Easy-to-use DAI micro majors in colour and sound generation

by David Watt

DATA Applications International was established seven years ago and has its headquarters in Brussels. It has subsidiaries in the U.K. at Cirencester, and Munich in West Germany, with representatives in most other European countries.

DAI specialises in microcomputers and devices for the industrial, scientific and educational markets, and its systems cover applications in production control, process control, communications, automatic testing and data logging. More than 25 modules have been designed to use the standard Eurocard of 100mm. by 160mm., including a series of real-world interface cards such as analogue-to-digital cards, IEEE bus interface card and communications modules. The cards all use a standard bus called the DCEbus — digital control element.

It has recently announced a new computer for the personal market — the DAI personal computer. Housing an integral keyboard, it is a single module and features high-resolution colour graphics, stereographical sound generation, a range of interfaces including two games paddle sockets, dual cassette input, an RS232C interface and a DCEbus interface.

The machine is based on the Intel 8080A microprocessor and may be supplied with 12K, 32K or 48Kbytes of RAM. In addition to that, the machine has 24Kbytes of bank-switched ROM containing the resident software, the Basic interpreter, utility monitor and general-housekeeping modules.

Floating-point option

The 8080 is a slow device by latest microprocessor standards but DAI has compensated for that by providing an optional floating-point processor, and a semi-compiling Basic. I could find no fault with the speed of the machine; a simple loop counting one to 100,000 took 30 seconds to execute, and 10,000 SIN functions, slightly more than 50 seconds.

The prototype computer was designed two years ago in a co-operative project with Texas Instruments as an attempt to produce a European microcomputer. When the prototype was completed, Texas Instruments decided against further involvement and DAI produced a production model alone. It has been available in Europe for some months and has apparently aroused a great deal of interest.

Three cables for power, television and for cassette recorder connection and two manuals are supplied with the system. The first manual is a 70-page introductory manual which I thought excellent although some people might consider it too condescending. It is written in a simple and chatty style and explains in a step-by-step manner how to connect the computer, switch-on, and how to write a simple program in Basic demonstrating some of the features of the system.

The other manual was a general-use guide called the personal computer handbook. I found its style and content good and comprehensive; it covers every feature of the system, but there were many typographical mistakes and omissions. Apparently, it was a preliminary copy, and DAI is producing corrected manuals.

As one of the main features of the computer is its colour graphics, it is obviously better to use it with a colour television although it will work equally well with a black-and-white set, giving shades of grey. A modern television with frequency lock is better.

I tested the system with an old reconditioned television and so found it very difficult to tune it properly. I succeeded several times and the colours were excellent.

There was a slight hum from the television when tuned to the closest frequency — also present when I tried the system with another set. I soon learned to ignore it and I believe DAI is working to remove this fault.

The computer is housed in an attractive, cream-coloured plastic case, light and yet robust. Behind the keyboard, which has a black metal surround, is a useful well — excellent for holding cassette tapes, pens or pencils. The back-plane is also black metal, matching the keyboard. The top casing may be removed by popping four plastic plugs.

Inside, everything appears neatly laid-out. The RAM and ROM chips are socketed as is the optional floating-point mathematics chip, the AMD 9511. On the left is a small Eurocard containing the components for the colour-graphics generator and PAL UHF television modulator. On the right is a robust-looking power supply enclosed in metal shielding.

It is not a machine for do-it-yourself maintenance; DAI with its background in industrial engineering applications has a reputation for reliability, and all its equipment is fully factory-tested before being supplied to the customer.

The backplane holds all the I/O ports plus the power switch and power socket. The power switch is a red plastic switch which lights when the power is on. A small green bulb on the right of the keyboard also lights and is a thoughtful touch since it is not always possible to see the power switch.

Below the power switch is the male 34-pin DCEbus connector. Besides the real-world cards, DAI is to provide a floppy-disc system and a printer which also will be interfaced through the bus. DAI has a floppy-disc system, but it is rather expensive since it was designed for the industrial market. A less expensive model is being designed for the personal computer. To the right of the DCEbus is the power socket which may be switched to either 220 or 110V AC.

On the right of that is an RS232C serial interface connector for a printer or terminal, followed by live DIN sockets. They are used for connecting two cassette recorders, two games paddles and a stereo output. The television aerial socket is on the right of the backplane.

An impressive feature of the computer is the colour-graphics module. There are 16 colours available including black and white and six basic modes of operation allow combinations of low- middle- and high-resolution, and a four- or 16-colour operation.

High resolution

Obviously, the high-resolution, 16-colour mode offers the ability to produce the most complex displays, but it is also the slowest mode and occupies the most space in memory. DAI has adopted an ingenious method to reduce the memory requirement for screen displays to half that required normally.

