<ESC>	6E	n	6E	<DXA>
4F	O	4F	<ESC>	6F	o	6F	<DXR>
50	P	50	<ESC>	70	p	70	<DIR>
51	Q	51	<ESC>	71	q	71	<DES>
52	R	52	<ESC>	72	r	72	<DEC>
53	S	53	<ESC>	73	s	73	<DLS>
54	T	54	<ESC>	74	t	74	<DLC>
55	U	55	<ESC>	75	u	75	<DSA>
56	V	56	<ESC>	76	v	76	<DAC>
57	W	57	<ESC>	77	w	77	<ESC>
58	X	58	<ESC>	78	x	78	<DND>
59	Y	59	<ESC>	79	y	79	<DEF>
5A	Z	5A	<ESC>	7A	z	7A	<ESC>
5B	[	5B	<ESC>	7B	{	7B	<ESC>
5C	\	5C	<ESC>	7C	|	<ESC>	7C
5D	]	5D	<ESC>	7D	}	7D	<ESC>
5E	^	5E	<ESC>	7E	~	7E	<ESC>
5F	_	5F	<ESC>	7F	DEL	7F	<ESC>

Table 9.2 (iii) Name tables – default entries (&8Ø to &BF)

Value (hex)	ASCII char	Meaning Lone	Escaped	Value (hex)	ASCII char	Meaning Lone	Escaped
8Ø	NUL	8Ø	\<ESC>	AØ	SP	AØ	\<ESC>
81	SOH	81	\<ESC>	A1	!	A1	\<ESC>
82	STX	82	\<ESC>	A2	"	A2	\<ESC>
83	ETX	83	\<ESC>	A3	£	A3	\<ESC>
84	EOT	84	\<ESC>	A4	$	A4	\<ESC>
85	ENQ	85	\<ESC>	A5	%	A5	\<ESC>
86	ACK	86	\<ESC>	A6	&	A6	\<ESC>
87	BEL	87	\<ESC>	A7	'	A7	\<ESC>
88	BS	88	\<ESC>	A8	(	A8	\<ESC>
89	HT	89	\<ESC>	A9	)	A9	\<ESC>
8A	LF	8A	\<ESC>	AA	*	AA	\<ESC>
8B	VT	8B	\<ESC>	AB	+	AB	\<ESC>
8C	FF	8C	\<ESC>	AC	,	AC	\<ESC>
8D	CR	8D	\<ESC>	AD	–	AD	\<ESC>
8E	SO	8E	\<ESC>	AE	.	AE	\<ESC>
8F	SI	8F	\<ESC>	AF	/	AF	\<ESC>
9Ø	DLE	9Ø	\<ESC>	BØ	Ø	BØ	\<ESC>
91	DC1	91	\<ESC>	B1	1	B1	\<ESC>
92	DC2	92	\<ESC>	B2	2	B2	\<ESC>
93	DC3	93	\<ESC>	B3	3	B3	\<ESC>
94	DC4	94	\<ESC>	B4	4	B4	\<ESC>
95	NAK	95	\<ESC>	B5	5	B5	\<ESC>
96	SYN	96	\<ESC>	B6	6	B6	\<ESC>
97	ETB	97	\<ESC>	B7	7	B7	\<ESC>
98	CAN	98	\<ESC>	B8	8	B8	\<ESC>
99	EM	99	\<ESC>	B9	9	B9	\<ESC>
9A	SUB	9A	\<ESC>	BA	:	BA	\<ESC>
9B	ESC	\<ESC>	9B	BB	;	BB	\<ESC>
9C	FS	9C	\<ESC>	BC	<	BC	\<ESC>
9D	GS	9D	\<ESC>	BD	=	BD	\<ESC>
9E	RS	9E	\<ESC>	BE	>	BE	\<ESC>
9F	US	9F	\<ESC>	BF	?	BF	\<ESC>

Table 9.2 (iv) Name tables – default entries (&C0 to &FF)

