System Guide

TORCH
COMPUTERS

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INTRODUCTION

This manual is a reference guide on the use of the various Commands, Utility programs, and Peripheral devices on the TORCH. It is intended as a "bridge" between the User Guide and the Programmers' Guide.

Note: At the time of writing, the Operating System current versions were: CCCP: 0.90, CPN: V70, and MOS: 0.92. As it is TORCH policy to upgrade and improve hardware and software, Operating System software with higher version numbers than those given may be issued at a later date. These versions will still be compatible with the versions described in this guide.

Some of the TORCH technical documents are reproduced at the back of the Guide for further technical information.

CONTENTS

COMMANDS

Introduction

The TORCH Operating System is stored in Read Only Memory (ROM) inside the TORCH. The Operating System controls the manipulation of data, and all the operations that the TORCH can perform. Commands are words that the TORCH operating system will recognise as definite instructions and act on immediately, (i.e. "executable statements"). These commands are "built into" the operating system so that as they are typed in at the keyboard, they are understood and acted on by the computer. Apart from these "built in" commands there are also a number of other commands, these will be dealt with in the following section "FILES AND FILENAMES", which may be read in conjunction with this section.

Below are listed all the built in commands that may be used on the TORCH with an explanation of each command.

Note: To enter a command, type the appropriate word on the keyboard and press `return` (Upper or lower case letters may be used when typing in a command). Note that commands may be abbreviated as shown in the description of each command.

Built In Commands

Help (H)

This command will list all the commands available and the information they require.

Foreground (F)

The F command is used to change the foreground colour of the screen, that is, the colour in which characters appear. The colour is indicated by a number from 0 to 15 as follows:

0 Black	8 Black/white flashing
1 Red	9 Red/cyan flashing
2 Green	10 Green/magenta flashing
3 Yellow	11 Yellow/blue flashing
4 Blue	12 Blue/yellow flashing
5 Magenta	13 Magenta/green flashing
6 Cyan	14 Cyan/red flashing
7 White	15 White/black flashing

To change the colour of the foreground to your liking, type F <space> followed by the number of the colour required.
EXAMPLE: Enter F   1 `return` sets the foreground to red

Background (B)

This is used in exactly the same way as the F command except that it changes the background colour and uses the same colour codes.

EXAMPLE: enter B   4 `return` this sets the background to blue.

Note: if the screen appears to go blank you have probably set the foreground to the same colour as the background and you cannot see the type.

Mode

The MODE command allows the user to change the format of the screen. This means that you can increase or decrease the character size

To use a MODE command enter MODE followed by a number from the table below and press `return` The number selects the screen format that you wish to use.

The codes for the different screen formats are as follows:

0   80x32 text (or graphics).

1   40×32 text (or graphics).

2   20×32 text (or graphics).

3   80×25 text.

4   40×25 text (or graphics).

5   20×32 text (or graphics).

6   40×25 text.

7   40×25 teletext display.

Where 80 × 32 means 80 columns by 32 lines. The Teletext display (mode 7 above), is the mode used for the British Telecom PRESTEL System. When the TORCH is first switched on the screen appears in mode 0.

Once a MODE command has been issued it will remain in this mode of operation until:

a) A new mode command is given.

b) An application program changes the screen mode.

c) The Master reset button at the back of the TORCH is pressed.

Note: Changing the mode clears the screen, selects a white foreground on a black background, and puts up the TORCH announcement, version number and a 0A> prompt.

VDU

The VDU command may be used to send given control codes to the screen driver. (The screen driver is part of the operating system software, and is used to print and draw on the screen). There are various functions available with this command which are listed below with their appropriate number codes.

To use the VDU command enter VDU followed by the number code required.

Number Codes		Function
0		Null (does nothing)
1	1	Send character to printer
2		Enable printer (switch printer on.)
3		Disable printer (switch printer off.)
4		Separate Cursor
5		Join Cursors
6		Enable VDU Driver
7		Ring Bell
8		Cursor left
9		Cursor Right
·0		Cursor Down
··		Cursor Up
·2		Clear Text Area
·3		Move Cursor To Start Of Line
··		Page Mode On
··		Page Mode Off
··		Clear Graphics Area
··	·	Define Text Colour
··	2	Define Graphics Colour
··		Define Colour Relationship

20		Reset Colour Relationships
21		Disable VDU Driver
22	1	Select Mode
23	9	Define Character
24	8	Define Graphics Window
25	5	Plot
26		Reset Windows
27		(escape)
28	4	Define Text Window
29	4	Define Graphics Origin
30		Home Text Cursor
31	2	Position Text Cursor
127		Delete Character
<N>		Any ASCII printable character code.

(*For an explanation of second column of numbers see below*).

EXAMPLES:

VDU 65 **return** Sends the character with ASCII value 65 to the screen. (i.e. prints the letter A).

VDU 7 **return** This produces a short "beep" on the speaker.

VDU 12 **return** The current text area is cleared and set to the current background colour.

VDU 2,1,<N>,3 **return** The printer is enabled, the character N is sent to the printer, and the printer is then disabled. For further programming information on any of the above functions, refer to the TORCH programmer's guide.

Note: Some number codes have following characters to complete the command.

EXAMPLE: VDU 22,2 **return** will set screen MODE 2, but will not switch on the printer.

If not enough characters have been entered to complete the command, then the operating system will add zeros until it is complete.

EXAMPLE: VDU 22 **return** will set screen MODE 0 because the operating system added a 0 to complete the command.

The second column of characters in the table above are the characters required to complete each individual command.

EXAMPLE: VDU 2,1,27,1,81,1,3 **return** sets 132 column print mode (ESC Q) on the TORCH matrix printer. This mode causes the printer to print in smaller (compressed) characters. (Refer to printer manual for ESC Q codes.)

Note: If SUPERVDU or another "Termulator" is loaded, the effects will be different. For example VDU 27,27,65,51, will select ADM31 popular terminal mode if SUPERVDU is loaded.

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Key (*Key)

The KEY command is used to program the 14 blue function keys along the top of the TORCH keyboard. This means that any of these keys may be programmed to represent a given set of characters chosen by the user. An example of this might be a company's name and address, or any piece of text that may have to be typed or printed frequently.

To use the key command: enter KEY followed by the number of the key you wish to program, and the characters you wish it to represent. *KEY may also be used as the KEY command.

EXAMPLE: If you wish the third key to produce the word TORCH,

ENTER: KEY 2 TORCH `return`

Note: The keys are numbered 0 to 13.
To include spaces at the beginning of the string, the whole string must be enclosed in quotes.

EXAMPLE: To set key 0 to produce -------1234------- (spaces are represented by -)

Type: KEY 0 " 1234 "

This tells the TORCH where the string of characters begins and ends, otherwise it would ignore the spaces. If you wish to include a quote within the string it is necessary to press the quote key twice.

EXAMPLE: To set key 0 to produce-------"XXX"-------
Type: KEY 0 "   " "xxx" "   " `return`

If you want to include a carriage return in your string you have to find another way of telling the computer to make a carriage return since to press `return` would close the current command. To do this you may use ¦M to mean carriage return where ¦ represents the character on the bottom of the key marked '¦

EXAMPLE: To set key 0 to set the foreground colour of the screen to blue, and the background to cyan:

Type: KEY 0 F 4 ¦M B 6 ¦M `return`

Pressing key 0 then gives F4 and B6 with automatic carriage return, which will change the foreground and background of the screen.

Note: KEYS 11 to 13 cannot be programmed unless the command *FX4, 2 is used first.
On "power on", or reset, the following keys are defined:

0	QUIT	¦M
1	HELP	¦M
2	NO	¦M
3	YES	¦M
9	BEGIN	¦M

*Basic

This command allows the user to run B.B.C. BASIC on the TORCH. To return the computer to normal operation, the command *CPN should be used. (see below), or press the master reset button at the rear of the computer while holding down the CTRL key. (For further information see Appendix A).

*CPN

The *CPN command returns control to the CPN operating system from B.B.C. Basic, after the *BASIC command has been used. It may also be used when running CPN to re-enter the system.

Time

The TIME command is used to set the time of the real time clock in the computer. and to display the time on the screen. To set the time. type TIME followed by the hours, minutes. and seconds. of the actual time, i.e. 09:40:30 `return`
The time will then be set when the user presses the space bar. To read the time. enter TIME `return` the screen will then display the time

User

The USER command is used to allocate a number (as a label), to a particular group of files on a disc. The reason one might do this. (especially in the case of a hard disc). is that if there are a lot of files on a disc, the user is able to select only the files required. by specifying the user number of that group of files. User numbers may be selected from any number between 1 and 31.

EXAMPLE: User 5 `return` will only allow access to the files with user number 5 and 0, note that files with user number 0 are always available to the user as well as the selected user number.

View

The VIEW command is used to display a picture file on the screen, it takes a file that uses the VDU control functions, and outputs them to the screen driver which displays them on the screen.

EXAMPLE: VIEW NEWPIX.PIC [return] will display the contents of that file on the screen. If no extension is given, the extension .PIC is assumed.

EXAMPLE: VIEW PIECHART [return] will display PIECHART.PIC

Note: Some picture files terminate with the VDU code 21 (disable screen) so that commands can be issued without corrupting the display. VDU 6 will restore that output.

Format

The FORMAT command is used to divide a floppy disc into tracks and sectors before the disc may be used. FORMAT may also be used to wipe an old disc clean. For further information about this command, see section on Disc Drives.

Duplicate (DUP)

DUPLICATE will copy the entire contents of Disc Drive B to Disc Drive A and is particularly useful for making backup copies of discs. Before the contents of the source disc is copied to the destination disc the DUPLICATE command formats the destination disc. This command may not be used with the hard disc.

Copy

COPY is used to make a copy of a file either onto another disc or to make another copy of the file on the same disc.

EXAMPLE: COPY A:SYS.MAN TO B:SYS.MAN [return] will copy the file called SYS.MAN from disc A to disc B.

To make a second copy of the file on the same disc enter:

COPY SYS.MAN TO SYS1.MAN [return]

The COPY command is particularly useful for making backups of single files rather than all the files on a disc.
Another example of the COPY command is where it may be used to copy a group of files with "ambiguous" filenames.

EXAMPLE: COPY B: DG*.* TO A: [return]
Where * represents any characters that follow the DG and the dot. All of the filenames below would be copied by the above command:

DGALIVAN
DG.COM
DGOVLY1.OVR
DGMSGS.OVR
DGCUSTOM.COM

Note: It is also possible to rename files when using the COPY command.

