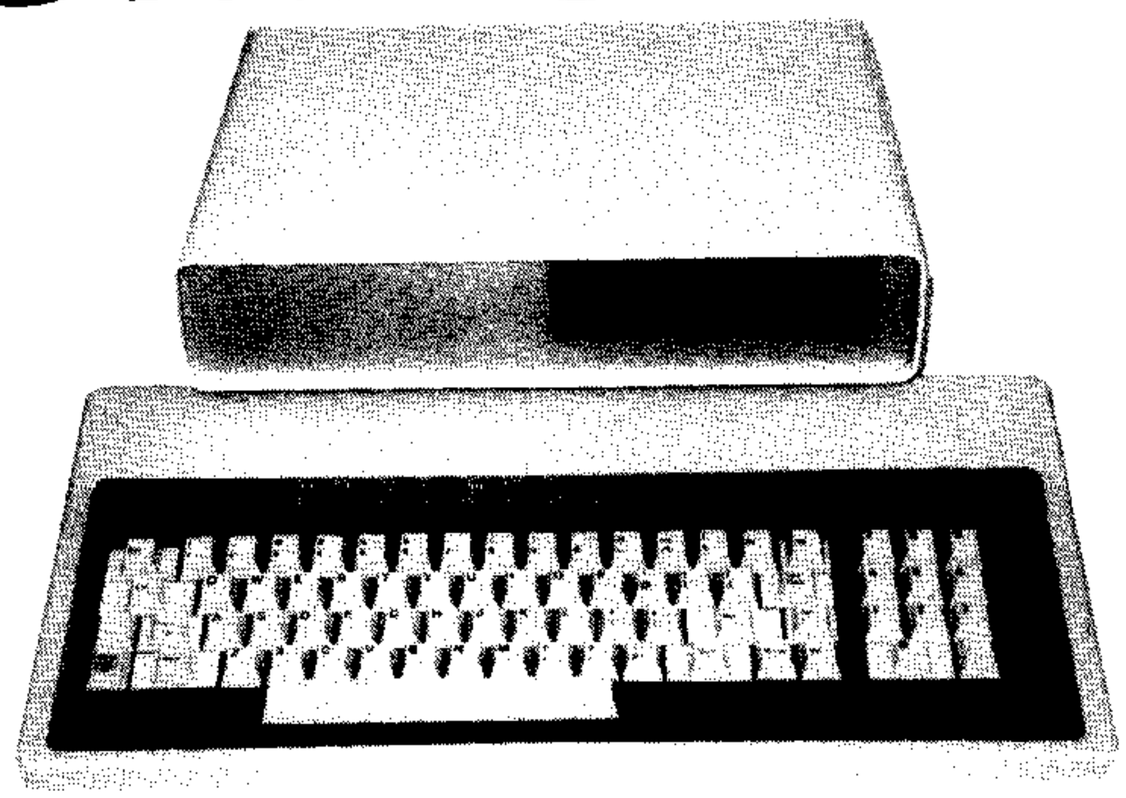
6809-BASED MICROCOMPUTER



Gary Mills discusses the choice of I/O devices and case to complete the system before going on to describe the testing and initial power-up procedures.

With assembly of the boards complete, the next step is to select and interface the appropriate input/output devices, attach a power supply, and install the complete system in a case or cases. Diagnostic test routines can then be run using the ROM monitor program.

The board can be used either with a separate keyboard and video monitor or with a serial terminal which includes both keyboard and VDU. Unless you already have such a terminal, you will probably wish to use separate devices. There is a wide range of suitable equipment to choose from.

The video monitor chosen may have either a composite video or a TTL interface. Using the composite video interface, any monitor that sinks 1 volt into 75 ohms will do. Since this is an almost universal standard, most composite video monitors can be used. Because the video resolution of the board is very high, the higher the resolution of the monitor, the better your display will look. 20MHz or over is a good figure to go for. Also, the picture will improve significantly if the video phosphor is a long persistence type, for example P39 or amber. Monitors that satisfy the requirements above include the Phillips Computer Monitor 80, No. BM7502/05 G (green) or A (amber), and the Kaga/Taxan KX1201, KX1202, and KX1203.

Pin No.	Signal
1.	Gnd
2.	TTLVID
3.	$\overline{\text{HSYNC}}$
4.	$\overline{\text{VSYNC}}$

Table 1 Pin connections on the TTL-Video output socket, SK8. Pin 1 is the pin nearest the composite video output socket, SK9.

Pin No.	Signal
1.	Gnd
2.	XMIT
3.	RCVE
4.	$\overline{\text{RTS}}$
5.	$\overline{\text{CTS}}$
7.	Gnd
11.	+5v
25.	−12v

Table 2 Pin connections on the RS232 serial ports, SK3 and SK4.