Value (hex)	ASCII char	Meaning Lone	Escaped	Value (hex)	ASCII char	Meaning Lone	Escaped
C0	@	C0	\<ESC\>	E0	–	E0	\<ESC\>
C1	A	C1	\<CET\>	E1	a	E1	\<DTL\>
C2	B	C2	\<TXT\>	E2	b	E2	\<DSB\>
C3	C	C3	\<TX8\>	E3	c	E3	\<DEB\>
C4	D	C4	\<VDX\>	E4	d	E4	\<DET\>
C5	E	C5	\<EMP\>	E5	e	E5	\<DSL\>
C6	F	C6	\<TXO\>	E6	f	E6	\<DSN\>
C7	G	C7	\<ESC\>	E7	g	E7	\<DNC\>
C8	H	C8	\<ESC\>	E8	h	E8	\<DST\>
C9	I	C9	\<ESC\>	E9	i	E9	\<DDT\>
CA	J	CA	\<ESC\>	EA	j	EA	\<DCO\>
CB	K	CB	\<ESC\>	EB	k	EB	\<DIG\>
CC	L	CC	\<ESC\>	EC	l	EC	\<DLA\>
CD	M	CD	\<ESC\>	ED	m	ED	\<DLR\>
CE	N	CE	\<ESC\>	EE	n	EE	\<DXA\>
CF	O	CF	\<ESC\>	EF	o	EF	\<DXR\>
D0	P	D0	\<ESC\>	F0	p	F0	\<DIR\>
D1	Q	D1	\<ESC\>	F1	q	F1	\<DES\>
D2	R	D2	\<ESC\>	F2	r	F2	\<DEC\>
D3	S	D3	\<ESC\>	F3	s	F3	\<DLS\>
D4	T	D4	\<ESC\>	F4	t	F4	\<DLC\>
D5	U	D5	\<ESC\>	F5	u	F5	\<DSA\>
D6	V	D6	\<ESC\>	F6	v	F6	\<DAC\>
D7	W	D7	\<ESC\>	F7	w	F7	\<ESC\>
D8	X	D8	\<ESC\>	F8	x	F8	\<DND\>
D9	Y	D9	\<ESC\>	F9	y	F9	\<DEF\>
DA	Z	DA	\<ESC\>	FA	z	FA	\<ESC\>
DB	[	DB	\<ESC\>	FB	{	FB	\<ESC\>
DC	\	DC	\<ESC\>	FC			\<ESC\>	FC
DD	]	DD	\<ESC\>	FD	}	FD	\<ESC\>
DE	∧	DE	\<ESC\>	FE	∼	FE	\<ESC\>
DF	_	DF	\<ESC\>	FF	DEL	FF	\<ESC\>

Command subroutines

Looking at table 9.2, in the escaped-name meanings column you can see some as yet unexplained terms, eg escaped-name &41 corresponds to \<CET\>. These strings enclosed in angled brackets \<\> are names of command subroutines. The subroutines required by the Teletext Telesoftware decoder (as in the BBC Microcomputer decoder) are contained in the Teletext filing system ROM. Each command subroutine has a three-character code (eg \<CET\>). An instruction to the decoder appears in the form of the name of the relevant command subroutine to be executed, followed by the names of any operands required along with the number and size of the operands if this is not implied by the command subroutine.

Each command subroutine has either a fixed (implied) number of operands or a variable number of operands. Each operand consists of either a fixed (implied) number of decoded bytes or a variable number of decoded bytes. Any variable quantity (either number of operands or number of bytes in an operand) is preceded by a number giving its value on this occasion. For the Teletext system, this number is either a single decoded ASCII hexadecimal digit ('0' to '9' and 'A' to 'F') or the decoded ASCII character 'X' followed by two decoded ASCII hexadecimal digits (most significant first). The general structure of a command before naming is:

<command subroutine>

<the number of operands, n, if variable>

<the number of names the first operand will encode to, i, if variable>

<the first operand>

<the number of names that the second operand will encode to, j>

<the second operand>

. . . and so on.

Many of the commands appearing in table 9.2 are not relevant to the Teletext system but are used by other systems making use of the general Telesoftware format. In general, there are three modes of obeying the commands – those which lie outside a block, those obeyed on the first pass and those obeyed on the second pass through the data. Any bytes received outside a block are ignored unless they are the names of the start block command and its operands, or a description of the medium being used. For the purposes of the first and second pass through the data, the block runs from after the start block command. Some commands are obeyed on the first pass through the block. If an end of block command is encountered, then the second pass stops at the name before this command. The rest of the commands are obeyed on the second pass through the block.