As in most colour graphic systems, the screen is divided up into small areas called pixels which may each have a particular colour. If 16 colours are available, four bits are required to define the colour of a pixel, and a byte of memory is required to store two pixels.

The DAI personal computer has two modes of colour operation; four-colour mode and 16-colour mode. In four-colour mode, a set of four colour registers may be set to any of the 16 colours, so the colour of a pixel may be only one of the four colours in the register. A pixel will be represented by two bits of data. In 16-colour mode, the colour registers are not used. Instead, two bytes are used to hold the colour information for a group of eight pixels. Any two of the 16 colours may be used for any group of eight pixels.

The low byte is used to store the colours for the group, called the foreground and background colours, while each bit of the high byte is set to zero or one to indicate the foreground or background colour for a particular pixel.

The system is made more flexible by allowing the background colour of one group to be continued in the next group until a new foreground colour is selected. It is possible to have three colours in one group of eight pixels.

As mentioned, the system has three degrees of resolution after giving vertical and horizontal definitions of 65 by 72, 130 by 160, and 256 by 336 pixels. Another mode is used primarily for displaying text, but it may be used for very high-resolution graphics although that feature is not supported by the resident Basic.

In addition to the graphics modes, the computer may be put into all-character mode which displays 24 lines of text, 60 characters per line, or the graphics modes may be modified to display four lines of text at the bottom of the screen. If, when a program is running in an all-graphics mode and an error occurs, break is pressed or the end program statement is executed, the display is moved up four lines to display the appropriate message at the bottom of the screen.

The computer uses the standard ASCII character set and the quality of the character display is excellent. One character, the ASCII form-feed character, value 12, is used to clear the screen and move the cursor to the top left-hand corner of the screen. If you type more than 60 characters on a line, the system continues automatically on the next line displaying a 'C' at the start to indicate a continuation. Input can be continued for slightly more than four lines in that way before an error is produced.

The keyboard has 57 keys in the standard QWERTY pattern. On the left are four cursor-control keys, for moving the cursor left, right, up and down and the CNTL key. On the right are the TAB, BREAK, RETURN, CHAR DEL and REPEAT keys.

Cursor control

The cursor control and the TAB keys are not recognised by the normal INPUT command, however there is a function in Basic called GETC which will obtain a single character from the keyboard and that function may be used to program the special keys. In normal text input, the CHAR DEL key moves the cursor back one character and prints a space. Unfortunately, it is possible to delete the prompt as well as any input you have typed with that key.

When typing in programs, that can have undesirable effects as Basic expects the first character on a line to be the prompt symbol. If you enter a line having erased the prompt symbol and type the line number starting in the first character position, the first character will be ignored which may cause a previous line to be overwritten. The problem is mentioned in the manual and it can be avoided by typing a space in the first position — but it can be annoying.

The CNTL key does not act in the same way as most systems, causing characters typed while the CNTK key is held down to generate a different ASCII character code. Instead, the CNTL acts as a toggle to change the mode of the alpha characters on the keyboard.

When the computer is switched-on, the alpha keys will generate upper-case letters unless shift is pressed which generates lower-case letters. If CNTL is pressed, the action of the keys is reversed which makes the keyboard more like a standard typewriter. I found it rather too easy to hit that key by mistake — awkward since Basic does not recognise lower-case letters in command and so it will generally cause a syntax error.

The re-set key is a tiny inset microswitch on the left of the keyboard which has to be pushed with the point of a pencil or some other sharp instrument — it is impossible to re-set accidentally. The keyboard is scanned by software. Debouncing and three-key roll-over are handled by the general housekeeping routines. Three-key roll-over means that the system will recognise up to three keys pressed simultaneously or in rapid succession, so key strokes are not lost even with very fast touch typists. A character may be repeated at a fixed rate by typing and

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also pressing-down the repeat key.

Although the keyboard is well laid-out, I found the keys were rather too close and had a slack feel to them. I wonder how well they will stand heavy use.

The computer has some extremely versatile sound-generation abilities. There are three programmable frequency generators and a white noise generator with programmable volume. That may be used to play sounds through the television or the stereo interface to your music system. Some very interesting effects may be obtained with them, particularly when using stereo.

Resident software

The resident software provided with the system comprises Basic interpreter, machine-language utility, and a set of general housekeeping modules. The modules may be used by machine-code routines or the PEEK and POKE commands of the Basic. The Basic interpreter produces semi-compiled code which makes it faster and more economical in execution.

