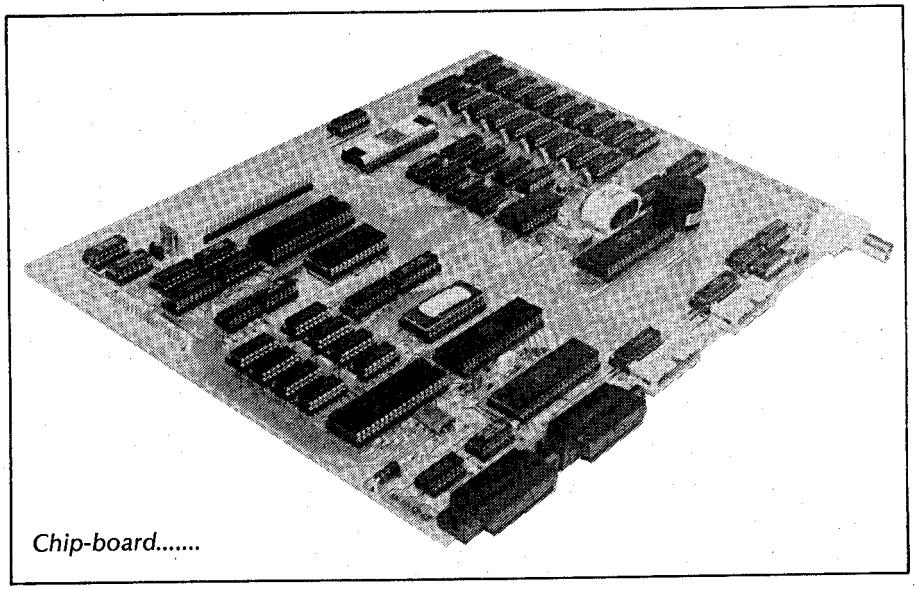
6809-BASED MICROCOMPUTER

In this, the first of a series of articles, G. Mills of Micro Concepts describes a new single-board microcomputer designed by Dave Rumball.

This article describes a single board, 6809-based micro-computer which incorporates a state-of-the-art graphics processor and other advanced features. It can be built at very low cost and is also available from Micro Concepts as a kit.

One of its features is the ability to appear as a Flex standard , machine to the wide range of Flex software. This would be of interest to those who are involved in writing software for microprocessor controlled equipment, allowing the board to be used as an inexpensive but sophisticated software development system. In case you aren't aware, the Flex operating system has a wide range of cross assemblers and an elegant command set, and is widely used for this type of work. British companies currently using Flex based development systems for microprocessor software development include Dacom, Racal, and Westwood. Because of its advanced features, this board offers a more cogenial environment for software development than many more expensive systems. Companies currently using the Micro Concepts kit (known as the Microbox II) for software development include Thorn EMI and British Telecom.

The design should also be of interest to those who want a really useful computer for very little money. It runs serious wordprocessing and data base software, has beautiful graphics, superb resolution, a completely soft character set and the prototype cost around £450 to build including discs, video monitor, keyboard, power supply and operating system (and the price is coming down).



Chip-board.....

By way of introduction, the following is a partial description of the hardware:

Central processor — Motorola 68B09E.

64K of dynamic RAM for the central processor. When running the board in the monitor mode, 8K of this is mapped out by the monitor EPROM. When running the Flex operating system, only 4K of the monitor EPROM is retained. This 4K contains driver routines for the discs, serial ports and parallel ports, as well as interface routines for the graphics chip and terminal emulator.

A floppy disc controller that will support up to two 3½ or 5¼ inch floppy disc drives, single or double density, single or double sided, 40 or 80 track.

One parallel keyboard port.

Two independent bi-directional RS232 ports with software programmable baud rates (50 to 19.2k baud), parity, stopbits, etc.

One Centronics standard parallel printer port.

A buffered, fifty pin expansion bus.