Pin No.	Inner row	Outer row
1, 2	D0	+5v
3, 4	D1	Gnd
5, 6	D2	Gnd
7, 8	D3	Gnd
9, 10	D4	Gnd
11, 12	D5	Gnd
13, 14	D6	Gnd
15, 16	nc	Gnd
17, 18	$\overline{\text{STROBE}}$	Gnd
19, 20	$\overline{\text{RST}}$	-12v

Table 3 Pin connections on the parallel keyboard port, SK2.

TTL video monitors can also be interfaced to the board. One of the commonest types is the IBM compatible monitor. There is a slight problem here in that the signals required (HSYNC, VSYNC and TTLVIDEO) are active high while the signals coming from the board are active low. To get around this problem, inverting buffers can be connected to the TTL video output lines. This is not available as a modification from Micro Concepts, but those who require it should not have too much difficulty sorting it out for themselves.

Keyboards

As with monitors, the 6809 board can be interfaced to a wide range of keyboards, including both parallel and TTL-serial types.

The WD2123 chip was expressly chosen because it can support serial TTL keyboards, and for greatest flexibility the RS-232 drivers were also provided. To interface a serial TTL device such as a keyboard, it is necessary to circumvent the drivers. Remove the 75189 receiver chip and replace it with a header, jumpered so that each input line connects directly to an output. When the port is required as an RS232 interface, swop back to the driver. Two serial TTL keyboards which would be suitable are the IBM Work-Alike from Diamond H Controls, Vulcan Road North, Norwich NR6 6AH, tel 0603-45291, and the GAT-0414

Pin No.	Signal
1	PA4
2	PA3
3	PA5
4	PA2
5	PA6
6	PA1
7	PA7
8	PA0
9	Gnd
10	PC7
11	PC6
12	PC5
13	PC4
14	PC0
15	+5v
16	PC1
17	PB7
18	PC2
19	PB6
20	PC3
21	PB5
22	PB0
23	PB4
24	PB1
25	PB3
26	PB2

Table 4 Pin connections on the EPROM disc board connector, SK6.

from Verospeed. Any serial keyboard used should be set to 9600 baud, eight data bits and no parity on start-up.

The second keyboard option is the parallel interface. Quite a few low cost parallel interface keybards can be found, but caution must be exercised. Make sure that the keyboard is ASCII encoded, and that it has a full set of upper and lower case letters, numbers and punctuation marks. The keyboard must provide a negative going strobe of at least one millisecond width to the board with each character.

If you are going to use a serial terminal instead of a separate keyboard and monitor, it should be set to 9600 baud, 8 data bits and no parity. The board requires RTS/CTS handshaking. If this is not available from the terminal, link the two pins together.

Power Supplies

The next piece of equipment is the power supply. There are two important considerations here, the dimensions of the power supply which must be determined in relation to the cabinet you are going to use, and the output current and number of voltage rails required. This in turn depends on whether you will also be powering your drive(s) with the same supply, whether you use the serial driver chips, and what the power requirements of your keyboard are.

The general requirements for the power supply are +5 volts at 2.5 amps, +12 volts at 2 amps, and -12 volts at 0.1 amps. This assumes that you will be powering two drives, and that you have a separate keyboard drawing a small amount of power. One supply which is suitable is the Model PRD 303 from Power Rail Electronics Ltd, tel 0582-600277. This unit is recommended for use with the Vero Total Access case used on the prototype because it fits easily within the limit the cabinet places on height.

The Case

This board does not necessarily require a case. Indeed, as we mentioned in the last issue, a prototype can be found mounted to the wall of the designer's workroom. However, a case does protect things, and it can also help to collect and organize the cables, power supply and drives.

The case pictured is from Vero and is a Total Access case type 212-8154H. To use it you will also need a chassis plate type 212-27826K. Use of this case requires that you mount the disk controller cable socket and the buss extension socket vertically. The power supply should be the one mentioned above, or should conform to the dimensions of the case. There is sufficient room available inside it to mount one 5 ¼ or two 3 ½ inch drives.

Further, a slot must be cut in the front of the cabinet to allow the EPROM disk to be installed. A connector cannot be taken out to the front of the case because the extension of the EPROM connector would create too hgh an impedance. Micro Concepts will substitute a reduced size EPROM board, in the kit if you specifically ask for it. This will fit fully within the cabinet but must be soldered on to the main board rather than socketed. In practice this only means you will have to replace EPROMs rather than replace the whole EPROM board.

The board should be mounted to the chassis plate with four standoffs. The fit is a bit snug, so make sure you mark the holes correctly before you drill.

