



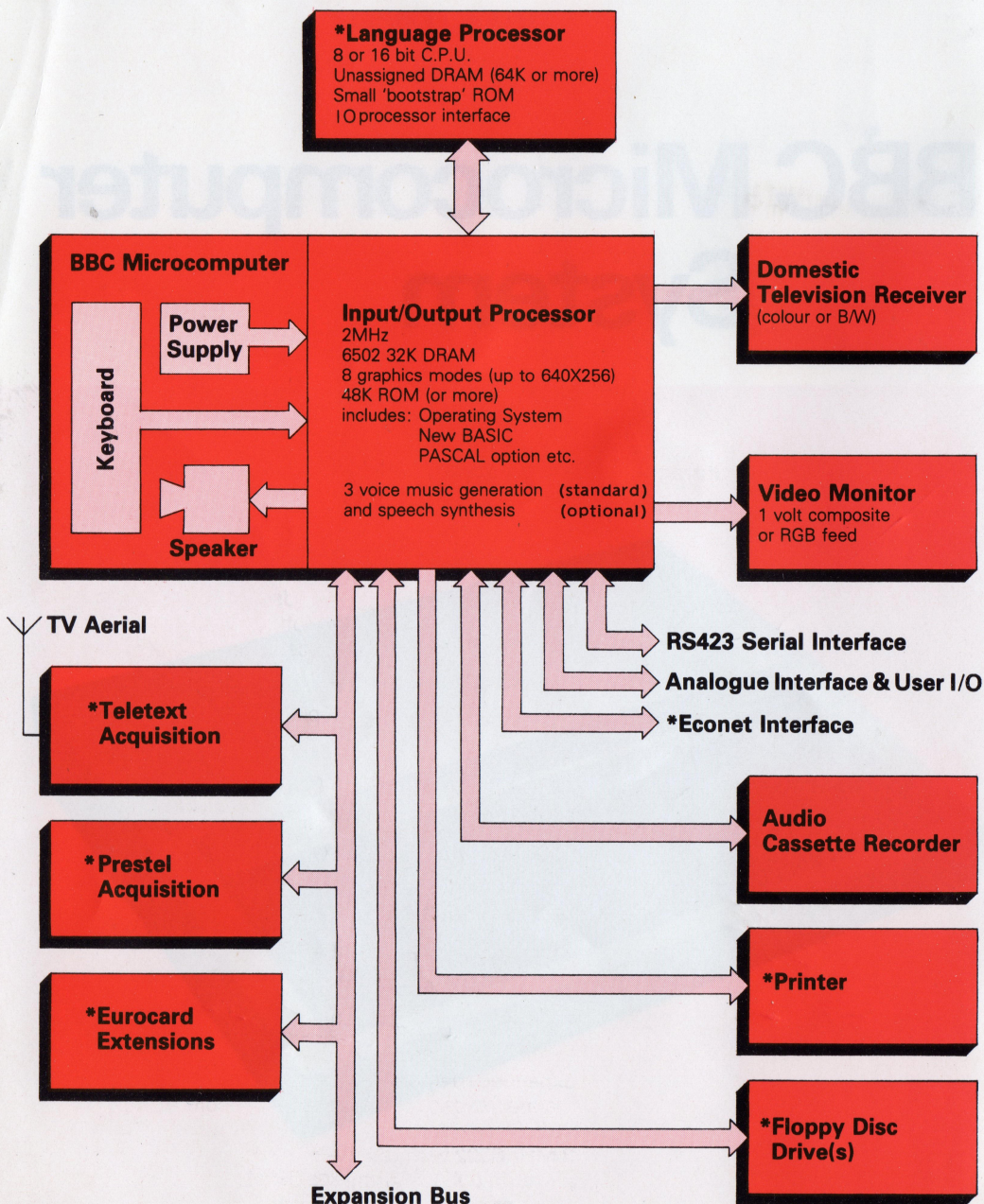
# BBC Microcomputer System





# BBC Microcomputer System Plan

\*Options requiring additional hardware within BBC Microcomputer





# MAIN FEATURES

■ <b>Processor</b>	2 MHz 6502A
■ <b>Memory</b>	16K ROM BASIC 16K ROM Machine Operating System 32K RAM (16K on Model A)
■ <b>Keyboard</b>	73 key full QWERTY layout, including 10 user definable function keys, 4 cursor control keys, two key rollover and auto repeat.
■ <b>Display</b>	Mixed high resolution graphics and upper and lower case text. Full colour on all 8 display modes: <div> <div> 0 640×256 2 colour graphics and 80×32 text  1 320×256 4 colour graphics and 40×32 text  2 160×256 16 colour graphics and 20×32 text  3 80×25 2 colour text  4 320×256 2 colour graphics and 40×32 text  5 160×256 4 colour graphics and 20×32 text  6 40×25 2 colour text  7 40×25 Teletext display </div> <div> Model B Only </div> </div> UHF, composite video and separate RGB and Sync outputs.
■ <b>External Storage</b>	300 baud and 1200 baud interface (with motor control) for standard cassette recorders.
■ <b>Tone Generation</b>	Three-voice music synthesis with full envelope control feeding internal loudspeaker.
■ <b>Printer Interfaces</b> (Model B Only)	1 8 bit plus full two-line handshake "Centronics" port. 2 75 baud to 9600 baud software selectable serial port to drive RS232 devices with full two-line handshake.
■ <b>User Input/Output</b> (Model B Only)	8 bit parallel input/output port.
■ <b>Analogue Inputs</b> (Model B Only)	Four analogue inputs for games, paddles or control applications.
■ <b>Expansion Capabilities</b>	Within the computer (at extra cost) Floppy Disk Interface Econet Interface Speech Synthesis Cartridge ROM Pack Interface "Tube" connector for second processor option.
■ <b>Second Processor Option</b>	The Computer is designed so that it can be expanded to run with a second processor and considerably expanded memory. Planned expansion units which are connected via the "tube" include: 3 MHz 6502 with 60K RAM Z80 with 60K RAM running CP/M 16 bit processor with 128K RAM.



## Model A BBC Microcomputer System

A fast, powerful self-contained computer system generating high resolution colour graphics and capable of synthesising 3 part music. The computer is contained in a rigid injection moulded thermoplastic case. The following are contained within the computer thus ensuring the minimum of connecting wires.

- 73 key full travel QWERTY keyboard with 10 user definable function keys. The keyboard has two key rollover and auto repeat.
