

# 6809-BASED MICROCOMPUTER

Gary Mills concludes this series of articles with a discussion of the two main chips used and the software available to run on the machine.

Although the visual star of the show is the NEC7220A graphics controller, the 6809 is itself a very noteworthy chip. It was designed as a sophisticated answer to the 8080 and 8085 Intel chips, and incorporates a vastly improved set of addressing modes.

One of the most important features of the chip is the capacity to use program counter realtive addressing. This allows the programmer to generate Position Independent Code (PIC). PIC can be loaded and run anywhere in the available address space, and is easily ROMable. Both of these features are used to great advantage by operating systems which run on the 6809.

In terms of sheer speed the 6809 compares favourably with the Z80. A straight clock speed comparison is misleading because the Z80 takes an average of four clock cycles to perform instructions while the 6809 takes one. From benchmarks published in the 68XX Micro Journal, a two megahertz 6809 performs at almost exactly the same level as a 6 megahertz Z80. The 6809 in this design switches between 1 and 2 megahertz under software control.

## The NEC7220A

The NEC7220A is a state-of-the-art graphics chip. While not a games chip, it has immense power for CAD applications and driving high resolution displays. It is currently used in the Epson QX10 and new QX16, and in the NEC personal computer series.

A full description of its capabilities would require several complete articles, but a brief list may help to convey the general idea:-

line and arc drawing  
area fill  
zoom and pan  
up to four independently scrollable areas  
software definable character set  
resolution of 768h by 576v (in this computer)

It does all of this at the incredible drawing rate of 80 nanoseconds per pixel. To understand how fast this is, look at the four figures over the page. They can be drawn and erased on the screen in succession in under 7 seconds.

The publications listed below may be of interest to those who wish to explore in more detail the facilities offered by this chip.

### uPD7220/GDC, uPD77220-1/ uPD7220-2 Graphics Display Controller

This is a fundamental document describing the chip's capacities and instruction set. However, it is terse and sparse on examples. It is published by NEC and can usually be requested when you purchase the chip, or ordered directly from them.

### Product Description Graphics Display Controller uPD7220

Another NEC publication but better furnished with examples of the chip in use. It is available free-of-charge.

### Application Note APN — 02 uPD 7220 Graphics Display Controller

Again from NEC, this document contains techniques and hints for programming the chip. It is available free-of-charge.

### "Super Graphics Hardware from NEC"

An article by Steve Levin in BYTE magazine, April 1983. It gives a clear and concise summary of the chip's capabilities. A good introduction.

### Monitor Routines Supporting Graphics

While contemplating the list of literature above, it may help to know that a great deal of work has been done for you. The kit for the project as supplied by Micro Concepts has a full set of assembly level graphics routines delivered in its firmware. They include:

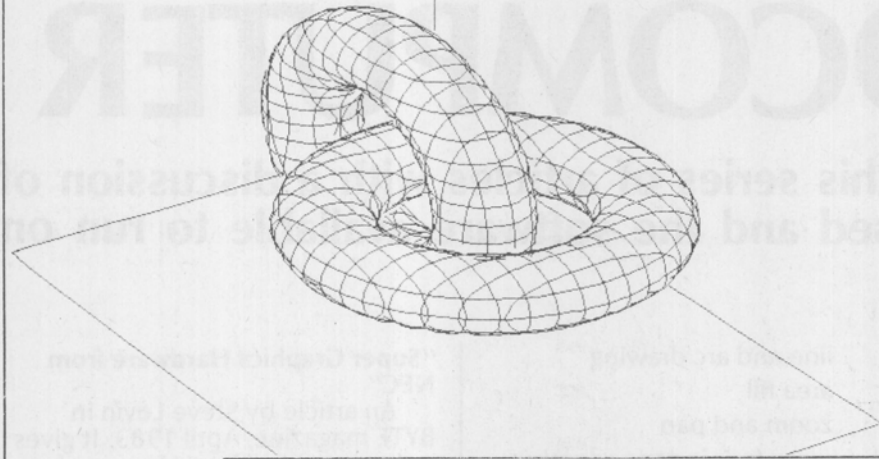
Set graphics cursor position  
Plot a point  
Plot a line  
Plot a rectangle  
Plot a circle  
Set a text cursor location  
Get a text cursor location  
Put a character on the screen  
Get or set a zoom factor  
Set an area fill pattern  
Fill an area

These routines can be called directly from your assembly language programs, and are fully described in the Microbox II literature.