The Total Access case is the only one we have tried using, but there is no shortage of other case designs for those who don't mind experimenting a little with mounting and connector positioning. Vero sell several larger sizes of Total Access case which would allow more flexibility in the choice of power supply, number and type of disc drives and in the use of the EPROM disc board. There are also a large number of other cases on the market which would no doubt be suitable. For those who want a really professional look, a number of manufacturers offer suites of matching cases to house processor, monitor, keyboard, disc drives and peripherals in several combinations of stacking and distributed units. One such packaging system from Vero was described briefly in a short item in last month's News Digest, and West Hyde Developments and OK Industries are among the other manufacturers who produce this type of case.

Power-Up And Testing

Assuming that you have purchased your hardware, assembled the board, tested for continuity, inserted the ICs, and connected the peripherals, the next steps are as follows.

First set the switches on SW1 to match the peripherals you have connected. The appropriate settings are shown in Table 5. Now connect power to the board. If all

Hardware	Switch Settings 1	2	3	4
Parallel keyboard and video monitor	off	off	off	off
Serial keyboard on Port 1 and video monitor	on	off	off	off
Serial Terminal on 1	on	on	off	off

Table 5 SW1 switch settings to select peripherals.

Pin No.	Inner row	Outer row
1, 2	Gnd	nc
3, 4	Gnd	nc
5, 6	Gnd	nc
7, 8	Gnd	Index
9, 10	Gnd	Select 0
11, 12	Gnd	Select 1
13, 14	Gnd	nc
15, 16	Gnd	Motor on
17, 18	Gnd	Direction
19, 20	Gnd	Step
21, 22	Gnd	Write data
23, 24	Gnd	Write gate
25, 26	Gnd	Track 0
27, 28	Gnd	Write prot
29, 30	Gnd	Read data
31, 32	Gnd	nc
33, 34	Gnd	nc

Table 6 Pin connections on the floppy disc port, SK5.

is well a header and a prompt will appear. The prompt should look like this

=>

Try typing a few characters. If they appear correctly on the screen, use the TM (test memory) command to test memory from 0000 to DE00. While the test is proceeding, tap the board gently. This will show up any bad solder joints.

Now switch off, disconnect all connections to the board and fit the NiCad battery. Be extremely careful not to short circuit it, as it can break open and foam over, damaging the board and making a mess. Momentarily short pin 22 of the clock chip to ground. This will cause it to load the default values into its RAM on power up.

Memory

AD=	ASCII dump of memory
HD=	Hex dump of memory
ME=	memory examine
PM=	Poke memory with value
FM=	Fill memory with value
SM=	shift a block of memory
FI=	find ASCII string in memory
TM=	test memory
DR=	display registers
CD=	calculate displacement

Input/Output

SI=	Set keyboard input port
SO=	set output port
SB=	set baud rate
LK=	load ASCII text from keyboard

Real Time Clock

DC=	display contents of RTC memory
MC=	modify contents of RTC memory

Disc

DF=	format disk
TS=	test stepping
TD=	test drive
RS=	read sector
WS=	write sector