- Internal 240/115V power supply is fully encased and made to BS Class 1.
- The internal loudspeaker is driven from a 3-voice music synthesis circuit with full ADSR envelope control.
- A fully modulated PAL colour television signal, for connection to a normal domestic television aerial socket, is available through a phono connector.
- A BNC connector supplies a composite video output to drive a black and white or PAL colour monitor.
- A standard audio cassette recorder can be used to record computer programs at 300 or 1200 baud using the CUTS standard tones. The cassette recorder is under full automatic motor control and is connected to the computer via a 7 pin DIN connector.
- An interrupt driven elapsed time clock enables real time control and timing of user responses.
- The unit uses a 2 MHz 6502 and includes 16K of Random Access Memory.
- A 16K Read Only Memory (ROM) integrated circuit contains an extensive and powerful Machine Operating System designed to interface easily to high level languages.
- A further 16K "Language ROM" contains an extremely powerful and fast BASIC interpreter. The interpreter includes a 6502 assembler which enables BASIC statements to be freely mixed with 6502 assembly language.
- Up to four 16K Language ROMs may be plugged into the machine at any time. These four ROMs are "paged" and may include Pascal, Word Processing, computer aided design software, Disk and Econet routines or Teletext acquisition software.
- The standard television output is 625 line 50 Hz, interlaced, fully encoded PAL, modulated on UHF channel 36. Other standards are available.
- The full-colour Teletext display of 40 characters by 25 lines has full character rounding with double height, flashing, coloured background and text – all to the Teletext standard.
- The non Teletext display modes provide user definable characters in addition to the standard upper and lower case alpha-numeric font. In these modes, graphics may be freely mixed with text. Text characters can be positioned not only on, for example, a 40×32 grid, but at any intermediate position.
- Separate or overlapping text and graphic windows can be easily user-defined over any area of the display. Each of these windows may be filled and scrolled separately.
- The Model A is able to support the following modes:
  - 4 320×256 2 colour graphics and 40×32 text
  - 5 160×256 4 colour graphics and 20×32 text
  - 6 40× 25 2 colour text
  - 7 40× 25 Teletext display