Delete (Del)

The DELETE command removes files from a disc once they are no longer required. DELETE followed by the filename will remove that file from the disc. Before doing so it will ask the user to confirm that he does want to delete that file by typing yes or no in answer to the question: do you want to delete "filename"?

EXAMPLE: DEL A:SYS.MAN [return] will delete the file SYS.MAN from the disc in drive A.

An option available with the DELETE command is the [u] option. If the filename is followed by this option, then the file will be deleted unconditionally, that is, without the user being asked if he wants to delete the file.

Note: If a file is protected by the [r] option of the PROTECT command, then the DELETE command will not effect it.

DIR

DIR is used to display a table of all the files on a disc on the screen.

EXAMPLE: DIR B: [return] will display all the files stored on disc B. If you want to display information on a particular file enter DIR followed by the filename.

EXAMPLE: DIR A:SYS.MAN [return] will display information on the file called SYS.MAN. There are three options available with the DIR command:

[L] will display the length of that file.

[P] will tell the user if the file is protected, and if it is, how the file is protected. i.e. if the file is read only, or read/write.

[S] will display the space left on that disc.

EXAMPLE: DIR A:SYS.MAN [L] **return** will tell the user the length of the file called SYS.MAN (in kbytes).

Rename

The RENAME command is used to rename a file, which might be useful if you wanted to regroup information or put outdated information into storage, and release the filename to use again.

EXAMPLE: RENAME SYS.MAN AS DISC.MAN **return** will change the filename from SYS.MAN to DISC.MAN.

Note: you must always have the same number of new names as there are files to rename.

Type

The TYPE command is used to display the text in a file.

EXAMPLE: TYPE SYS.MAN **return** will display the contents of the file called SYS.MAN.
When looking at the contents of a file it is possible to stop the screen scrolling and observe the current display of text by holding the CTRL and SHIFT key down at the same time. Pressing the escape key will also stop the screen scrolling, and a message will be displayed on the screen asking the user if he wishes to stop the program or carry on. The user responds to this by pressing the Y or N key for yes or no respectively.

Print

The PRINT command is used to print out information from files onto a printer. This is used the same way as the TYPE command.

EXAMPLE: PRINT SYS.MAN **return** will make the printer print the contents of the file called SYS.MAN.

Note: *FX followed by the correct code to select a printer (as described in the section on printer

information) must be entered before the PRINT command to tell the TORCH what type of printer is connected to it.

Command (C)

The COMMAND command, may be used to output the contents of a file, to the TORCH as a series of commands.
Comprehensive facilities are available for argument substitution.

EXAMPLE: C BEGIN.DOC **return** will take this filename and use it as the input stream to the TORCH.

If no extension is given then a default of .SUB is assumed.
For further information refer to the section: "Preparing Command Files".

Input

The INPUT command is used to enter a text file to the TORCH and store it on disc.

The syntax used is: INPUT followed by the filename, followed by **return**

The user may then enter text which will be stored in this file. After the text has been entered press END or CTL Z to return to the command line. To display the text after it has been stored on disc use the TYPE command as described above.

EXAMPLE: INPUT SYS.MAN **return** After entering this the user would now be able to write a text file called SYS.MAN.

Editing facilities are available on the five right hand blue keys at the top of the keyboard.

The functions of these keys are listed in the following table:

KEY	FUNCTION
Lower case	Move cursor down
Upper case	Move cursor up
Move left	Move cursor to left
Move past	Copies chr. above cursor
Move right	Move cursor to right

Note: that as soon as one of these screen editing keys has been pressed, a second cursor known as the editing cursor will appear on the screen. This will disappear from the screen every time a carriage return is entered but will reappear when one of the edit keys is pressed again. The delete keys (delete left, and delete right,) on the right hand keypad, may be used to delete characters as required whilst using the INPUT command.

Protect

The PROTECT command is used to protect files in various ways depending on the option selected from the following:

s: File is invisible to the DIR command.
u: This option cancels the s option.
e: Is execute only.
r: File is read only.
w: File is read/write. (cancels r option).

The command syntax is:

    PROTECT "filename" [options]

EXAMPLE: PROTECT TORCHTEL.COM [r] `return`

This will make the file TORCHTEL.COM read only. This means it cannot be deleted or modified until another PROTECT command has been used.

PROTECT B:*.COM [s] `return`

This makes all the files on drive B with extension .COM (program files) into system files, which means in effect that they do not appear on the directory, but may still be used.

PROTECT without any options will display the protection assigned to the specified files(s).

EXAMPLE:

PROTECT B:TORCHTEL.COM `return` will display TORCHTEL.COM and any protection that might be assigned to that file.

(For information on syntax used when naming files, see next section "Files and Filenames".)

FILES AND FILENAMES

All the commands that may be used for the manipulation of files are described in the previous section "COMMANDS".

When a piece of text or data is to be taken from the computer and stored on disc, it has to be put in a "file" on the disc. This file has to have a name so that the computer can identify it at a later date, retrieve its contents, and load it back into the computer. Filenames are made up of:

(1 to 8 characters). (0 to 3 characters,) where a character is defined as: a letter from A to Z, a number from 0 to 9, or any of the following:

@, £, $, &, -, /.

Examples of filenames:

GALLIVAN.DES
DISC.TXT
JMB/RA
DEMO-1
Z.X
LETTER.001
REM.

Note: In the above example GALLIVAN.DES, GALLIVAN is the filename, and .DES is known as the extension. If the extension is omitted, the CCCP operating system, or the current program may add one. (This is explained further below.)

Within these limits the user may name his/her own files according to their own system. Any filenames that do not conform to the above requirements would be invalid and would not be accepted by the system.

Ambiguous Filenames

Where it is desirable to include a file within a certain group, without giving it a precise name you can use what is called an "ambiguous" filename. This makes use of two characters:

? and *

These characters may be used to represent whichever character the user desires them to. Thus, ? in any position in a filename means "any character".

EXAMPLE: SYS.??? means SYS. followed by any characters. What this means is that a file starting with SYS. may have any optional extension, and will still be recognised by the operating system.

The * character in any position has the same effect but it can mean any number of characters.

EXAMPLE: *.COM means all files with a COM extension.

. means all files on the default disc drive.

The default disc drive (A), is the drive the computer will access on "power on," or after a reset unless the logged on drive is changed. (See section on Torch Disc System.)

Note: When using the COPY command (see section on commands) the disc drive name A or B becomes part of the filename.

EXAMPLE: A:SYS.MAN

Where A: is the disc drive,
SYS is the filename,
.MAN is the extension.

The name of the disc drive becomes part of the filename so that the operating system knows exactly on which disc drive it will find the file called SYS.MAN.

Command Files and Submit Files

If a file name is entered at the beginning of the command line without an extension the TORCH operating system will add the extension .COM and then look for this on the disc. If it has it then it will load it and run it. If the operating system adds the .COM extension to a filename, looks for it and doesn't find it on the disc, then it will add the extension .SUB, it will then look for this on the disc. This is known as a SUBMIT file. Such a file will have in it a sequence of commands written as text. When it finds it, the operating system will use this file as it's input rather than the keyboard. The operating system will then execute this file as a series of commands.

EXAMPLE: A file called SYS.COM may be executed by entering:

SYS return

A file called SYS.SUB may be executed as a command file by entering SYS return provided the file SYS.COM does not exist.

UTILITY PROGRAMS

The TORCH computer is supplied with a system disc containing utility programs. The utility programs provided are listed below with a brief description of each program and its function. To use any of the utility programs, put the system disc in drive A and type the name of the utility followed by **return**

Note: Backup copies should be taken of all system programs before use.

As it is TORCH policy to upgrade and improve existing software, some versions of the Utility programs described below may not have all the features of future versions. However, all present software will be supported in future upgrades. (Software upgrades will be available from your dealer for a small handling charge.)

The following programs are described in this section:

1) FONT.
2) EXEC.
3) TORCHBUG.
4) RS 423.COM
5) MUSIC.
6) MAPDISC.
7) POKEDISC.

FONT

This program allows the user to design character sets for special use or just for personal preference. The program is menu driven and should be self explanatory.
When FONT is run it will ask the user if he wants to modify an existing FONT file, or to create a new one from the current character font. Either enter the name of the file to be modified, or press **return** to create a new FONT file. Font will then display a list of options from which the user may design his own character font.

When selecting a character to be re-defined, the ASCII character code (in Hex), should be entered. Alternatively, enter = followed by the character to be selected.
The selected character is defined on an 8×8 grid around which a cursor is moved and is used to re-define the character. The cursor movement is controlled by the keys on the numeric key pad. Key 5 reverses the field of the pixel (picture element) under the cursor. all the keys around key 5 i.e. 4, 6, 8, and 2 2 are used to move the cursor left, right, up, and

down, respectively. The character to be defined is shown in parentheses above the grid box in mode 0, 1, and 2 sizes. At the bottom of the screen is a box showing the current character font for reference. While editing the character, a number of commands are available to alter the grid quickly, all of these commands are listed on the screen when the program is run.

The W command allows the user to allocate a filename to the new character font and save it on disc.

If a filename is given the extension .COM then this file may be saved and run as a command file.

EXAMPLE: To set up a font called GOTHIC.COM enter GOTHIC followed by return, and the TORCH will add the .COM extension itself and load and run the file. (For an explanation of the syntax used for naming files, see the section on FILES and FILENAMES.)

Note: FONT is not limited purely to producing character sets, it may also be used to produce graphic fonts to produce pictures or circuit diagrams for example. This is achieved by redefining the characters of the current font as graphic characters.

EXEC

The EXEC command allows the user to specify upto approximately 120 characters that will be 'typed' after execution of a SUB file. The effect of any such command is exactly as though the characters in question had been read from the keyboard buffer.

Note: If SUPERVDU or other termulators are to be loaded with a command (SUB) file, then the EXEC command should be used.

Operation

The characters following the EXEC command are programmed into function key 8 and, if it is sufficiently long also into function key 7. The codes for key 8 (and 7 if necessary) are added to the keyboard 'typeahead' buffer. When the Torch next tries to read input from the command line in interactive mode the soft key definitions will be read and expanded. The format for the parameter

given to EXEC is the same as that used by the function keys (i.e. vertical bar is an escape character).