In the Teletext system, only one pass is made through the data, all the commands being obeyed on this pass.

A complete list of the commands relevant to the Teletext system along with a brief description is given in table 9.3. However, it should be noted that the table does not show all the commands listed in the name tables as not all of these are relevant to Teletext.

Table 9.3 The command subroutines

Code	Command subroutine
<DCO>	Comment
<DDT>	Define data type
<DEB>	End block
<DEC>	Change escaped-name's meaning (command)
<DEF>	Revert to default format
<DES>	Change escaped-name's meaning (decoded string)
<DET>	End of file
<DIG>	Ignore
<DIR>	Inhibit run
<DLA>	Load address (absolute)
<DLC>	Change lone-name's meaning (command)
<DLR>	Load address (relative)
<DLS>	Change lone-name's meaning (decoded string)
<DND>	No reversion to default format before next file
<DSB>	Start block
<DTL>	Title of file
<DXA>	Execution address (absolute)
<DXR>	Execution address (relative)
<ESC>	The escape operator
<TXT>	Teletext
<UER>	Error in transmission
<ULB>	Eight-bit byte adjustment (lower)
<URB>	Eight-bit byte adjustment (raise)

These commands relevant to the Teletext system are discussed below.

Start block and medium description commands

Start block <DSB>

Operands: Ø, 1 or 2; each variable in length.

<DSB> marks the start of the block of data. The first operand is the number of this block. The second operand (which only needs to be present for one of the blocks of a file) is the number of blocks in the file. The blocks need not be numbered if the end of file <DET> command is used.

Example: <DSB> '1' '2' '1' 'Ø'

(This is the 16th block of the file.)

Teletext <TXT>

Operands: $\emptyset$, 1 or 2; each of variable length.

<TXT> makes the changes to the name table necessary for data with
odd parity, streamlines the tables for Teletext and then executes the
<DSB> subroutine to mark the start of the block.

Thus, any Telesoftware file for the BBC Microcomputer decoder
received from CEEFAX will start with the name of this command.

The changes from the general format which are brought about are:

In the name tables, all names that would be a parity error if received are
set to be names of the <UER>, error in transmission, subroutine. If they
are received, the <UER> subroutine will alert the decoder that there
has been a transmission error. All lone-names with correct parity are set
to decode to themselves after a logical AND with &7F.

The command subroutine <ULB> is given the lone-name &E$\emptyset$ and the
command subroutine <URB> is given the lone-name &FE. The
escaped-names &E$\emptyset$ and &FE are set to decode to themselves. The
command subroutine <DSB> is given the escaped-name &42.

The decoder is set to expect numerical information (numbers describing
variable operands, load addresses etc) to be given in ASCII hexadecimal
digits.

Example: <TXT> '2' '1' '1' '1' '1' '4'

(Teletext: This is the first block of four.)

End block <DEB>

Operands: none

<DEB> marks the end of a block of data. If the end of the block is
marked by the end of a Teletext page then the <DEB> command is
optional.

File and segment information commands

End of file <DET>

Operands: none

<DET> indicates that this block is the last block in a file. It can be
omitted if the end of file is indicated by other means.

Title of file <DTL>

Operands: 1, 2 or 3; each of variable length.

The operands of a <DTL> command describe the title of the Telesoftware file (first operand), its version number (optional second operand) and its date of issue (optional third operand). The date should be given as the modified Julian date (see section 9.5).

Files whose blocks may only be received in order are arranged on CEEFAX as a chain. The first block is marked as the chain-header and should contain a <DTL> command giving details of the file. Other blocks need not. Files whose blocks may be received out of order are also arranged on CEEFAX as a chain. However, each block is marked as a chain-header and should contain a <DTL> command.

Example: <DTL> '2' '7' 'P' 'r' 'o' 'g' 'r' 'a' 'm' '1' '5'

(File title is 'Program'; version number 5.)

Comment <DCO>

Operands: variable number; each of variable length.