- All graphics access is "transparent" resulting in a fast snow-free display.
- Extensive support is provided in the Machine Operating System for the graphics facilities, and this is fully reflected in the BASIC interpreter. These facilities include the ability to rapidly draw lines and to fill large areas of colour. In addition, very rapid changes of areas of colour can be effected.
- The Model A BBC Microcomputer System can be expanded at any time to the Model B System. In addition, or as an alternative, other facilities such as the Econet, may be fitted within the computer systems.

## Model B BBC Microcomputer System

The Model B BBC Microcomputer System is an enhanced version of the Model A Microcomputer but with the following differences:

- 32K Random Access Memory (RAM). This enables all the graphics modes to be used
 

0 640×256 2 colour graphics and 80×32 text	(20K)
1 320×256 4 colour graphics and 40×32 text	(20K)
2 160×256 16 colour graphics and 20×32 text	(20K)
3 80× 25 2 colour text	(16K)
4 320×256 2 colour graphics and 40×32 text	(10K)
5 160×256 4 colour graphics and 20×32 text	(10K)
6 40× 25 2 colour text	(8K)
7 40× 25 Teletext display	(1K)
- The installed RAM is divided between the high resolution graphics display, the user's program and Machine Operating System variables. The Machine Operating System requires about 3¼K of RAM in the Model A. If higher resolutions are required with large programmes then the second processor option may be fitted.
- Serial interface to RS423 standard. The new standard has been designed to be inter-operable with RS232C equipment but offers a considerably enhanced specification – for example in maximum length of cable and maximum data transfer rates. Baud rates are software selectable between 75 baud and 9600 baud. The interface provides not only two-way data transfer, but also two way hand-shaking using RTS and CTS lines. Connection to the machine is made via a 5 way "diamond" DIN connector and various interconnecting plugs are available for the various standard 25 way D type circuits.
- An 8 bit "Centronics type" parallel printer port is provided with "Strobe" and "Acknowledge" lines.
- An 8 bit input/output port is also provided.
- 4 12 bit analogue input channels are provided. Each channel has an input voltage range of 0-2.5V and the internal converter provides a number in the range 0 to 4095. The conversion time for each channel is 10 milliseconds and when the conversion is complete, the processor is interrupted and the value stored in a memory location for later access. These analogue inputs can be used not only in laboratory control situations, but also as inputs for games-paddles or joysticks.
- A 1 MHz buffered extension bus is provided for connection to PRESTEL, Teletext or various other expansion units.
- All interface sockets to external peripherals, are fitted to the Model B. These include R/G/B/Sync for colour monitors, Econet, serial interface, parallel printer, disk and tube. Having the interface sockets fitted enables the internal expansions mentioned above to be fitted without further soldering.



Both **Model A** and **Model B** may have the following expansion options fitted internally at purchase, or by Dealers at a later date.