Restrictions

Only one EXEC command may be included in any SUB file or sequence of such files. This limits the total command length that may be EXECed. The keyboard buffer is not cleared before execution of the program so it is advisable to include a control-X (entered as ¦X) as the first character in the buffer. Similarly a carriage return should be included at the end of the string if it is intended that the command should be terminated by one. This may not, of course, always be the case (see below).

The keys 8 and, sometimes 7, are used by EXEC and therefore may not be set by the user when EXEC files are used. The key definition resulting from EXEC will of course remain in keys 8 and 7 and may be reused as necessary. If the string involved is sufficiently short only key 8 will be affected.

Help screen

If the EXEC command is invoked without any parameters, then a screen of information describing the command will be displayed.

EXAMPLES: Set up a SUB file which may be easily invoked by a user with little or no experience of computers, which will set up a printer and a yellow foreground on the screen and will leave the user in an MBASIC program called ACCOUNTS. Since the program is to be run as a 'turnkey' system, (i.e. automatically runs a specific program on power on), the file will be named 'BEGIN.SUB'. This allows it to be executed by simply typing the CTRL+BEGIN keys together, with the disc in drive A.

The contents of this file might be as follows (lines beginning with a semicolon are comments):

```
; Set up a parallel printer
*FX 5, 1
; Set up screen
MODE 0
F 3
; Now run the accounts package
EXEC  X ¦MBASIC ACCOUNTS ¦M
; Note that the  X clears the line of any
  unnecessary letters while the
```

```
; SUB file is being obeyed and the ¦M is
  necessary to ensure that
; the command will be entered.
; Also note that while EXEC need not be the
  last command in a file
; there may only be one EXEC and it will not
  take effect until all
; other commands have been executed.
```

This file (with or without the comments) will have the desired effect.

A programmer wishes to have a simple method of editing and assembling programs using WordStar, M80 and L80. The following submit file (called UPDATE.SUB) will set up function keys 4 and 5 to invoke the assembler, key 8 to invoke WordStar and leave the programmer in WordStar at the end of the file. It is assumed that the program under development is on drive B with the assembler etc. on drive A. Further, this programmer always begins files with a 'ruler line' on the second line of the file. Tab stops are set up by a sequence of control keys whenever the file is altered.

```
; Set up key 4 to assemble the program.
KEY 4 M80= B : $1
; and key 5 to do the link
KEY 5 L80 B : $1, b : $1/n/e
; now invoke WordStar
EXEC WS B : $1.MAC ¦M ¦X ¦OF ¦OV ¦OT
```

This file is invoked by a command of the form UPDATE EXEC to allow editing of the file EXEC.MAC.

TORCHBUG (monitor and debugging aid)

Aim of program

To provide a simple debugger program capable of loading files (either object code or Intel Hex), modifying and testing the code, and then saving the resulting program.

Operation

TORCHBUG is invoked as an ordinary COM file. It loads and relocates itself automatically at the top of the free store. If a filename is given on the command line as a parameter then that file will be loaded at 0100H but not executed. From TORCHBUG the following command keys may be used.

HELP: (Function key 1) This key will always reveal some information about what options are available from the part of the program in use. It usually leaves the user in the same mode as if no key had been pressed, but an exception to this is the Modify command where the program will return to the TBUG> prompt if help is requested.

QUIT: (Function key 0) This key returns the user to the 0A> command line. A cold boot is performed, removing TORCHBUG from the system but preventing SAVE being used. N.B. Because the save command will not work after TORCHBUG has been run, always use the S command from TORCHBUG. (A "cold boot" refers to a condition whereby the peripheral processor in the TORCH (the 6502) is reset. This is the same effect as pressing the master reset button at the rear of the TORCH.)

G   Go. This command allows the user to execute a program from any memory location. The address to go from should be entered as a hexadecimal number terminated by a carriage return.

I   Load Intel hex file. The name of a hex file will be prompted for and should be entered in the format outlined below. Errors detected in the standard hex format will cause the file to stop loading with an error message. The file will be displayed as it loads.

L   Load COM file. The program will prompt for a filename and then the first location in memory from which the program should be loaded. No checks are made to prevent overwriting of the CPN etc.

M   Modify memory. This command allows dumping and modifying of blocks of memory. The first address will be prompted for as in G above. Memory is displayed in blocks of 16 bytes in HEX format followed by the sixteen characters made from those numbers with the MSB set to zero and non printing characters displayed as '.'.

To change memory locations copy the new values onto the line with the cursor and press return. If fewer than 16 hex numbers are entered then only the first few bytes of that block may be modified. The line will then be redisplayed and may be modified further if necessary. If '.' is entered on the ine then the program will return to the TBUG prompt. To display the next 16 bytes of memory s mply press return without modifying anything. Ho'ding return down will allow large areas of memory to be displayed. WARNING — any entries other than those specified above (or HELP) will cause the current line of memory to be cleared to 0.

R   Register display and modify. After invoking this command the user is requested to enter the name of a register. Registers AF, BC, DE, HL, IX, IY, SP, and PC, may be modified by this command and except for IX, IY the first letter is sufficient to identify the register. Upper or lower case may be used. If register name X is entered the main register set and the alternative register set will be exchanged in the register buffer.
Pressing CR on its own will display the current value of all registers in the register buffer.

S   Save file. This command allows areas of memory to be saved to disc. The user is prompted for filename and also for the first and last addresses to be saved. This means that programs need not be saved from location 0.

All filenames entered when using TORCHBUG (except the optional one on the command line) have the following format: Optional drive name A or

B followed by ' : ', up to 8 character name then optionally ' . ' and 3 character extension. If the extension is omitted it always defaults to '.COM'. The filename is taken to be as entered without any uppercasing. This last point allows access to any files consisting of printing characters only.
All hexadecimal numbers except those used by modify are of the following format: any number of characters consisting only of 0-9 and A-F or a-f, terminated by any other character. Numbers entered to modify a block of memory must contain exactly 2 digits.
The command line prompt in TORCHBUG is always TBUG>.

EXAMPLE OF USE: A software package is supplied to allow customisation of WordStar for the Torch computer. This consists of the files WSPAT.HEX (an Intel Hex file) and WSCUSTOM.COM. (For an explanation of WSCUSTOM.COM see the separate document 'Patching WordStar for the Torch.) To produce a copy of WordStar for the Torch the following procedure should be used:
Install WordStar without selecting any terminal but installing whichever printer driver is appropriate to your own installation. Assuming that the disc in drive A now contains the files mentioned above, TORCHBUG.COM and a wordstar file (here called WS.COM) enter the following:

Torchbug WS.COM

The TBUG> prompt should appear. WordStar is now in memory so the patch file should be loaded by pressing I. The prompt 'Filename:' will appear and WSPAT.HEX should be entered. N.B. If no extension is given then the file type will default to '.COM'. The hex file will load and be linked automatically into the existing program. The next stage is to save the patched version of WordStar by pressing S and then a new filename such as WS1.COM to save the patched WordStar. The start address should be given as 0100 and the end address as 3f00. The name under which WordStar is saved should not already exist on the disc as TORCHBUG will never delete an existing file.

RS423.COM

RS423.COM allows Data to be received through the serial port on the TORCH. This facility allows the TORCH to communicate with other computers which have an RS423 interface.

This program is run by typing: RS423 "filename." `return` The file 'filename' is opened, and the program waits for characters to come in on the RS423 port. The TORCH reads the characters as they come in and puts them in the file, using the RTS line to prevent the sender going too fast. If no characters are sent for more than 5 seconds, the TORCH asks if the end of file has been reached, if so closes the file and returns to the command line.

The RS423 program running on a TORCH can be treated as a printer which will record output sent to it onto disc. Text files are therefore easily sent to the TORCH by simply printing them to it.
Object files (.COM files) should be sent using a utility which sends binary characters to the serial port on the other computer. For information on the pin connections of the RS423 interface on the TORCH see the "PERIPHERALS" section.

MUSIC

The TORCH music system consists of two programs, one of which plays music files, whilst the other is used in creating them.

MUSIC: The MUSIC program plays standard TORCH music files, the format of which is described below. TORCH music files usually have the extension .MUS

EXAMPLE: MUSIC B:CHARIOTS.MUS
MUSIC B:CHARIOTS
either of the above commands will play the music file named:

B:CHARIOTS.MUS

Note: The default extension is .MUS
(For explanation of filename syntax see section on FILES AND FILENAMES.)

Music Compressor (MUSCMPX)

This program compresses a TORCH music manuscript file, (these normally have the extension .MSC) to give a TORCH music file, (normally with the extension .MUS) for use with music.

EXAMPLE: To compress the file
B:CHARIOTS.MSC into the file
B:CHAR.MUS enter the command:

MUSCMPX B:CHARIOTS B: CHAR

Note: The default extension is .MSC
Both programs will give full instructions if run without specifying a filename.

Description of music files

A music file is an ordinary text file. With the exception of comments (see below), it is free format, with spaces and newlines being used to separate items. The program MUSCMPX will remove all unnecessary characters from a music file.
The file consists of a mixture of note descriptors and special items. These are described below. The end of file is detected automatically.

Note Descriptors

∴ note descriptor is a sequence of four items. These are:

(1)   Channel Code.
(2)   Dynamic Mark.
(3)   Note Name.
(4)   Length.

The channel code controls the channel and range that are used. There are three channels and two ranges, as shown in the table. A channel can only produce one note at a time, and the notes indicated in the file for a channel are automatically queued.

Code	Channel	Range
*	0&1	Bass
1	1	Normal
2	2	Normal
3	3	Normal

The dynamic mark controls the volume of a note. There are 8 dynamic marks permitted:

ff	loudest
f	.
mf	.
mp	.
p	.
pp	.
ppp	quietest
r	silent

The note name is specified as an uppercase letter from A to G, followed by # or b if required to indicate sharp or flat (names such as Cb OR F# will be accepted). These names indicate the octave from the middle C to the B above. Following the name by + or – signs will respectively raise or lower the note one octave. The range of notes available is:

Normal Range	B-- to D++++
Bass Range	C----- to D#

If the dynamic mark is 'r', then the note name should also be so. The length is a number from 1 to 255 indicating the length of the note in unitsd of 50 ms, i.e. 20 indicates one second.