All of the above will be familiar to anyone who has experience with run-of-the-mill Flex machines available from a number of manufacturers. The following features are unique to this design:

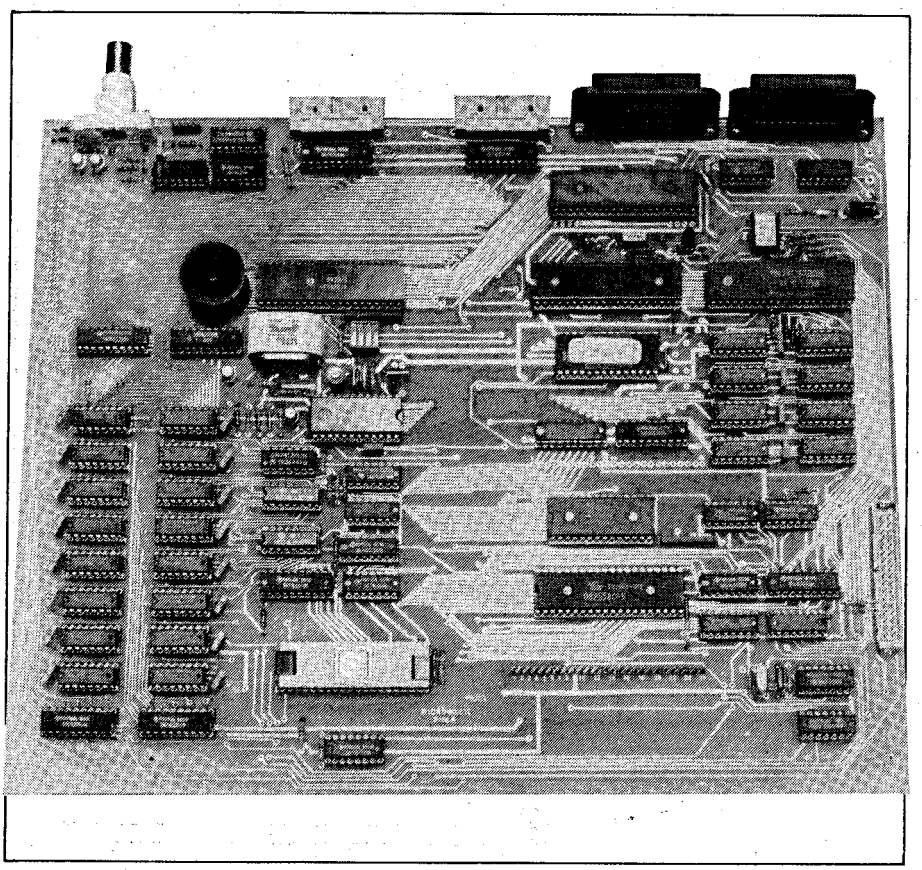
An additional 128K of dynamic RAM partitioned into alphanumeric video RAM, graphic video RAM, and RAMdisk.

An alphanumeric display format of 108 columns by 24 lines when using the terminal emulator resident in the monitor EPROM. The terminal

emulator and the associated character set are in software and therefore can be redefined if desired. Alternate memory resident emulators come with the kit. One gives a format of 84 by 24 and another 128 columns by 56 lines.

Exceptional monochrome graphics facilities generated by an NEC 7220A graphic display controller. The resolution of the display is 768 pixels by 576 pixels. By way of comparison, this is a resolution 2.7 times greater than the BBC Model B in its highest resolution mode. Graphics primitives (for example the Bresenham algorithm for arc and line drawing) are built into the 7220A, resulting in very fast drawing speeds.

A RAMdisc facility, using a variable amount of the 128K RAM. This RAMdisc looks exactly like a floppy disc to the operating system. The capacity of the disc can vary between 170 sectors (42.5K) when using the full graphics capabilities of the machine, and 500 sectors (125K) when the machine is being used with a serial terminal and no graphics output. Its mid capacity, when using the terminal capacities of the 7220A, is exactly the size of a single density, single sided 40 track Flex disc. This enables the user to perform fast disc to disc copying with only one disc drive.