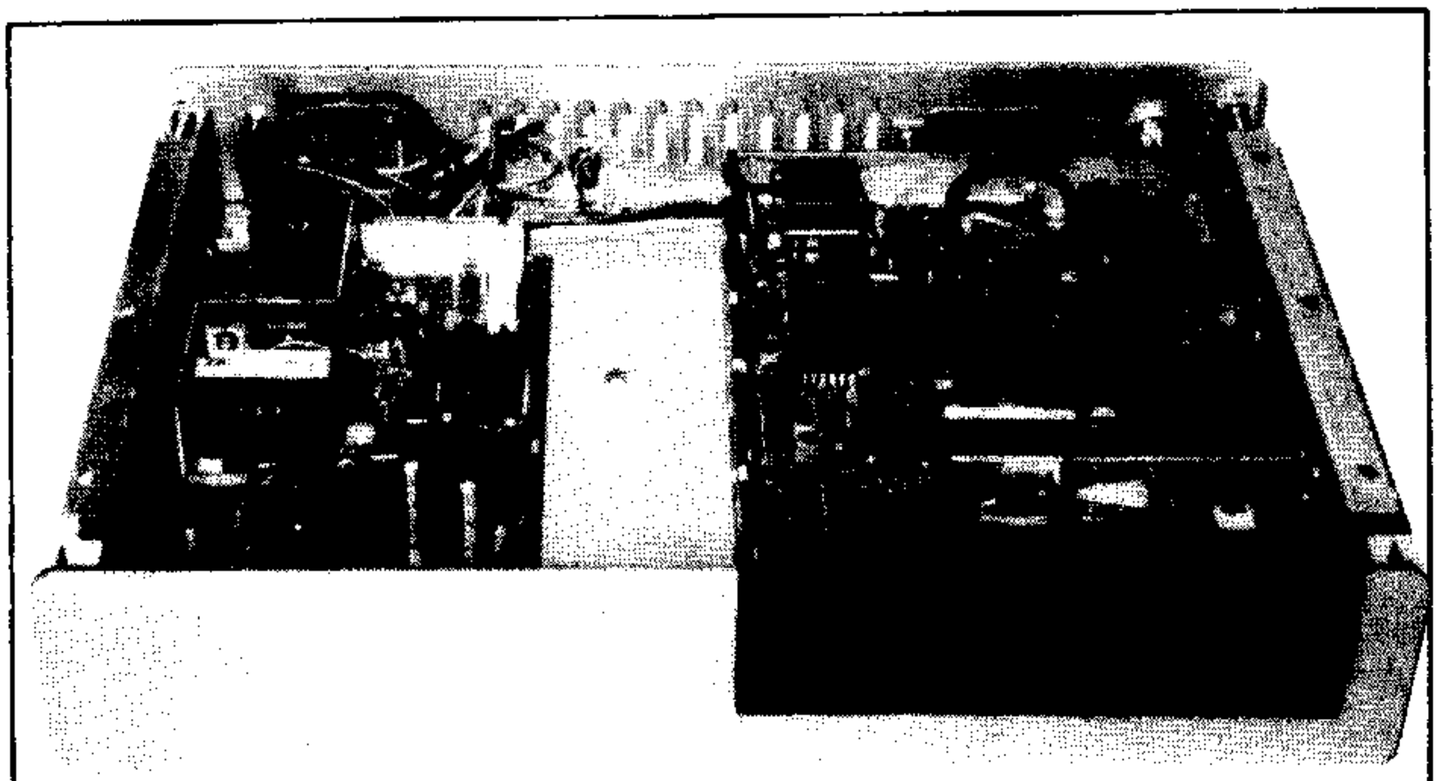
Running Programs

JU=	jump to program
CP=	continue program after software interrupt
RP=	run program

Flex

BF=	boot Flex from disk
BO=	boot Flex from wherever it was last booted
JT=	jump to Flex warm start

Table 7 A list of monitor commands, arranged according to the area they serve.



An internal view of the computer showing the power supply and disc drive installed below the chassis.

Reconnect the board. If you have drives, now is the time to hook them up. They should be set for head load with motor on and the drive selected.

A further suite of routines in the monitor which can be used for testing the disk drives is listed in Table 7.

If you have got this far and have Flex, you are ready to boot it. If you don't have Flex, you can still use some of the powerful monitor commands. A list of commands is given in Table 7, each with a short description.

If there are problems with the board here are some things you might check:

are the configuration switches set correctly?

are your serial devices connected correctly?

are any of the chips getting overly hot?

do any of the address or data lines look shorted?

is the 16MHz clock being generated?

are E and Q getting to the processor?

are the DRAMS getting the correct signals?

is the MONO9 EPROM getting the correct signals?

are there any spurious interrupts?

is there a video signal?

Pin No	Inner row	Outer row
1, 2	D6	Gnd
3, 4	D7	Gnd
5, 6	D4	Gnd
7, 8	D5	Gnd
9, 10	D2	Gnd
11, 12	D3	Gnd
13, 14	D0	Gnd
15, 16	D1	Gnd
17, 18	$\overline{\text{BUSY}}$	Gnd
19, 20	$\overline{\text{STROBE}}$	Gnd

Table 8 Pin connections on the printer port, SK1.

Pin No	Inner row	Outer row
1, 2	+5v	+5v
3, 4	Gnd	Gnd
5, 6	$\overline{\text{BA0}}$	IC19 pin 6
7, 8	$\overline{\text{BRTS}}$	BA1
9, 10	BD1	BD0
11, 12	BD3	BD2
13, 14	BD5	BD4
15, 16	BD7	BD6
17, 18	BA2	BR/W
19, 20	BA4	BA3
21, 22	16MHz	BE
23, 24	WDS	Q
25, 26	$\overline{\text{RTC}}$	$\overline{\text{LPEN}}$
27, 28	$\overline{\text{I/02}}$	$\overline{\text{RDS}}$
29, 30	$\overline{\text{I/01}}$	I/OBUFF
31, 32	$\overline{\text{NMI}}$	$\overline{\text{RST}}$
33, 34	$\overline{\text{FIRQ}}$	$\overline{\text{IRQ}}$
35, 36	TTLVID	VSYNC
37, 38	Gnd	Gnd
39, 40	-12v	+12v

Table 9 Pin connections on the expansion bus socket, SK10.

● Next month's concluding article will discuss applications and the use of the machine and will include a list of some of the Flex software available. A basic kit for this project is available from Micro Concepts, 2 St. Stephens Road, Cheltenham, Gloucestershire GL51 5AA, tel 0242-510525. **ETI**