### The Flex Operating System

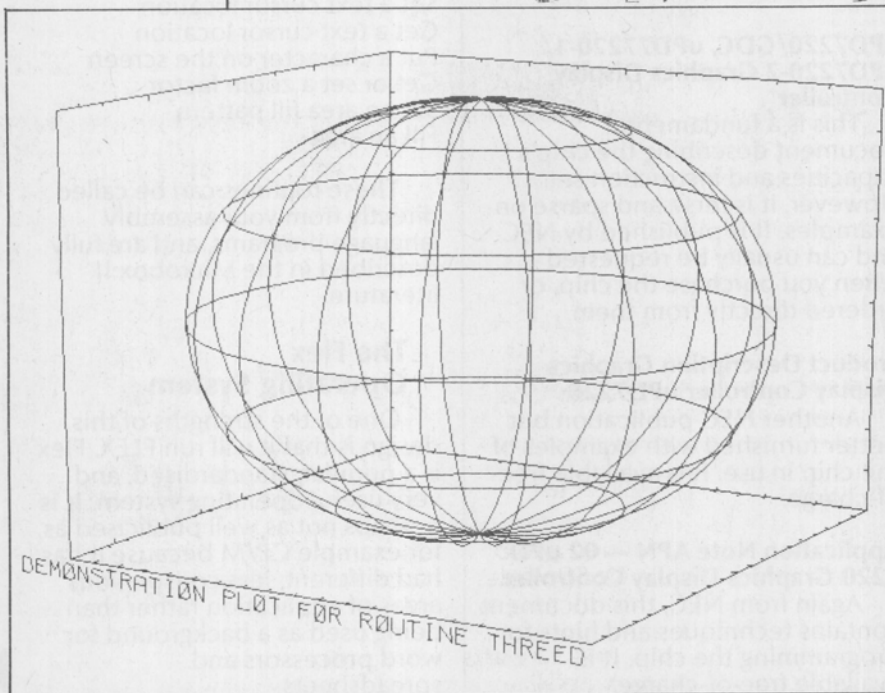
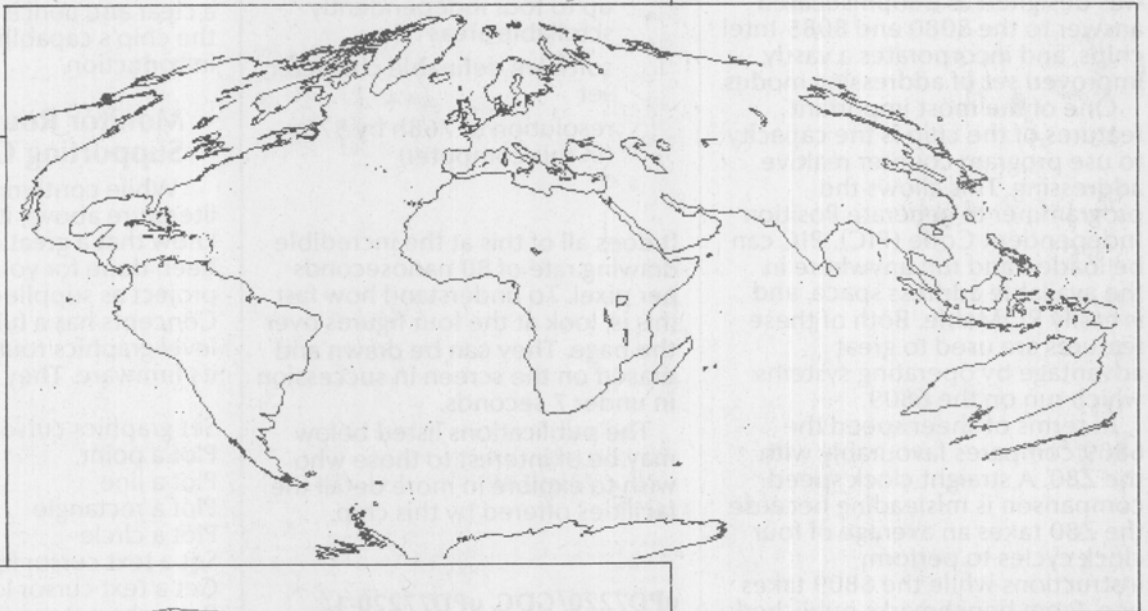
One of the strengths of this design is that it will run FLEX. Flex is a popular, standardised, and very useful operating system. It is perhaps not as well publicised as, for example CP/M because it has had different, less conspicuous areas of application rather than being used as a background for word processors and spreadsheets.

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FLEX can run wordprocessors and spreadsheets (very good ones, too), but is primarily known as an engineer's operating system. It is consistently found on software development machines. Because of this there is a welter of languages, compilers, interpreters, assemblers and cross assemblers that run on FLEX, and because this machine can look like a standard FLEX machine to them, they all run on it.