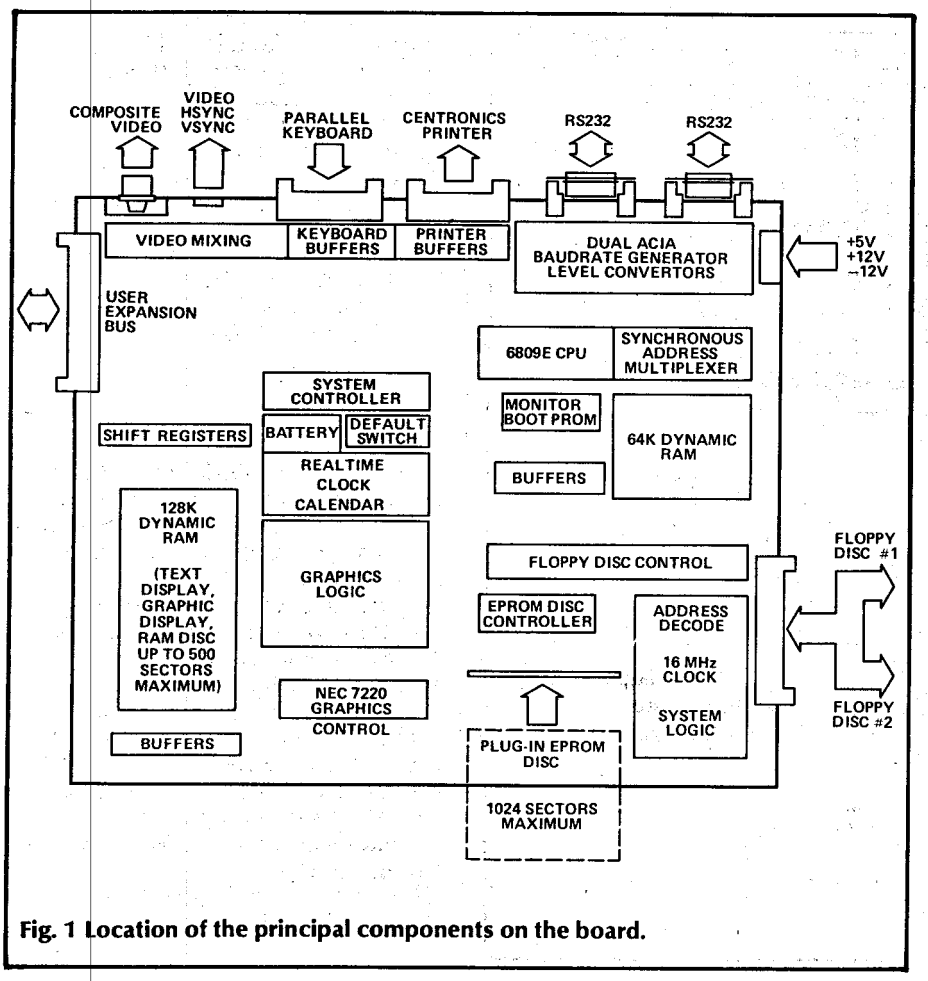


Fig. 1 Location of the principal components on the board.

An EPROM based silicon disc which again looks to the DOS exactly like a floppy disc, but this time write protected. The EPROM disc is fabricated on its own small PCB which plugs into the main board. This allows the user to keep a number of these discs programmed for different applications. The capacity of this board is 4 EPROMS which can be 27128's, 27256's, or 27512's. These will give 64K, 128K, or 256K bytes of disc space respectively.

An on-board EPROM programmer requiring only a programming power source (for 21V EPROMS three 9 volt batteries stablized by a zener diode can be used).