Comments are indicated by the <DCO> command, and may be displayed by the decoder whilst Telesoftware is decoded (the display is controlled in the BBC Microcomputer Teletext System by the Telesoft mode command *OPT1).

The recommended layout is:

1st operand – name of program
2nd operand – language
3rd operand – type of computer used
4th operand – date of publication
5th operand – source of program
6th operand – other comments

Example: <DCO> '1' '9' 'A' ' ' 'p' 'r' 'o' 'g' 'r' 'a' 'm'

(The name of the program is 'A program'.)

Ignore <DIG>

Operands: variable number; each of variable length.

The decoder will ignore the operands of a <DIG> command.

Load address (absolute) <DLA>

Operands: 1 of variable length.

The operand of a <DLA> command is the first absolute address in memory that the decoded Telesoftware should be stored at (unless overruled when issuing the *LOAD command – see chapter 6 in the Telesoft mode).

The first decoded byte of the operand represents the most significant byte of the address.

Example: <DLA> '4' '2' 'Ø' 'Ø' 'Ø'

(Store the Telesoftware starting at address &2ØØØ.)

Load address (relative) <DLR>

Operands: Ø or 1; of variable length.

The operand of a <DLR> command represents the offset from the first address that decoded Telesoftware is being stored at. Decoded Telesoftware should now be stored from this offset onwards.

The <DLR> command allows blocks to be received and decoded out of order.

If there is no operand, then the data should not be stored in a contiguous block of memory, but should be passed to a command line interpreter in whatever order the blocks are received and decoded. BASIC programs are loaded in this way after using the Telesoft mode command *EXEC.

Example: <DLR> '1' '3' '1' 'Ø' 'Ø'

(Store any further Telesoftware in memory starting at &21ØØ – assuming that the base address is &2ØØØ).

Execution address (absolute) <DXA>

Operands: 1 of variable length.

The operand of a <DXA> command gives the execution address of the file of Telesoftware.

Example: <DXA> '4' '2' 'Ø' 'F' 'Ø'

(The execution address is &2ØFØ.)

Execution address (relative) <DXR>

Operands: 1 of variable length.

The operand of a <DXR> command gives the execution address relative to the load address of the file.

Example: <DXR> '2' 'F' 'Ø'

(The execution address is &2ØFØ – assuming that the base address is &2ØØØ.)

Inhibit run <DIR>

Operands: none

The DIR command inhibits execution of the program immediately after its reception.

Define data type <DDT>

Operands: 1 or 2; of variable length.

The <DDT> command defines the type of data in the file and the hardware at which it is directed. The data type applies until superseded by a different <DDT> command.

Example: <DDT> '2' '4' 'B' 'B' 'B' 'C' '3' '1' '6' 'K'

(The following program is in BBC BASIC for a 16K machine.)

Format redefinition commands

Change escaped-name's meaning (decoded string) <DES>

Operands: 2; first of length 1 decoded byte, second of variable length.

The <DES> command changes the entry in the name tables for the escaped-name given (first operand) to decode to the string given (second operand).

Example: <DES> ØØ '4' 'w' 'o' 'r' 'd'

(The escaped-name ØØ will decode to 'word'.)

Change escaped-name's meaning (command) <DEC>

Operands: 2; first of length 1 decoded byte, second of length 3 decoded bytes.

The <DEC> command changes the entry in the name tables for the escaped-name given (first operand) to represent the command subroutine given (second operand).

Example: <DEC> FF 'U' 'E' 'R'

(Reception of the escaped-name &FF indicates that there has been a transmission error – the command subroutine <UER> is executed.)

Change lone-name's meaning (decoded string) <DLS>

Operands: 2; first of length 1 decoded byte, second of variable length.

The <DLS> command changes the entry in the name tables for the lone-name given (first operand) to decode to the string of bytes given (second operand).

Example: <DLS> ØØ '4' 'W' 'O' 'R' 'D'

(The lone-name ØØ will decode to 'WORD'.)

Change lone-name's meaning (command) <DLC>

Operands: 2; first of length 1 decoded byte, second of length 3 decoded bytes.

The <DLC> command changes the entry in the name tables for the lone-name given (first operand) to represent the command subroutine given (second operand).

Example: <DLC> FF 'E' 'S' 'C'

(The lone-name &FF becomes a name of the escape operator.)