Whilst the TORCH will automatically queue notes on a channel, there is a limit to the amount that can be queued, and it is recommended that notes be kept in their "real" order. The file can be conveniently formatted to aid this. For example, here is the start of "Chariots of Fire":

1				2				3			
1	f	Db+	8	2	r	r	32	3	r	r	
1	f	Gb+	8							32	
1	f	Ab+	8								
1	f	Bb+	8								
1	f	Ab+	24	2	f	Ab-	4	3	f	Db-	48
				2	f	Db	4				
				2	f	F	4				
				2	f	Ab	4				
				2	f	Db+	4				
				2	f	Ab	4				
1	f	F+	24	2	f	F	4				
				2	f	Db	4				
				2	f	Ab-	4				
				2	f	Db	4				
				2	f	F	4				
				2	f	Ab	4				
1	f	F+	16	2	f	Db+	4	3	f	Db-	48
				2	f	Ab	4				
				2	f	F	4				
				2	f	Db	4				
1	f	Db+	8	2	f	Ab-	4				
				2	f	Db	4				
1	f	Gb+	8	2	f	Bb-	4				
				2	f	Db	4				
1	f	Ab+	8	2	f	Gb	4				
				2	f	Ab	4				
1	f	Bb+	8	2	f	Bb	4				
				2	f	Db+	4				

The TORCH will indicate if it detects an item in the wrong place but will not attempt to rectify the fault.

Special items

The following special items are available:

    (1)   Comments
    (2)   Repeat marks
    (3)   Debug mode

Comments are indicated in one of two ways. Firstly, a semicolon indicates that all text until the end of the line containing the semicolon is a comment.

Secondly, anything within braces { } is also a comment (except within the first kind of comment). Braces may not be nested, but may contain new lines. This second kind of a comment is known as a "debug remark", as it is handled specially in debug mode.

Repeat marks are used to allow the repetition of part of a tune. Up to ten independent repeat systems may be active at any one time. The number of the repeat system (0 to 9) is indicated by # in the following description.

Four items are used to control repeats. These have the following effects when found whilst playing the tune:

    7#   All previous information about this repeat system is forgotten. the system is marked "first time", and this location is noted.

    8#   If this system is marked "first time". it is changed to "second time", and a jump is made to just after the location of the noted 7#. Otherwise it is ignored.

   10#   If this system is marked as "second time", then a jump is made to just after the location of the first 11# beyond this point in the file. Otherwise it is ignored.

   11#   Ignored (see 10#).

The first item found for any repeat system MUST be a 7#.

Debug mode is provided to allow the notes being played to be viewed on the screen. It is entered whenever the item 121 is found whilst a tune is being played, and left whenever a 120 is found Debug mode has two effects. Firstly, all debug remarks (see above) are displayed as they are reached during the playing. Secondly. whenever a note is played, details about it are displayed on the screen. These details are obvious.

N.B. It has been found that the extra processing involved in debug mode may have the effect of delaying some notes slightly (normally by about 1 length unit). If there is any doubt in this matter. the tune should be tried without debug mode.

MAPDISC

Each disc used on the TORCH system has an allocation map, which shows exactly which parts (sectors) of the disc are being used.

MAPDISC has two functions:

1) To allow the user to view the allocation map of the disc and look at the status of the sectors on the disc.

2) To allow the user to check that the map is correct, and if necessary attempt to correct it against the disc.

When MAPDISC is run it will first ask the user to enter the drive to be scanned and then display an

allocation map of that disc showing the sectors that are allocated. For a full map of the disc, option F should be selected; this looks at the directory on the disc, and for each file it notes which sectors that file uses. It then sets up a full map on the screen of the disc. The symbols shown on a full map of the disc may be interpreted as follows:

A cell completely shaded in grey: this is a data sector that has been allocated and is used.

A completely empty cell: this is an unused and unallocated sector.

A cell with a grey horizontal line: this means there is an allocated L3 block in that sector.

A cell with a grey vertical line: this means there is an allocated L2 block in that sector.

A cell with a grey x: this is a cell that has been allocated but is not used. (garbage)

A cell with a grey u: this means that this sector is unallocated but is in use.

A cell with a grey dot in the centre: this indicates that this cell has got multiple uses. i.e. Two files "think" they own this sector.

As well as the full map of the disc (containing the above symbols), being displayed with the F option, there is also a full option menu displayed. All the options available are displayed on the menu.

The 12 options available on the full menu are as follows:

G, M, U, 2, and 3 display their specific sectors, (as described on the screen). Note that options 2 and 3 display blocks L2 and L3 respectively. (L2 and L3 blocks are described in Appendix C).

A   Re-displays the main map of the disc.

N   Allows scanning of another disc.

Q   Quits the program.

W   Writes the allocation map back to the disc ¡after it has been modified).

T   Tidies the map, that is, it erases all garbage sectors from the disc, and fixes all un-allocated sectors. **Note:** After using T, use the W option to put back the "fixed" map. When the T option is selected. the message "Tidied" is displayed on the screen.

H   Displays a file handle. That is, it displays all the information associated with a particular file. When the H option is selected, the number displayed following the H is the handle number of the file. i.e. Its position in the directory.

The following are additional symbols that may appear on the map after the H option (described above) has been selected:

A completely blue cell: this is a data sector for that file.

A cell with a blue horizontal line: this sector is an L3 block for that file.

A cell with a blue vertical line: this sector is an L2 block for that file.

A blue cell with a white U: this sector is part of the file but is unallocated on the map (irrespective of use).

A blue cell with a white dot in the middle: this is a sector used in that file and is also used by another 1 or more files.

Note: the above symbols only appear on the map when the H option (described above) is selected.

P   This option will allocate the entire map as if used. Again to implement this on the disc, the W (write) option described above, should be selected. Note that when the P option is selected, the message "Protected" is displayed on the screen.

Type Ahead

If MAPDISC is in the middle of drawing a map of a disc, and a key is pressed, which is a valid option, (as described above), then MAPDISC will break off from drawing the map of the disc, and execute the option selected. A message is displayed on the screen telling the user if MAPDISC is drawing a map, or if it is interrupted whilst doing so. Note that when a particular option is selected, a message may be displayed on the top left hand side of the screen. This message is: "working" or "drawing map".

Using Mapdisc with the Hard Disc

When using MAPDISC with the hard disc, the map of the disc is displayed in one piece rather than two as in the case of the floppy disc. The figures on the

top right hand side of the screen indicate the tracks that are currently being displayed. Note that only part of the map is displayed at any one time, and that other parts of the map may be viewed by scrolling left, and right by using the following keys:

[< ({   Any of these keys will scroll the map to the left.

] >) }   Any of these keys will scroll the map to the right.

When the map reaches end of scroll in either direction, that function will be disabled, (i.e. scrolling in that direction) and the relevant scroll option (left or right) will disappear from the menu.

Another option available with the hard disc, but not with the floppy, is the "scrunch" option. Scrunching a map causes the entire map to be compressed horizontally until it fits on the screen. This is done by allowing each square to represent the appropriate sector, on all of a number of consecutive tracks. The symbol displayed in the square is the "most important" symbol of those that would be displayed on a complete map. The order for determining the "most important" symbol is:

Multiply allocated sectors in a specific file (when using the H option). (Blue square with a white dot).

Unallocated sectors in a specific file. (A blue cell with a white U).

Multiply allocated sectors on the disc. (A cell with a grey dot).

Unallocated sectors on the disc (but used). (A cell with a grey U).

L2 Blocks in a specific file. (A cell with a blue vertical line).

L3 Blocks in a specific file. (A cell with a blue horizontal line).

Data sectors in a specific file. (A completely blue cell).

Allocated but not used sectors (Garbage). (A cell with a grey X).

L2 Blocks on the disc. (A cell with a grey vertical line).

L3 Blocks on the disc. (A cell with a grey horizontal line).

Data sectors on the disc. (A cell shaded in grey).

Unused sectors. (A completely yellow cell).

When using MAPDISC with the hard disc. all the options available are listed on the menus.

POKEDISC

POKEDISC allows the user to scan a disc and change the contents of the sectors directly, without using the normal file structure.

When using POKEDISC, the typeahead facility is suppressed, in that, it will only "remember" the first letter that is typed. Issue 3, of POKEDISC may be used with floppy discs only. Issue 4, may be used with the hard disc and floppy discs.

At any time POKEDISC is displaying 1 sector of the disc. This sector may be displayed in one of four modes, each of which is selected by its relevant letter key. These four modes are as follows:

D   This selects the DIR mode which displays the 16 directory entries.

K   This mode displays the sector as a set of 256 characters. If the character is not a character that may be displayed on the screen, then a hexadecimal code will be displayed instead. For instance, a carriage return would be displayed as 0D. A yellow character indicates that the most significant bit of the character is set. A space with the most significant bit of it's byte set would be represented by the symbol of a square bracket on its side.

H   This mode displays the entire sector as 256 pairs of hexadecimal digits.

M or N   Either of these letter keys will select mixed mode: this displays one eighth of the sector at a time. The particular part of the sector being displayed is shown at the top right hand of the screen, and also down the left hand side. Example BYTES 00 to 1F. The 32 bytes being displayed are treated as 16 words, (each of two bytes) each word is displayed as 16 bits. 4 hex digits. 2 characters, and possibly a sector address if valid. **Note:** because of the way the Z80 processor handles words, the least significant byte is the first character.

Moving around the disc

A number of keys may be used to move around the disc. The letter keys A and B are used to select disc drive A OR B. If a hard disc is used, then B will

cause the user to be asked to enter the surface required. Some of the keys listed below will have different functions depending on which issue of POKEDISC is being used.

> The 0 key selects: cylinder (track) 0, Issue 3.
> cylinder 0, side 0, sector 0, (0:0:0) Issue 4.

> The S key moves to the other side of the disc.
> The R key moves down 1 track.
> The C key moves up 1 track.
> The E key moves down 1 sector.
> The X key moves up 1 sector.

When using issue 4 of POKEDISC, the E and X keys may be used to move to another track if necessary.

When in mixed mode (i.e. when option M or N is selected), the W key is used to move down 2 Bytes, and the Z key is used to move up 2 Bytes.

The J key (followed by 4 digits) is used to move to a particular sector, whose location is determined by the 4 digits that follow the J. When using an issue 4 version of POKEDISC, the J followed by the cylinder number and a colon, the side number and a colon, and the sector number, are entered, to "jump" to a specific part of the disc. Also, the delete key may be used with issue 4.

EXAMPLE: Issue 3: J0516

Issue 4: J5:1:6

This would move the user to cylinder 5, side 1, sector 6.

The QUIT key, which is the first blue function key at the top left of the keyboard, (key number 0), is used to quit a particular option, or to quit the program entirely.