The list of languages and applications that Micro Concepts sells is representative. The high-level languages include BASIC, both interpreted and compiled, COBOL, C, Small-C, PL9, Pascal, a Pascal cross-compiler for the 68000, Forth and BCPL. Assembly language packages include cross-



assemblers for just about every commercially available chip, relocating assemblers, debuggers, simulators and translators. Applications include word processors, mail merge packages, database managers, and spreadsheets.

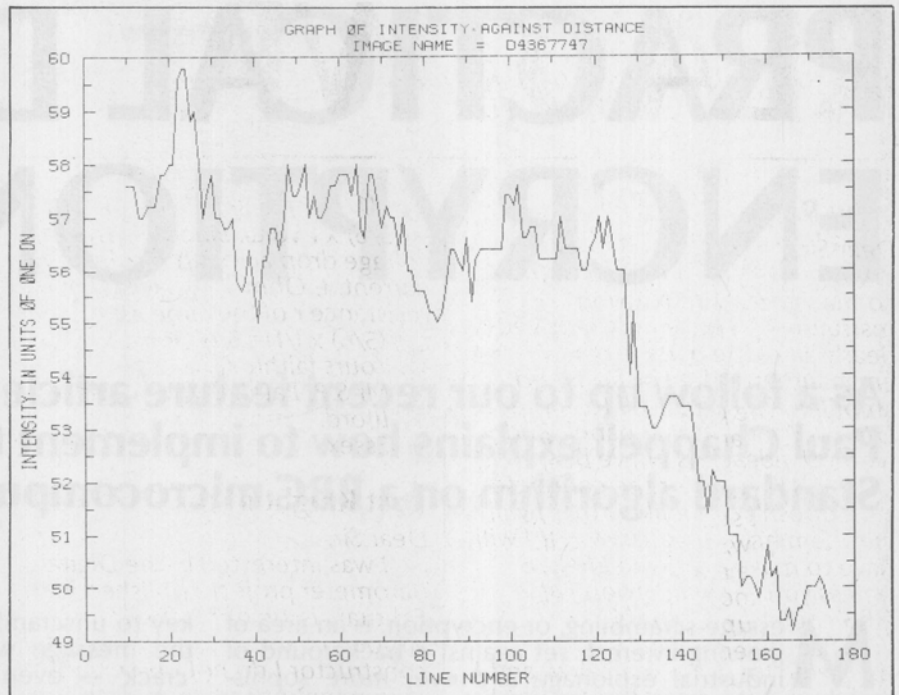
Not only does FLEX support disk, EPROM disk and EPROM programmer in this design, but a graphics macro library compatible with FLEX's native macro-assembler is provided with the kit. Further, two of the FLEX compilers, PL9 and Small-C, have graphics libraries expressly written for this machine. Already there is a character set editor, graphics screen dump, save, and restore routines, several games and an interactive graphics package for The four figures with this article

were dumped to printer using the routines above.

Another aspect of a machine or system's useability is the number of people using it, and their availability. For FLEX there are several sources of information and news. One is the "68XX Micro Journal", an American publication that can be purchased in London at Stirling Microsystems on Baker Street or subscribed to directly. There are also various Dragon and Tandy Colour Computer organs.

## 6809 User's Group

The 68 Micro Group is a very active user's group which includes a large number of user's who have already built this kit. They hold meetings every four weeks in London, and maintain a disk library of around 30 volumes for FLEX and the 6809. You can have access to this library as a member either at their meetings or through the mail. At the moment they have 3 full disks devoted especially to this machine including the character set editor, screen save and dump routines, and the PL9



graphics interface mentioned above. You can contact the membership secretary about joining. Jim Turner, 63 Millais Road, London E11, tel 01-558 3681.

A basic kit for this design (the Microbox II) is available from Micro Concepts, 2 St. Stephens Road, Cheltenham, Gloucestershire GL51 5AA, tel, 0242-510525.

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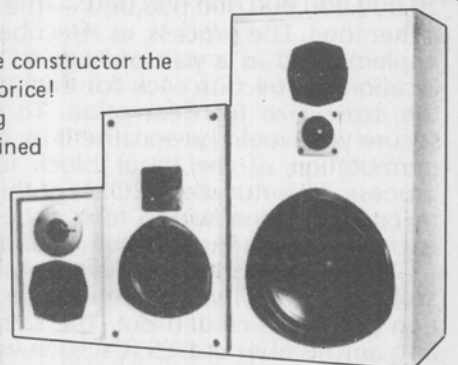
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