It is an extremely versatile version of Basic designed to resemble Microsoft Basic as much as possible, with additional commands to cover the colour and sound facilities of the system.

Variable names may be of any length although only the first 14 characters are significant. Integers may be in the range 2^{32} to -2^{32} which gives numbers up to 1,000,000,000. Floating-point numbers may be in the range 10^{+18} to 10^{-18}, printed to six digits of accuracy.

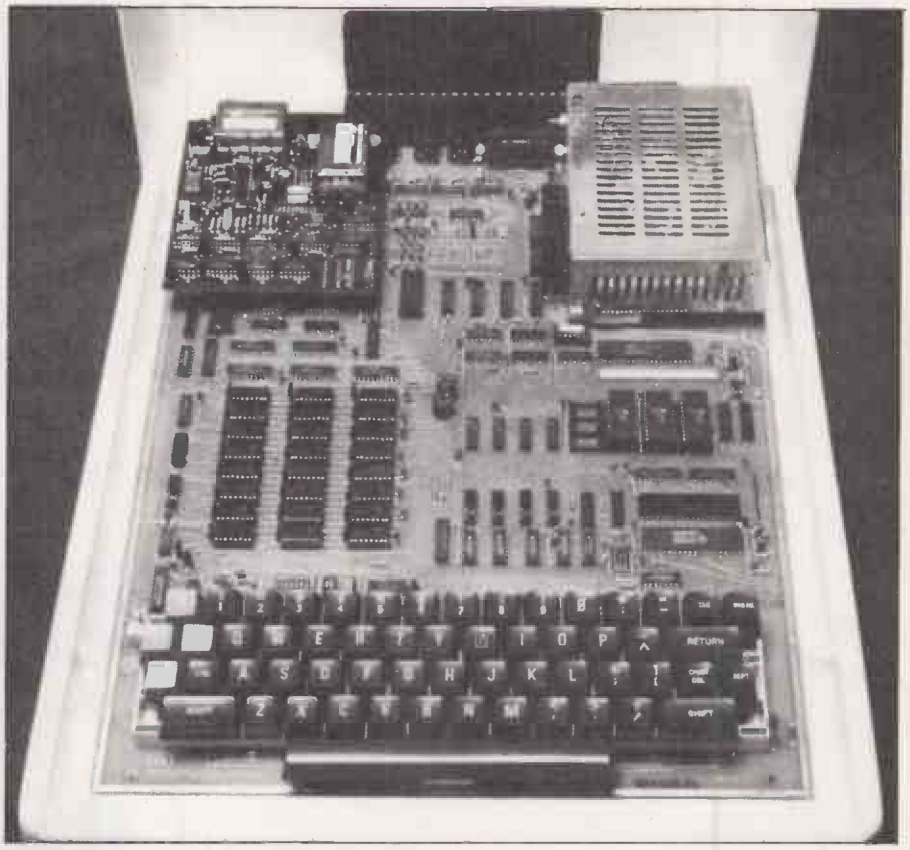
Strings may be up to 255 bytes long, arrays dimensioned to any number of levels, and dimensions having up to 256 elements. Before you use strings or arrays you must reserve sufficient space using the CLEAR statement. Finally, line numbers may be in the range one to 65536.

In keeping with the powerful colour-graphics facility, nine special commands and functions have been included in the Basic to the screen, these are:

MODE
COLORT
DOT
FILL
DRAW
SCRN
XMAX
YMAX

Mode is used to set the graphics resolution for four or 16 colours, graphics-only or mixed text and graphics. The text-only mode may also be selected. COLORT sets the four-colour register when in the four-colour mode.

DOT, DRAW and FILL are used to display dots, lines or rectangles of colour on the screen. The function SCRN returns the value of the colour displayed at a particular point on the screen. XMAX and YMAX give the maximum value for X and Y co-ordinates according to the current resolution. Thus in Modes 1 and 2, which are low-resolution, XMAX is 71



and YMAX is 64, while XMAX is 335 and YMAX is 255 in high resolution.

Those commands proved very easy to use particularly as the relationship of XMAX to YMAX is close to the three-to-four relationship in television screen sizes so that circles appear round when drawn on the screen. That contrasts with some systems where a special mapping algorithm must be used to produce correctly-proportioned shapes.

Three commands are available for programming the frequency and noise generators, ENVELOPE, SOUND and NOISE. ENVELOPE forms a series of pairs of volumes and time periods which may be used to modify the amplitude of sound being generated. The envelope may end in a constant volume or be made to repeat its sequence, until another is requested or the sound turned-off.