The MOVE PAST or COPY key, will display a further menu with more options, all of which are selected by using the left hand keypad on the TORCH.

REDO: This option allows the user to define specific sector addresses to the blue function keys along the top of the keyboard, numbered 4 to 10. REDO followed by the QUIT key, (blue function key 0) will bring the user back to the menu.

SENTENCE/WINDOW: save the current sector in a special buffer.

SCREEN: This option is used to copy the contents of the buffer (referred to above) back to the screen.

UNDO: Any editing that has just taken place will be cancelled and the sector re-read from the disc.

BEGIN: This option allows the user to actually start editing the sector. Once in this mode, none of the above options will be operational except the cursor control keys, and LINE and RETURN (see below). With issue 4 of POKEDISC, a screen message will be displayed when the BEGIN key is used.

END: This finishes the editing operation, and returns the user to the normal mode of operation for POKEDISC.

LINE: This moves the cursor to the start of the current line.

RETURN: This moves the cursor to the start of the next line.

Note: When editing, it is possible to change anything in the sector that is displayed on the screen by typing any valid character at that point. Whilst editing a character, the escape key may be used to enter a hex code. Also the " key, and the ' key may be used to set, and clear, respectively, the most significant bit of a character.

The valid keys for the "entry" field of a directory display are 2, 3, D, and N. Those for attributes of a file are: R, W, S, U, E, and G.
The TORCH will interrogate the user before it writes back to the disc any editing that may have taken place on a particular sector.

Note: On a hard disc, letters A to F are used to represent sectors 10 to 15 respectively on each track. However, cylinder numbers are still displayed in decimal.

TORCH DISC SYSTEM

Data and programs used on the TORCH system are stored on mini floppy discs or hard discs. Floppy discs are constructed from a thin piece of plastic sheet, treated with a magnetic compound which allows the storage and retrieval of data to and from the disc. When the disc is placed in the DISC DRIVE it is spun at high speed, the heads of the disc drive read and write data to and from the disc. Great care should be taken when handling discs as they are easily damaged.

The following points should be remembered when handling discs:

1. Always store the discs in the protective envelopes provided when not in use.

2. Avoid bending the discs.

3. Insert into disc drives carefully.

4. Don't touch exposed area of disc.

5. Don't expose disc to extreme temperatures or magnetic fields.

6. Avoid getting smoke or other contaminents on the surface of the disc.

7. Don't switch the power to the TORCH on or off without first removing the disc(s).

To load a program on the TORCH system a disc should be inserted into one of the Disc Drives on the right of the VDU screen. The top disc drive is drive A and the bottom drive is drive B. When using only 1 disc drive, the user will normally use drive A. This is because the computer's operating system automatically "defaults" to drive A on "power on". Drive A is referred to as the logged disc drive, although this may be changed if required. (see section entitled COMMANDS).

Loading a File from Disc

To load a file from disc, place the disc with your program on, in disc drive A, carefully closing the door of the disc drive, ensuring that the disc is fully inserted into the drive. To load your program type the filename of the program and press `return`. If you want to find out the names of the files (programs) stored on a disc, type DIR and then press `return`. The VDU will then display the contents of the disc. For details of other disc commands, refer to the section on COMMANDS.

Saving a File on Disc

Before a file can be saved on disc the disc has to be "formatted". This process prepares the disc to receive data. The disc is divided into 80 tracks, track 0 being at the outside edge of the disc, track 79 being at the inside edge of the disc. The tracks on both sides of the disc are divided into 10 sectors, and each sector can store 256 bytes (characters) of data. It is in these sectors that the files (or data) are stored. The number of sectors required to store any given file will depend entirely on the length of the file. (See Appendix C).

To format a disc, place it in disc drive A, type FORMAT and press `return`. The computer will now instruct you via the VDU to tell it which disc drive you are using. Type A or B and the computer will now format the disc as described above. During this formatting process your TORCH automatically checks that no errors have occurred. Should any errors occur during this formatting process, the computer will display on the VDU an error message, so you should then check that you have placed a disc in the correct drive, i.e. the one designated above, or try another disc in case you have a faulty or corrupted disc in the machine. For explanation of error messages see section on disc errors.

Important

It should be noted that the formatting process completely clears the disc of any files that are on it. Care should be taken not to put the wrong disc into the machine. The FORMAT command is used for erasing data off old discs and for formatting new discs prior to saving data on them.

To prevent losing important programs (and a lot of time!) either by loss or damage to the disc, or by accidental erasure of data from the disc, it is recommended that "backup" copies are made of all important discs. Discs may also be Write Protected to prevent data accidentally being written over an existing file. All TORCH system and utility programs should be backed up, and write protected.

Making Backup Copies of Discs

A useful exercise in making backup copies, would be to copy the two discs that came with your TORCH system. It is good practice also, to make backup copies of the discs you have been using at the end of each day.

To Duplicate a Disc

1. Put the disc to be copied into drive B: this is called the "source" disc.

2. Put the blank disc into drive A: this is called the "destination" disc.

3. Type DUP and press `return`

The screen will then display the following instructions:
"Press Return to continue or any key to abandon"

When you press `return` your TORCH will then format disc A and duplicate the contents of disc B onto disc A.
Whilst it is doing this it continuously checks for errors; should an error occur during this process an error message will be displayed on the screen, such as:

Disc A Track 1D error 0E

In the event of this happening, try taking the destination disc out of the drive and putting it back in again; it could be that the disc was not aligned in the drive properly. Repeat the above procedure to copy the contents of disc B onto disc A.
For an explanation of disc errors see section entitled DISC ERRORS.

Write Protecting a Disc

To prevent a disc having data written onto it accidently, or its data accidently wiped off, a square of adhesive paper should be placed over the small notch or cut out on the side of the disc. This cutout is known as the WRITE PROTECT NOTCH. Adhesive patches to cover the write protect notch are supplied with the blank discs.

Disc Errors

When the TORCH is reading or writing data to or from the disc, it is continuously checking for errors. If an error occurs during a read operation, the TORCH operating system attempts to re-read the track up to 5 times.
If an error occurs during a write operation, the operating system will re-format the track, and then attempt to re-write the data up to 5 times.

If no error has occurred during a write operation, the data that has just been written onto the disc is verified for integrity and if any data corruption has occurred, the track will again be re-written up to 5 times. Every second attempt at re-writing the track, the operating system will re-format the track.
If after 5 re-tries of either re-reading or re-writing, there is still an error, then an error signal such as the one below will be printed on the screen.

DISC A track 1D error 0E

This tells the user the disc drive that failed, the track that failed, and the hex error code, in that order.

Note: The track number that is given in this error message is a hexadecimal value, and is actually twice the true track number, plus the side number. In the case of the example above, this would actually be Track 14 Side 01

Normally all of the above operations of re-reading and re-writing are "invisible" to the user until, after the fifth attempt at re-reading or re-writing, it has abandoned the operation and printed the error message.

To monitor the above operations as they take place, and determine where and when an error is occurring, type in the following before performing a read or write operation:

[SYSTEM 16]

Press `return` and continue as normal. If an error occurs now, the operating system will immediately print an error message such as the one below.

DISC A track 08 re-reading

This time the error message is printed to the screen as soon as an error occurs, and informs the user each time that a re-reading, re-writing, or re-formatting operation takes place. As before after 5 attempts at re-reading, and re-writing, then the operation will be abandoned. In which case the user will have to try again.

A similar instruction to [SYSTEM 16] is [SYSTEM 64] in this case the operating system will continue to attempt to re-read, re-write, or re-format data even after 5 attempts have failed, this process will continue unless the following error message is displayed:

DISC A track 08 unrecoverable error 18

This error message only occurs after 5 attempts at re-formatting a track have failed. In this situation, (which is very rare) there is either a serious fault with the disc, or with the disc drive itself, and the user should try another disc before consulting a dealer.

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Note: To set more than one system function at a
time add the two function numbers together. e.g. to
have both [SYSTEM 16] and [SYSTEM 64] set, type
[SYSTEM 80]. Any form of reset will remove these
functions (e.g. CTRL C). [SYSTEM 0] may also be
used to remove these functions.

HARD DISCS

The TORCH hard disc has a storage capacity of 10 or 20 mega-bytes. The disc is split up into 4 mega-byte surfaces, any remaining space on the disc which is not a multiple of 4 is assigned to the last surface, which would be 4 mega-bytes or less. The floppy disc drive is drive A, and the surfaces on the hard disc are assigned sequentially after that, (e.g. B, C, D, etc.). Each track on the hard disc has 16 sectors, whereas each track on a floppy disc has 10 sectors. Therefore any disc utilities should take this into consideration. However to the user of CPN (and hence any CP/M software), the surface of the hard disc is "seen" as a large floppy disc. All commands (except the DUP command because of the difference in the number of sectors per track), file structures, and directory structures are identical. Speed of disc access is increased to a factor anywhere between 2 and 4 times that of a floppy.

Any of the surfaces may be selected as the logged on drive by entering the appropriate letter followed by a colon. On power up drive A is the logged on drive.

Correct use of Hard Discs

The hard disc is not normally formatted by the user: it is formatted by TORCH at the manufacturing plant before being shipped. Therefore it is important for the user to observe the following procedures when using the hard disc to maintain efficiency.

Disc access is fastest when a file occupies contiguous (adjacent) records on a disc. This minimises head movement which can seriously affect speed of performance when accessing files. Through continuous use, files become fragmented. To prevent this, we recommend that you periodically copy all files onto either an empty surface on the hard disc, or onto one or more floppy discs.

To re-organise a fragmented surface, copy the files to another surface or disc, delete all the files on the fragmented surface, then copy all the files back.

The operating system will then allocate contiguous sectors to the files. It should not be necessary to perform the above operation unless a degradation ⌐ performance has been noticed.

Note: If a file is greater than 358K then it cannot be copied to a floppy disc. To find out the size of the files on a surface enter:

    DIR <letter>: [L]   •

where <letter>, is the letter name assigned to the particular surface that you wish to examine.

Abnormal ending of a file operation

If a program is terminated abnormally, e.g.

    ctrl shift escape,
    power cut,
    ctrl reset,
    run-time error, etc.

this may cause fragmentation, and the appearance of data on the disc which can no longer be accessed. Power cuts which occur whilst the machine is actually writing to the disc may cause data corruption. Therefore, if any of the above has occurred, the program MAPDISC should be used to recover the data. For details of how to use MAPDISC refer to the section on utility programs.