- Floppy disk interface
- Econet network interface (separate leaflet available)
- Voice synthesis circuits
- Cartridge ROM pack interface
- Various alternative high-level languages in ROM

**External** options which plug directly into the machine include:

- Paddles
- Cassette Recorder
- Black and White and colour monitors and televisions
- 5¼" single-sided disk drive (100K)
- 5¼" dual double-sided double track density disk drives (800K)
- 80 column dot-matrix printer
- Daisy Wheel Printer
- Teletext acquisition unit } both of these enable Telesoftware to be
- Prestel acquisition unit } downloaded into the BBC Computer as well as
- providing access to the normal
- Teletext/Prestel services. Pages may be
- "grabbed" and stored for later use
- 3MHz 6502 second processor with 60K of RAM
- Z80 second processor with 60K of RAM and a fully CP/M-compatible operating system

Considerable attention has been paid to the overall design of the system and application software. A modular approach has been adopted specifically to ease the interfacing of various high-level languages (such as BASIC and Pascal) to the operating system.

### ■ **Machine Operating System (MOS)**

A 16K ROM is used for the MOS. This software controls all input/output devices using a well defined interface. The MOS supports the following interrupts:

- ☐ Event Timer (used as elapsed time clock)
- ☐ 4 channel analogue to digital converter
- ☐ Vertical sync
- ☐ Keyboard and keyboard buffer
- ☐ Tube byte transfer
- ☐ Music tone generation and buffer
- ☐ Serial interface, input and output, and buffers
- ☐ Parallel input/output port

and "hooks" are provided to support other devices such as:

- ☐ Teletext
- ☐ Prestel
- ☐ Econet file system
- ☐ Disk file system

Many of the operating system calls are vectored to enable the user to change them if required at a future date.



## ■ BASIC

The BASIC interpreter is an extremely fast implementation, very close to the Microsoft standard but with numerous powerful extensions:

- ☐ Long variable names
- ☐ Integer, floating point and string variables
- ☐ Multi-dimension integer, floating point and string arrays
- ☐ Extensive support for string handling
- ☐ IF ... THEN ... ELSE
- ☐ REPEAT ... UNTIL
- ☐ Multi-line integer, floating point and string functions
- ☐ Procedures
- ☐ Local variables
- ☐ Full recursion on all functions and procedures
- ☐ Effective error trapping and handling
- ☐ Cassette loading and saving of programs and data
- ☐ Full support for the extensive colour graphics facilities
- ☐ Easy control of the built-in music generation circuits
- ☐ Built-in 6502 mnemonic assembler enabling BASIC and assembler to be mixed, or pure assembly language programs to be produced.

## ■ Other High Level Software

A range of other high level software is presently under development or being commissioned. It is envisaged that a number of the larger programs will be available on ROMs which can be left in the machine and used as needed. It is hoped that these will include Pascal, Computer Aided Design package, and Word Processing. Details will be announced.

## ■ Applications Software

This project is unusual in that a range of application packages is being developed at the same time as the computer equipment. These packages will include such diverse applications as:

- ☐ Astronomical predictions
- ☐ Computer Assisted Learning
- ☐ Engineering training
- ☐ Financial modelling
- ☐ Games
- ☐ Income Tax
- ☐ Musical compositions
- ☐ VAT
- ☐ Primary school

A quality assurance scheme and a software library system will support all aspects of software development. More details of these items will be announced in due course.



The Econet communications network enables a number of computers to share expensive resources such as a printer and a disk "file server". The system is primarily intended for schools and colleges but also lends itself to many office and business applications.

- Up to 254 stations may share the network facilities
- Connection between stations is by cheap 4 wire "telephone" cable
- The network may be up to 1 kilometre from end to end
- Very low interface cost on each computer
- More than one printer or file server may be on the net
- Any station can "VIEW" any other similar station's screen
- Messages may be passed between any machines
- All inter-machine interaction can be barred to any specific machine or group of machines

Because of the low costs involved, it is possible to dedicate one computer as a file server and one as a printer server. However, once pupils have loaded files from the file server, there is no reason why the file server computer should not be used as a normal disk computer until it is again required to act as a file server. The same flexibility applies to the printer server.

Technical support and service can be obtained from a number of sources:

- Pre-sale advice (please send a large S.A.E.) from

**BBC Microcomputer System**

PO Box 7

London W3 6XJ

- After sales service and advice by a National Dealer Network
- Warranty repairs by Currys Ltd

This description and specification is subject to change without notice.