No reversion to default format before the next file <DND>

Operands: none

The <DND> command stops the decoder resetting its name tables to their default values prior to decoding the next file (see also the Telesoft mode call *OPT3).

Revert to default format <DEF>

<DEF> resets the name tables to their default values (see also the Telesoft mode call *OPT3).

The escape operator <ESC>

The function of the escape operator (<ESC>) is to indicate that an escaped-name follows, rather than a lone-name. Thus it permits 512 distinct names rather than 256. The escape operator must have at least one lone-name and may have escaped-names.

Eight-bit byte adjustment

For the Teletext system which only sends odd parity bytes, there are only effectively seven bits to the byte. The <ULB> and <URB> commands are available to 'add' an eighth bit.

Eight-bit byte adjustment (lower) <ULB>

Operands: 1 of decoded length 1 byte.

<ULB> indicates subtract &58 from the next decoded byte (to give a value in the range &C8 to &FF or &00 to &27, if only bytes in the range &20 to &7F can be transmitted).

Example: <ULB> 20

(Decodes to &C8.)

Eight-bit byte adjustment (raise) <URB>

Operands: 1 of decoded length 1 byte.

<URB> indicates add &58 to the next decoded byte (to give a value in the range &78 to &D7).

Example: <URB> 20

(Decodes to &78.)

Error in transmission <UER>

<UER> indicates that there has been an error in transmission.

Appendix 1
Installing the TELEROM into the BBC Microcomputer

CAUTION
STATIC SENSITIVE DEVICES – DO NOT HANDLE UNTIL YOU HAVE READ THESE INSTRUCTIONS

Please read these instructions carefully before attempting this conversion. If you are not completely confident of your ability to carry out this conversion yourself it will be in your own interests to take your unit to an authorised BBC Microcomputer dealer for him to carry out this upgrade.

First find out whether or not your computer has a series 1 operating system installed, by typing in ***FX0** **RETURN** . If a number greater than 1.00 is displayed, you have a series 1 system.

1. Ensure that the computer is not connected to a mains power socket.

WARNING
DO NOT REMOVE THE LID OF THE COMPUTER WHILST IT IS CONNECTED TO THE MAINS

2. Unscrew the two large-headed screws on the rear panel of the computer and the two large-headed screws on the underside of the computer (near the front). Carefully remove the lid.

3. Unscrew the two (three on some computers) bolts securing the keyboard assembly to the lower case and *carefully* unplug the 17-way ribbon cable connecting the keyboard assembly to the main printed circuit board (PCB) by pulling the socket away from PL13 on the main PCB.

4. Move the keyboard away from the main PCB until the loudspeaker plug (PL15) is accessible. Unplug the loudspeaker by *carefully* removing the socket from PL15. Place the keyboard assembly to one side on a flat surface. ›

5. If your computer already contains a 'series 1' operating system then proceed to instruction 8.

6. The current Machine Operating System (MOS) is situated in the bottom right-hand corner of the main PCB in one of two configurations which are:

(i) One integrated circuit (IC) in socket IC51 identified by the legend 'B02' printed on the top. If you have this format carefully remove the MOS IC from IC51 using an IC extractor (a small screwdriver used with extreme care will do). Identify the BASIC language IC by the legend 'B01' or 'B05' printed on it, and if it is not already in socket IC101 then remove it as before and replace it in socket IC101 as described in '7' below.

(ii) Four ICs in sockets IC52, IC88, IC100 and IC101 (these sockets are all next to each other despite the numbering) identified with the legends 'C', 'D', 'E' and 'F' respectively printed on the top. If this is the case the BASIC language IC (identifiable by the legend 'B01' printed on the top and all four MOS ICs should be removed as described in (i) above. Replace the BASIC IC in socket IC 101 as described in '7' below.

7. The new MOS is supplied in a single IC identified by the legend 'B04' printed on the top. Insert the ROM carefully into the socket IC51 ensuring that all the 'legs' locate properly into the holes and are not 'bent under' upon insertion. The IC should be orientated so that the semi-circular cutout in the top of the IC is at the top, ie away from the keyboard. Avoid touching the IC legs with your fingers wherever possible.