Backing up the Hard Disc

The progams BACKUP, and RESTORE are provided for the purposes of backing up a hard disc surface onto floppy disc. Backups should be made at regular intervals and when the user feels it is necessary.

In general there should be 3 copies of the disc:

1) The current working copy.
2) The latest backup.
3) The previous backup.

The latest backup (2), should not be over-written when making a backup, otherwise if there is an error, that backup will be lost. It is standard procedure to over write the previous backup (3). This is called the Grandfather, Father, Son concept.

The BACKUP and RESTORE suite of programs, consists of the following:

    BACKUP.SUB
    RESTORE.SUB

BACK.HEX
REST.HEX
SP65.COM
GO6502.COM

All of these files are necessary for BACKUP and RESTORE programs to function.

To run BACKUP, insert the floppy disc with it on in drive A, and enter BACKUP followed by a carriage return. (Similarly for RESTORE). In both cases a menu will appear, listing in green letters, the surfaces available on the hard disc, and asking the user to select one of them for BACKUP or RESTORE. When one has been selected, another menu will appear asking the user to insert a floppy disc. It is up to the user to ensure that this disc is already formatted and is not wanted for any other purpose. While the actual backing up operation is taking place, a display at the bottom of the screen will indicate how far through that floppy disc it has got. Each little square on the screen represents one track on the disc. When the backup or restore operation has been completed, the user will be given the option of exiting from the program, or doing more backup or restore work. When a surface has been backed-up or restored, that surface is displayed in red on the main menu instead of green.

Note: Each surface can take up to 11 floppies, therefore the user should ensure that there are enough discs to back up the surface. If any errors occur whilst writing to a floppy, the program may request a new disc, so it is advisable to ensure that there are more available for this purpose if necessary. The program may be exited from any time when it is asking for a key press, by pressing the END key on the left hand keypad.

Errors

Errors on the hard disc are indicated by the following:

$<NN>$ $<NNNNNN>$

USER PROGRAM ERROR 60

The error code above indicates the type of error that occurred. The 6 digit number gives the sector at which the error occurred. If any of these error codes are displayed, please contact TORCH for advice, as the disc may need to be re-formatted. It is very unlikely that this will occur as, in general a hard disc is much more reliable than a floppy disc. Note that if the backup procedure has been followed, very little data will have been lost permanently.

PRINTER INFORMATION

There are two types of printer that may be connected to the TORCH, parallel or serial. Your TORCH dealer will advise you on the type of printer that will be most suitable for your requirements, and supply appropriate connecting leads. A point to note is that parallel printers cannot be located more than a few feet away from the computer: this is because the capacitive effect of the line (i.e. the connecting leads) may cause the data to be corrupted during transmission to the printer.

RS423 Interface Notes. (Serial Interface.)

The RS423 interface on the TORCH is compatible with the RS232C interface on many microcomputers and printers. The RS423 drivers simply have a higher line driving capability than normal RS232.

The serial printer interface is available via the 25 way female D type connector, on the back of the TORCH. (see FIGURE 1).

The default format of the data sent is:

1 Start bit.

8 Data bits.

1 Stop bit.

"Mark" is –5 volts.

"Space" is +5 volts.

The following is a list of the pin connections made to the serial output connector.

PIN NO.	SIGNAL NAME	FUNCTION	INPUT/ OUTPUT
pin 2	TXD	Transmit Data	output
pin 3	RXD	Received Data	input
pin 4	CTS	Clear To Send	input
pin 5	RTS	Request To Send	output
pin 7	S.G.	Signal Ground	- - - - - -

The above signals are the standard V24 TTL level "handshake" signals.

Using the Printer

When the TORCH is first switched on, or after the master reset switch has been used, the operating system of the computer "assumes" that a printer is not connected. To tell the computer that a printer is connected, in the case of a serial printer type:

*FX 5, 2

and press **return**. This command tells the TORCH that a serial printer is connected to it. (For parallel printer see next section.)

When using the serial port, the BAUD RATE (bits per second) may be selected by use of the *FX commands listed in the following table:

*FX 7. x Set up receive baud rate

*FX 8. x Set up transmit baud rate

Values for x

1	75	baud	5	2400	baud
2	150	baud	6	4800	baud
3	300	baud	7	9600	baud
4	1200	baud	8	19200	baud

Note: If a printer is accidentally selected without one being connected to the computer, the program that is running at the time will attempt to output characters to the printer, that is, it will wait for the correct "handshake" signal to be returned from the printer, telling it to send characters. (The computer is kept "hanging").

To abandon this program without connecting a printer: press CTR SHIFT and ESCAPE at the same time, or press the master reset button located at the rear of the computer.

To print files from the TORCH, use the PRINT command followed by the name of the file.

EXAMPLE: PRINT SYS.MAN will make the printer print the contents of the file called SYS.MAN

Note: The PRINT command is used in the same way for a serial or parallel printer.

A number of printers run a Data Terminal Ready (DTR) protocol. This requires that pin 20 of the printer be connected to pin 4 of the TORCH. The only other connections to be made would be TXD (Transmit Data), and GND, (Ground).

It is important to note at this stage, that different types of printers may have different handshaking

protocol. It may be necessary to consult the printer technical manual, to verify that the input connector of the printer matches the output connections of the TORCH as listed in the above description.

In the case of a DIABLO printer the following connections would be made:

> Pin 20 of the printer to pin 4 of the TORCH.
> Pins 4, 5, 6, of the printer are linked together.
> Pin 5, of the TORCH linked to pins 4, 5, 6 of the printer.
> Pins 2, 3, of the TORCH connected to pins 3, and 2, respectively on the printer.

Centronics Interface (Parallel Interface)

The parallel interface on the TORCH is a standard Centronics compatible port. The 25 way male D type connector on the TORCH should be connected via a length of IDC type ribbon cable to the standard "DELTA" connector on the printer. (A cable is supplied with the TORCH printer).

The following pin connections should be made: (see Figure 1).

Pin No: 14 — 25 are connected to ground.

PIN NO.	SIGNAL NAME	FUNCTION
1	STB	STROBE
2	D0	Data
3	D1	Data
4	D2	Data
5	D3	Data
6	D4	Data
7	D5	Data
8	D6	Data
9	D7	Data
10	ACK.	ACKNOWLEDGE
11-13	NO CONNECTION	

After connecting the printer as described above, type:

> *FX 5, 1

this tells the computer that a parallel printer is connected to it. Now use the PRINT command to print out a file on the printer.

EXAMPLE: PRINT SYS.MAN will print out the contents of the file named SYS.MAN

If two printers are connected at the same time. (serial, and parallel) then either can be selected by one of the following commands:

> *FX 5, 2 Selects the serial printer.
>
> *FX 5, 1 Selects the parallel printer.
>
> *FX 5, 0 For no printer

The following is a list of things to check if you are unable to get your printer to function properly on the TORCH:

1) Check that the printer is connected to a power source.

2) Check that the correct interface connections have been made from the printer to the TORCH. (see above).

3) Check that the correct instructions have been typed in at the keyboard of the TORCH

4) Look in the printer operator's manual for switch positions such as: on/off line, page length. baud rate, etc.

In the event of the user being unable to get the printer to function properly after going through the above check list, he should contact his dealer for advice.
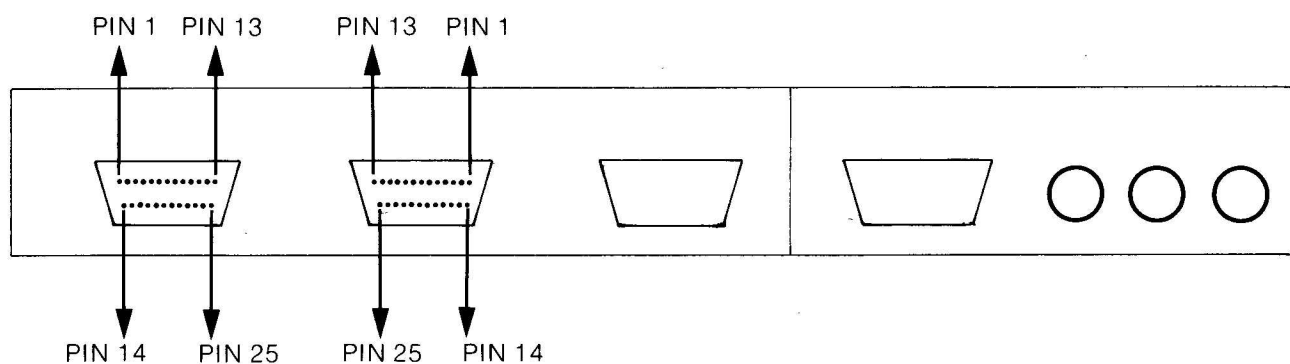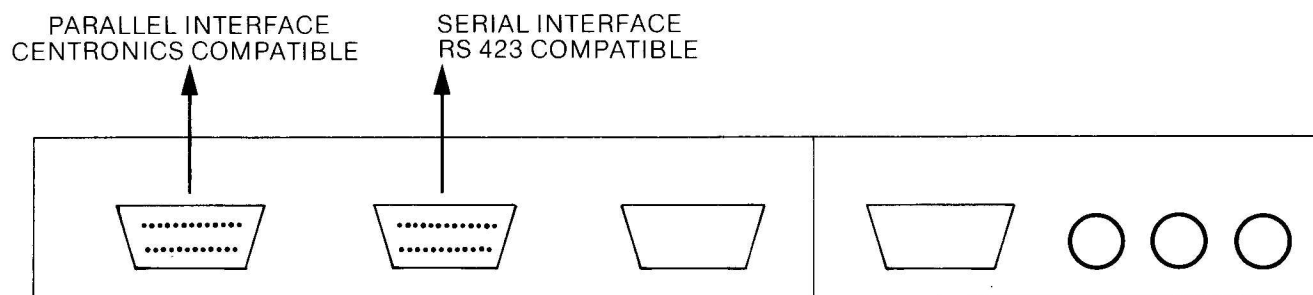
PARALLEL INTERFACE
CENTRONICS COMPATIBLE

SERIAL INTERFACE
RS 423 COMPATIBLE

PIN 1   PIN 13   PIN 13   PIN 1

PIN 14   PIN 25   PIN 25   PIN 14

Fig. 1. Rear Panel of TORCH.

TORCH
COMPUTERS

PERIPHERALS

The peripherals that may be connected to the TORCH are listed below with their respective pinout connections and connector locations.