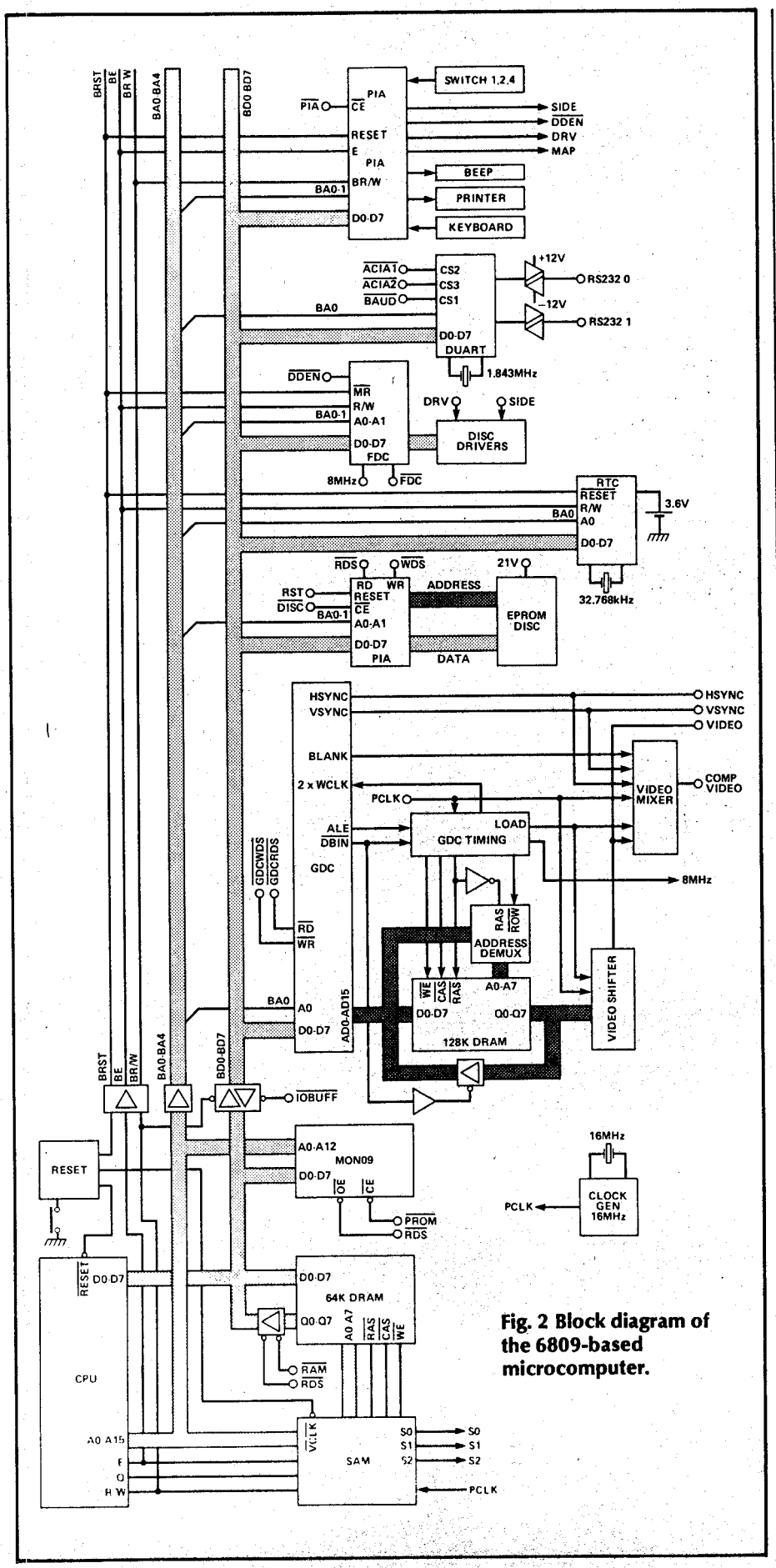


Fig. 2 Block diagram of the 6809-based microcomputer.

A battery backed-up real time clock and calendar. This is used by Flex to date stamp files. The clock chip also contains 50 bytes of non-volatile RAM, some of which is used to maintain system parameters such as baud rates, floppy disc step rates, physical to logical mapping of disc drives and start-up parameters for the graphics device.

It should be apparent by now that the board has been designed with some thought. The combination of EPROM disc and RAM disk makes it very fast indeed and in most cases disc access time is not even noticeable.

The effect of the silicon discs and the fast graphics hardware is to make the machine compare favourably with the graphics on much larger machines (in one incarnation it was used by Imperial College as a graphics terminal for a VAX). Further, the terminal emulation software and the handling of the ROM and RAM discs so that they look like floppy discs enables the system to run Flex software with no more modification than would be necessary with any other Flex computer. In fact, it will boot any Flex operating system. It is in effect a superset of existing Flex computers, not an entirely new departure that leaves the software developers years behind.

Another interesting feature of the design is the low chip count. Fully populated, and including the EPROM disk, the board has only 68 chips of which 24 are memory and five are EPROM.

We hope this brief introduction has whetted your appetite! Next month Dave Rumball will describe the design of the board and the reasoning behind his choice of chips and facilities. Succeeding articles will cover construction and use and will include a list of available software. For those who can't wait that long, the kit is available from Micro Concepts at the address below and includes full construction details. Contact them for information on prices, etc.

Micro Concepts, 2 St. Stephens Road, Cheltenham, Gloucestershire GL51 5AA, tel 0242 - 510 525.

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