Now set the following links:

S18   North
S19   East
S20   North
S21   Two off east/west
S22   North
S32   West
S33   West

NB north is the edge of the PCB nearest to the back of the case and south is the edge nearest to the keyboard. East and west follow logically from these.

8. Insert the TELEROM IC (identifiable by the legend 'TFS') into any free socket (IC88, IC100 or IC52) as described in '7' above.

Note: This User Guide assumes that the Teletext ROM is in the far right position of the filing system ICs (nearest the edge of the circuit board). If this is the case, then, when the microcomputer is powered up, the Telesoft filing system is automatically selected.

If the Teletext ROM is not in the far right position then the Telesoft filing system is not automatically selected on powering up. You can select Telesoft either by typing in

*TELESOFT `RETURN`

or by pressing the `T` and `BREAK` keys together.

9. Reassemble the BBC Microcomputer by reversing instructions 1 to 4 above. Your computer is now ready for use.

Appendix 2
Teletext reception

Teletext information is conveyed from the UHF TV transmitter to UHF domestic TV aerials as part of the complete 625 line UHF channel transmitted wave form. The pages of Teletext information are contained in a digitally coded form on unused blank lines which occur during the frame fly-back period and these pages of information are continually refreshed and updated. Thus a basic requirement for 'good' Teletext reception is 'good' TV reception, ie a 'clean' TV signal of adequate level.

Generally speaking 'good' Teletext reception should be possible in BBC/IBA defined UHF TV service areas with the usual 'line of sight' qualification, but may be difficult under fringe conditions.

A starting point is the reception of good quality, low noise (imperceptible snow), colour TV reception, but this alone will not guarantee error-free pages of Teletext information. Very close reflections of the received signal (ghosting) can be almost imperceptible on a good colour picture but can still result in Teletext reception errors. This effect can vary between the four TV channels in use because the channels are of different frequencies and the reflections are usually frequency-dependent.

If problems are experienced a number of questions should be answered before condemning the equipment as faulty, or writing to the BBC/IBA and/or the equipment manufacturers etc:

1. Is the aerial of the correct group? (UHF bands are split into different groups throughout the country.) Reputable aerial manufacturers conform to specific technical standards which are essential for the best possible Teletext, and colour television. The final display of Teletext information depends in the first instance on the aerial signal – this *must be right* before proceeding any further.

2. Was the aerial system properly installed *externally* with good quality UHF cable, avoiding kinks or sharp bends in the cable, and terminated in a good quality coaxial plug correctly fitted *and soldered*?

Note: Indoor aerials are *not* recommended for television or Teletext reception.

3. Is the aerial of the correct polarisation (horizontal and vertical systems are employed in different regions of the UK) and is it directed towards the transmitter intended to serve the area? Out of area reception is often employed for a number of reasons, including ignorance of the correct transmitter for the area.

4. Will the aerial signals provide a good quality, low noise, colour television picture free from all reflections? (The new electronic test card is a valuable aid in detecting close reflections.)

If all of the above criteria are met it may be necessary to adjust the position of the aerial especially if Teletext character error rates vary between channels, or between pages of information.

The aerial should be tried in all positions, including variation of height, preferably by the use of the 'cranked arm' type of mast. If a satisfactory result is not possible by this means, moving the aerial to a different location is occasionally the only answer.

If the TV aerial signal is fed through amplifiers and/or signal splitting devices to feed more than one outlet, it may, in cases of Teletext reception difficulties, be necessary to feed the signal direct to the Teletext unit in the first instance. This will help to reduce any problems caused by the signal distribution system. If the Teletext unit is fed from a larger MATV (master aerial TV) system further professional advice should be sought from a reputable contractor.

Every effort should be made to ensure the best possible level and quality of signal so that the end result will not vary with time, weather conditions etc.

Expenditure on good quality aerial installations at the outset will prove to be an investment in the long term.