U.H.F. Output

The TORCH computer incorporates a PAL U.H.F. modulator which allows an ordinary domestic television set to monitor the video output of the TORCH.

The U.H.F. modulated output of the TORCH is available on the rear panel via a female co-axial socket. The output of this socket should be connected to the U.H.F. input of the television using 75 ohm co-axial cable. Once connected, tune a spare channel of the television set to channel 36.

R.G.B. Output

Red, Green, and Blue, drive signals are available on the rear panel of the TORCH via the 6 pin DIN socket marked R.G.B. The required synchronising signal is also available on this socket. These signals may be used to drive a T.T.L. level input colour monitor. (Logic level 1 = Gun On)
(Logic level 0 = Gun off)

The pin designations are as follows:

PIN NO.	SIGNAL	COLOUR OF WIRE
Pin 1	RED	red
Pin 2	GREEN	green
Pin 3	BLUE	blue
Pin 4	SYNC.	yellow
Pin 5	0 volts.	black

Cassette Interface

When using B.B.C. BASIC on the TORCH it is possible to load and save programs on a standard audio cassette recorder (mono or stereo). The connection to the recorder is made via a 7 pin DIN socket (marked cassette), on the rear panel of the TORCH.

As many cassette recorders have a standard 5 pin DIN socket, a 5 pin DIN to 5 pin DIN hi-fi lead, may be used to connect the TORCH to the cassette recorder.

For details of the command syntax used when loading and saving programs in B.B.C. BASIC, refer to the B.B.C. User Guide which is available from any B.B.C. machine stockist.

Analogue Input

Provision has been made on the rear panel of the TORCH for the input of analogue signals. which are fed, via a 15-way female connector to a four-channel, twelve bit, analogue to digital converter device.

This facility allows the user to connect analogue devices such as a light pen, joystick, or laboratory instruments etc. to the TORCH. The pin connections to the ANALOGUE input socket are as follows:

Pin 1	+5 Volts.
Pin 2	0 Volts.
Pin 3	0 Volts.
Pin 4	Analogue Input Channel 3.
Pin 5	Gnd.
Pin 6	0 Volts.
Pin 7	Analogue Input Channel 1.
Pin 8	Gnd.
Pin 9	Light Pen Strobe.
Pin 10	Push Button 1 (Joystick control).
Pin 11	Voltage Reference.
Pin 12	Analogue Input Channel 2.
Pin 13	Push Button 0 (Joystick control).
Pin 14	Voltage Reference.
Pin 15	Analogue Input Channel 0.

For details of how to use the analogue to digital input channels on the TORCH, refer to the Programmers' Guide.

Econet Interface

The TORCH has a standard ECONET interface, which allows the transfer of information, and sharing of peripheral facilities (printers etc.) on a network of computers. The ECONET interface is accessible through the 15 way male D type connector on the rear panel of the TORCH marked ECONET.

The pin connections to the ECONET interface are as follows:

Pin 1   – Clock.

Pin 10   + Clock.

Pin 4   0 Volts.

Pin 14   – Data

Pin 7   + Data

RS423 Serial Interface

The RS423 Serial Port on the TORCH is compatible with the RS232C interface. The only difference being, that the RS423 drivers have a higher line drive capability than normal RS232C. All the signals used on the serial port are standard V24 TTL level handshake signals.

The RS423 Serial Port is available via the 25 way female D type connector on the rear panel of the TORCH. The following is a list of pin connections made to the serial output connector:

Pin 2   Transmit Data. (TXD)

Pin 3   Receive Data. (RXD)

Pin 4   Clear To Send. (CTS)

Pin 5   Request To Send. (RTS)

Pin 7   Ground.

Data is transmitted using 1 start bit, 8 data bits, and 1 stop bit.

Parallel Port

The parallel printer port on the TORCH is a standard CENTRONICS compatible port. It is available on the rear panel of the TORCH on the connector marked PRINTER. This is a 25 way, male, D type connector.

The pinout connections are as follows:

Pins: 14 – 25 are connected to ground.

PIN NO.	SIGNAL NAME	FUNCTION
1	STB	Strobe
2	D0	Data
3	D1	Data
4	D2	Data
5	D3	Data
6	D4	Data
7	D5	Data
8	D6	Data
8	D6	Data
9	D7	Data
9	D7	Data
10	ACK	ACKNOWLEDGE
11-13	NO CONNECTION	—

For further details on using the parallel port with a printer see the section on Printer Information.

Telephone

The TORCH computer is connected to the telephone line using a British Telecom jack plug (This comes as standard with each TORCH.) This plugs into a wall socket on the telephone line. If you do not already have one fitted, then it will be necessary for you to contact British Telecom and arrange to have one fitted.

The TORCH is fully British Telecom approved for connection to the Public Switched Telephone Network. Plugging in your TORCH to the same line as your telephone will still allow you to use your telephone normally (but, obviously not at the same time as the TORCH is accessing the telephone line.)

The TORCH BT approval number is:
S/1298/3C450026.

COMPARISON OF CPN AND CP/M

CP/M stands for Control Program Monitor and is a standard operating system for microcomputers. CPN which stands for Control Program Nucleus, is the TORCH "look alike" operating system and allows the user to run CP/M programs on the TORCH.

The most significant difference between the TORCH CPN operating system and CP/M is that CPN is stored in ROM whilst CP/M is stored on disc. This means that a computer system running CP/M has to use a system disc that loads the CP/M operating system into memory every time the computer is reset. In the case of the TORCH CPN operating system, it requires no special system disc as it is automatically loaded and run on power on.

The built in commands used in TORCH CPN are essentially the same as CP/M. However, there are some differences, which are highlighted in the table below. For a full explanation of how to use the TORCH commands, refer to the section in this manual called COMMANDS.

The following table is a comparison of CP/M commands with their TORCH CPN counterparts.

CP/M Command.	TORCH CPN Command.
DIR	DIR CPN Command can be given several filenames and also options.
ERA	DELETE Prompts for each filename. (like ERAQ).
ERAQ (MP/M)	The [u] option stops prompting.
MOVCPM	Not Required.

CP/M Command.	TORCH CPN Commands.
PIP	COPY, DUP, INPUT, or PRINT depending on operation desired.
REN	RENAME Different syntax. Allows multiple renaming.
SAVE	Identical to CP/M Version 2.2
STAT dev:=dev: STAT DEV:	No Equivalents at Present. Some facilities provided by *FX 2 and 3.
STAT filename	[L] and [P] Options of PROTECT.
STAT filename $ r/o etc. STAT d:	PROTECT [S] option of DIR.
STAT USR:	Similar To USER Command.
SUBMIT	COMMAND (C) Works slightly differently.
SYSGEN	Not Required.
TOD (MPM)	TIME
TYPE	Same.
USER	Same as CP/M Version 2.2
XSUB	Provided automatically by COMMAND.
FDISC	FORMAT and DUP

Note: that CPN has more built in commands than CP/M and is more "user friendly". It can be seen that this allows more flexibility when using the TORCH.

CUSTOMISATION OF STANDARD CP/M PROGRAMS FOR THE TORCH

There are two methods available for customising programs on the Torch. The first method is to use the control codes available on the standard Torch. The second method involves the use of a 'Termulator' program which allows the Torch to look like a standard terminal.

The simple method is the neatest for the end user, but can only be used with programs that do not require 'Clear to end of line' and 'Clear to end of screen' codes. Many programs will allow codes for these to be given but will still run correctly without them (although slightly slower). Other codes which are occasionally required are 'Insert line', and 'Delete line'. If any of these advanced codes are necessary then a termulator must be used but if they are optional a straight installation is usually possible. The other restriction is that the program must send its output through the BIOS or through the direct console I/O. If you are in any doubt as to how the output is produced the solution is to try it and see. If you find the screen covered in gibberish such as ' –' then you will have to use a termulator.

Programs that can be installed directly include 'WordStar', 'Supercalc' and 'Pearl'.

The following control functions are available on the Torch:

> Move cursor up/down/left/right.
> Move cursor to x, y.
> Move cursor home (i.e. to top left).
> Clear screen.
> Highlight on.
> Highlight off.

There are several other codes (see Programmers Guide) but these are specific to the Torch and therefore of little use except for initialising the screen to the correct mode etc.

The codes for the above functions are as follows:

> Cursor up   — 11 decimal, 0B hexadecimal.
> Cursor down— 10decimal, 0A hexadecimal.
> Cursor left (backspace)   — 8.
> Cursor right   — 9.

Locate cursor at position X,Y on the screen: The cursor 'lead-in' string is 31 decimal (1F hexadecimal). There are no middle or end strings, the coordinates are sent in binary with the offset of 0. The x coordinate (column) is sent first.

Move cursor to home position which is code 30 decimal (1E hexadecimal).

The clear screen may be done in two ways:

If an initialisation string is permitted then code 12 decimal (0C hexadecimal) is sufficient. If not you should send code 22 (16 hexadecimal) followed by the required screen mode (usually 0 or 3). This ensures that the screen is always in the correct mode.

The following sequence of codes should be used to turn highlight on:

17, 129, 17, 0	(decimal)
11, 81, 11, 00	(hexadecimal)

To turn highlighting off use:

17, 128, 17, 1	(decimal)
11, 80, 11, 01	(hexadecimal)

These codes will only work if the program is capable of sending characters greater than 127. If you find that your installation runs correctly without these highlighting codes but that the screen goes blank when you attempt to use them then you cannot use highlighting without a termulator. Of the programs mentioned above only SuperCalc has this problem and it may be solved by patching location 2BAA from CA (hexadecimal) to C3 (hexadecimal). Use TBUG or a similar program to do this.

The initialisation string permitted by many programs should be used on the TORCH to set up screen mode and colours. It may be found on many programs that the initialisation string is not long enough to allow setting of both background and foreground colours. In this case the foreground

may usually be set. The initialisation string will typically be of the following form:

22, 00, 19, 1, 2, 0, 0, 0 (decimal).

Screen	Colour
mode	of foreground.

If the screen mode is set to zero then the program must be told that the screen is 32 lines high. Some programs (such as Pearl) will only work correctly with a 24 line screen. In this case use screen mode 3.

Termulators

If the above techniques fail then the other solution is to use a termulator. A "Termulator" is a piece of code which is loaded into the top of memory, which intercepts characters sent to the console (screen) by a program, and performs a translation before passing them to the screen controller.

The translation may be simple, for example changing the "translated console output" calls to "raw output" or complicated, for example making the TORCH emulate another type of terminal, or allowing the definition of soft keys.