Appendix 3
Summary of Terminal mode commands

The following is a quick reference list of all the Terminal mode commands together with the relevant keys, and the order in which they appear:

Description of command	Keys used
Select a channel	**f4**
Fine tune a channel	**f4** and **SHIFT**
Select a page	**f0**
Select last explicit page	**f1**
Select index page	**f1** and **SHIFT**
Keep a page	**f3**
Release a kept page	**f3** and **SHIFT**
Reveal page	**f2**
Conceal page	**f2** and **SHIFT**
Enter an operating system (*) command	**f5**
Save a page to file	**f7**
Load a page from file	**f6**
Hold page	**f8**
Exit to previous filing system	**f9**
Exit to Telesoft and execute	**f9** and **SHIFT**

Appendix 4
A statement about
Telesoftware by
the BBC

A considerable part of this manual is concerned with a new service called Telesoftware which is being offered by the BBC. The following is a statement by the BBC highlighting some important points which relate to the introduction of this service.

The BBC started the first regular public broadcasting of computer software in March 1983. This new 'Telesoftware' service is carried by the BBC Teletext service which means that you can receive Telesoftware simply by calling up the appropriate pages of CEEFAX. The programs will appear on your TV screen if you wish, but you can also download them automatically by using your Adapter linked to your BBC Microcomputer.

The Telesoftware service is carried on pages 7∅∅ to 7∅6 on CEEFAX at present. Page 7∅∅ carries the index of Telesoftware being broadcast and page 7∅1 carries the Telesoftware newsletter (REM) which contains general information about the service. Programs for downloading are transmitted on pages 7∅2 to 7∅6.

Some programs are supplied by the Microelectronics Education Programme and are intended primarily for use by schools and colleges; some will be written to link up with broadcasts and there will be programs and procedures from many other sources including individual contributors.

Fresh programs will be introduced at intervals and the variety and number of programs on Telesoftware will increase. Since the programs will be broadcast publicly you will be able to receive them without any extra payments, but we have to safeguard the copyright of the producers of programs, so we are starting the service with the following copyright rules and statement:

General
1. The following concessions apply only to those programs ('Telesoftware') broadcast by the BBC on CEEFAX.

(i) Domestic users of a program broadcast on CEEFAX may:

- Make two copies only for private purposes.
- Adapt or modify it for private purposes but not for sale.

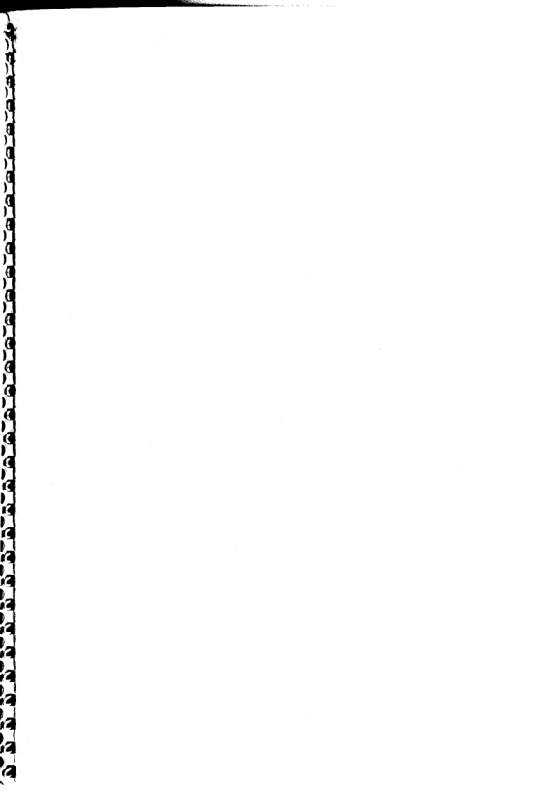(ii) Educational and training institutions and agencies may:

- Record and use the program for their own educational and training purposes but not for sale.
- Adapt, modify and distribute a program for their own educational and training purposes but not for sale.

(iii) No part of a program may otherwise be reproduced, stored in a retrieval system or transmitted in any form or by any means, without the prior permission of the BBC, except in accordance with the copyright act (1956).

2. Different concessions apply, and are set out in detail in *Recording BBC Educational Programmes*, with respect to those BBC programmes listed in *The Annual Programme for Schools and Colleges* and/or *The Annual Programme for Continuing Education*.

3. All other BBC programmes may *not* be recorded without the prior consent of the BBC and the holders of copyright and performing rights in the component parts of the programmes concerned.