For further information, refer to the Programmers' Guide.

PREPARING COMMAND FILES

A command file contains a set of characters which can be presented to the TORCH as though they were typed at the keyboard. Command files are prepared using the INPUT command, or a word processor such as Typewriter or WordStar.

EXAMPLE: Reset the TORCH and insert a blank formatted disc into drive A. Enter the following lines of text, each terminated by `return`

      INPUT BEGIN.SUB
      F 6
      B 4
      HELP

Now enter a control– Z (press control and Z together) followed by `return` After a slight delay, the prompt 0A> will appear. The file BEGIN.SUB now exists on the disc. Check this by using the DIR command or the TYPE command.

To enter the contents of BEGIN.SUB as a sequence of commands, use the command:

      C BEGIN.SUB

      BEGIN.SUB should be loaded from disc, and the commands F 6 (Foreground cyan), B 4 (Background blue), and HELP should be executed. The TORCH will then be ready for commands from the keyboard.

When using command files, facilities are available for argument substitution, and inserting comments into the file which would then be displayed on the screen when the file is executed. Where a dollar sign ($) followed by a number appears as part of the text in a command file, the argument corresponding to that number will be substituted in the text of the command file. Where dollar zero ($0) appears, the name of the command file is substituted. The filename may be followed by up to nine arguments, which are separated by spaces and terminated by the lines end.

Special characters may be inserted into the argument using backslash \ followed by a letter.

n :newline	(moves to a new line).
s: space	(inserts a space into that argument).
0 :null argument	(that argument is ignored).

EXAMPLE C TEST XXX TXT RU N

In this example TEST is the filename, XXX is argument 1, TXT is argument 2, and RU N is argument 3. Note that to incorporate a space into the argument RU N, s was used when entering the file, as an actual space may not be used within an argument, but is used to separate arguments.

To copy files of a specified name from drive B to drive A, for example for making backups, enter the file BACKUP.SUB containing:

      ; Backing up $1

      DEL A: $1 [u

      COPY B: $1 TO A:

      VDU 7

      followed by control Z and `return`

The command file C BACKUP *.DOC will display the words "Backing up *.DOC", delete all files on disc A with the .DOC extension, copy all files from disc B with the .DOC extension to disc A, and then sound a bell on the speaker, to tell the user that the backing up operation has been completed. (The old version of the files were first deleted from disc A and then replaced with the new version from disc B). Using the above procedures the user may write their own command files for various purposes.

APPENDIX A

Basic Mode

The command BASIC runs a BBC BASIC interpreter on the peripheral processor in the TORCH. In this mode, the Z80 processor is not used.

BASIC can be used for simple calculations, in much the same way as a programmable calculator.

To run BASIC on the TORCH enter BASIC followed by `return`. The prompt " > " will then be displayed which means that the BASIC interpreter is ready to accept commands typed in at the keyboard.

Below are some simple examples of BASIC commands, and a simple graphics program.

EXAMPLES:

    PRINT 56*2 (or P. 56*2)

This gives the computer the command to display the product of 56 and 2 on the screen.

    VAT = 1.15
    PRINT VAT*200, VAT*300

This assigns the decimal value of 1.15 to VAT, multiplies it by 200, and 300, and then displays the results on the screen.

PRINT ~ 23 will display 23 in hexadecimal, i.e. 17

PRINT & FE will display hex FE in decimal, i.e. 254

The following program will draw coloured triangles on the screen.

```
10 MODE 2
20 GCOL 0, RND(15)
30 PLOT 85, RND(1500), RND(1200)
40 GOTO 20
```

For a full description of BBC BASIC, refer to the BBC computer user guide.

Disco Lights

This is an example of how a TORCH can be set up as two types of Disco light for the office party. using BBC BASIC.

Strobe

In CPN, enter the following:

*FX 10, 3 `return`
*FX 9, 1 `return`

B 15 `return`

Light Box

Using BASIC mode, enter the following program:

```
10 MOVE 0, 0 : MOVE 0, 1000
20 PLOT 85, 1200, 1000
30 *FX 10, 10
40 *FX 9, 10
50 VDU 19, 1, RND(7) +8, 0, 0, 0
60 VDU 19, 0 RND(7) +8, 0, 0, 0
70 F=INKEY (200)
80 GOTO 50
```

Then run it by typing RUN followed by `return`.

APPENDIX B   Definitions of Standard Terminology
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Systems/QA department document QA-A-02

Version 1.00 Issued 82-11-10 by CDWF.

(C) 1982 Torch Computers Limited.

       The following is a summary of some technical terms used by
Torch, whose definitions are sometimes confused.

TRACK   The amount of disc physically read or written at
                   one time. It is normally either 10 or 16 sectors.

CYLINDER   (1) On a floppy disc, the amount of disc that can
                        be read or written without moving the disc
                        head. Since Torch only uses double sided
                        discs, this is always 2 adjacent tracks.
                   (2) On a hard disc, 2 adjacent tracks. This term
                        will occasionally be used for convenience but
                        has no physical significance.

SECTOR   The amount of disc handled at one time for
                   addressing purposes. It contains 256 bytes.

RECORD   The amount of data transferred to or from a file
                   at one time by CPN. It contains 128 bytes, in
                   order to be compatible with CP/M.

BLOCK   Used to mean either sector or record. It is
                   confusing, and its use should be avoided.

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COMPUTERS

APPENDIX C

CPN Floppy Disc File Structure
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General description
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Systems/QA department document Sys-B-01

Version 1.02 Issued 82-11-08 by CDWF.

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PHYSICAL STRUCTURE

A floppy disc has a physical structure of:

80 cylinders	00 (outer)	to	79	(inner)
2 sides	0 (upper)	to	1	(lower)
10 sectors	0	to	9	
256 bytes	000	to	255	
8 bits	0 (LSB)	to	7	(MSB)

NOTATION

Each side of a cylinder is called a track, and has a "track number" of (cylinder << 1) + side. Each sector is also given a "sector number" of (track << 4) + sector.

Sectors may also be specified by a two or three part value. This will either be cylinder:side:sector (e.g. 63:1:4) or else track:sector (133:5).

Where several bytes are assembled into a single object, bit 0 of the object is bit 0 of byte 0, and so on.

N.B. Disc error messages such as "Disc A track 2F error 18" refer to the track number in hexadecimal, not decimal.

LOGICAL STRUCTURE

The logical structure of a CPN disc is as follows.

Cylinder 0 is reserved for system information. All other cylinders are available for storing data, L2 blocks, or L3 blocks.

Cylinder 0 is broken up into various parts. Sectors 0:0:0 to 0:0:9, and 0:1:0 to 0:1:5 (16 sectors) form the directory. Sectors 0:1:6 and 0:1:7 form the disc allocation map. Sector 0:1:8 holds a standard pattern used for disc drive tests, and sector 0:1:9 holds various other information (see Torch Systems Department document Sys-B-02). The two parts of the directory are treated as being concatenated in the obvious order.

0:0:0 (0000) (000h)	to	0:0:9 (0009) (009h)	Directory
0:1:0 (0016) (010h)	to	0:1:5 (0021) (015h)	Directory
0:1:6 (0022) (016h)	to	0:1:7 (0023) (017h)	Allocation map
0:1:8 (0024) (018h)			Test pattern
0:1:8 (0024) (018h)			Other information
1:0:0 (0032) (020h)	to	79:1:9 (2553) (9F9h)	Data etc...

DIRECTORY

The directory consists of 256 directory blocks, each of 16 bytes. These blocks are assumed to be in the logical order, with byte 0 of block 0 being byte 0 of sector 0:0:0, and byte 15 of block 255 being byte 255 of sector 0:1:5. Those blocks from block 0 to the one before the first "end" block (or block 255 if there is no end block) are either valid or null entries, whilst those beyond the first end block are ignored.

The block structures are:

Bytes	Bits	Null	End	Normal (A)	(B)
00/01	00-13	3FFFh	0000h	L2 block sector no.	L3 block sector no.
00/01	14	1	0	0	0
00/01	15	1	0	1	0
02-03	all	Unused	Unused	Highest record number in the file (see note)	
04	all	Unused	Unused	User number of file	
05-12	0-6	Unused	Unused	File name main part	
05-08	7	Unused	Unused	User set attributes	
09-12	7	Unused	Unused	Reserved	
13-15	0-6	Unused	Unused	File name extension	
13	7	Unused	Unused	0=r/w file	1=r/o file
14	7	Unused	Unused	0=normal	1=SYS file
15	7	Unused	Unused	0=normal	1=execute only

N.B. The record number in bytes 02-03 is the highest record number that has been written to in this file. See also below.

SPECIAL DISCS

If byte 01 of the first directory entry is 40h (64), then
the disc is a special "Reserved disc" that does not conform to
these standards. In this case, bytes 05-15 are the disc name, in
some sense, and the rest of the disc is undefined for these
purposes. For further details, see the appropriate Torch Systems
Department documents.

ALLOCATION MAP

The allocation map is divided into 256 words (of 16 bits).
Words 2 to 159 correspond to tracks 2 to 159 (cylinders 1 to 79),
and words 0 to 1 and 160 to 255 are unused. The format of each
word is as follows:

Bits 00-09 Sectors 0-9 (in that order): 0=free, 1=allocated
Bits 10-15 Must be set to 1.

FILE STRUCTURE

A CPN file consists of a number of records, numbered from 0
upwards. Each record is 128 bytes long, not 256, and thus
occupies only half a sector. However, the two records in a
sector always form an even/odd pair of records in the same file.
The records of a file are held together by L2 and L3 blocks
in the way described below. If a file only uses records 0 to
255, then it will not have an L2 block. Otherwise it will
contain exactly one L2 block. The disc operating system will
automatically switch files between the two states as necessary.

THE L2 BLOCK

An L2 block is broken into 128 words of 16 bits. Word
number n contains either the sector number of the L3 block
referring to records 256n to 256n + 255, or 0 if none of these
records have been written to. Thus a file may contain up to
32768 records.

THE L3 BLOCK

An L3 block is also broken into 128 words of 16 bits. Here,
word number n refers to records 2n and 2n+1 as follows:

bits 00-13   sector number holding records 2n and 2n+1
                    0 indicates both records never written to.
bit 14   record 2n   )   (0 = never written to
bit 15   record 2n+1)   (1 = written to

Record 2n occupies bytes 0 to 127 of the sector, and record 2n+1
occupies bytes 128 to 255, in the obvious way.

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