SOUND is the command which causes a note to be generated. A channel, envelope, volume, frequency, and whether tremolo or glissando effects are required, must be specified and a function, FREQ, is used to set the frequency.

NOISE is used to generate white noise using a specified envelope and volume. There is also a command, TALK, which may be used to generate some very interesting sound effects. DAI says it called that command, TALK, for want of a better name.

Programs and data may be saved or loaded from a cassette or floppy disc. The commands to do that in Basic are LOAD, LOADA, SAVE and SAVEA. Files may be of three types, 0 indicating a Basic program, 1 a data file array, and 2 a machine-code file.

Data may be stored only in the form of an array. INPUT and PRINT to a tape are not supported by the Basic. LOAD and SAVE are used for storing and loading Basic programs, file-type zero. A file name may be specified as part of the command.

If a file name is specified in a LOAD command, the computer searches for the required file, listing other Basic programs as it passes, and the file name is found. Otherwise, LOAD loads the first program it encounters.

LOADA and SAVEA are similar except that they operate on data array files only; LOADA does not display the names of files it passes over. CHECK may be used to display the names and file-types of files on a cassette, and also performs check-sum validation of the file names.

File-load errors

Four types of file-load errors can be detected by the system of which error two, like check-sum error, and error three, data drop-off are the most likely to occur. They are caused generally by turning the volume on the recorder too high or too low. The CHECK command is the only way of discovering what is on a tape because the LOAD command displays only Basic file names, while LOADA and the utility monitor-read command do not display any names at all.

I would have preferred to see all those commands display the name of the file loaded as a visual check, especially if no particular file is requested, since the system will then load the first file of the correct type automatically.

The system will stop automatically and

start the tape recorder if it has a remote-control socket when loading saving or checking files.

The Basic has a useful edit command which allows text to be moved to an edit buffer for display and amendment. Any number of lines from a single line to a whole program may be edited at one time. The edit buffer displays the lines as typed-in except the carriage return character is indicated by a special symbol " ↵ ".

The cursor control keys on the left of the keyboard may then be used to move the cursor round the lines on the screen. The screen acts as a window to the edit buffer. If you wish to edit some text now shown on the screen, moving the cursor in the required direction causes the text to be scrolled over.

The CHAR DEL key deletes the current character and moves-up all text on the line to the right. Typing a normal key inserts the character in the text before the current character. The edit command is very easy to use although it does not have facilities such as searching for a character string or changing characters. To change a character, you must insert the new character and delete the old.

David Collier at DAI explains that it is possible to write a much more powerful editor around the edit routine because all the routines are accessible using machine-code calls. One possible application of this is for a word-processing system.

The Basic has good program debugging facilities permitting a trace of program lines to be displayed on the screen while a program is running. Programs may also be stepped through, a line at a time, by using the STEP command and pressing the space bar for each step.

Hexadecimal numbers may be included in a program by prefixing the number with the '#' symbol. Numbers may be printed in Hexadecimal format by using the HEX$ function. PEEK, POKE, INP, OUT, WAIT, INPUT and PRINT are all available and are similar to the same instructions in Microsoft Basic. '?' may be typed instead of PRINT.

When you type data in response to an INPUT command, pressing RETURN does not move the cursor to the next line as on some systems. Instead, the cursor is left following the last character typed, giving more control over screen formats. It means you must execute a PRINT or CURSOR command to go to a new line.

The utility monitor may be entered from Basic by typing UT. The monitor has all the standard facilities to examine and store data or machine code in memory. Blocks of memory may be read or written to tape in the same manner as the LOAD and SAVE commands.

Conclusions

• A very enjoyable machine to use and considerable thought seems to have gone into every aspect of its design; it is difficult to find anything to criticise.

• The error-handling facilities of the system seem very good and is very difficult to do anything wrong in Basic without obtaining a suitable error message; it is possible to crash the system if you are using machine code.

• The system is designed for the personal and educational market and not for small business — it could probably be used as such with a suitable degree of effort.

• The editing facilities in Basic would form a sound basis for producing a word-processing system for this machine.

• The prices are £595 plus VAT for a 12K system, £725 for 32K and £795 for 48K which make it competitive with the Apple, TI-99/4 and many other colour-graphic systems: the optional hardware mathematics module is £149 and is a sound investment if you intend doing a good deal of mathematical calculation.

• The colour-graphics and sound-generating facilities are very good and the system is designed to interface with many types of peripheral.

• One area in which the system could be used very easily is home security, or as a control system for central heating and the home environment.

• The single area in which the Basic seemed slow was in building pictures using high resolution.

• To some extent, that is understandable considering the number of pixels in a high-resolution display and obviously it runs faster in machine code.

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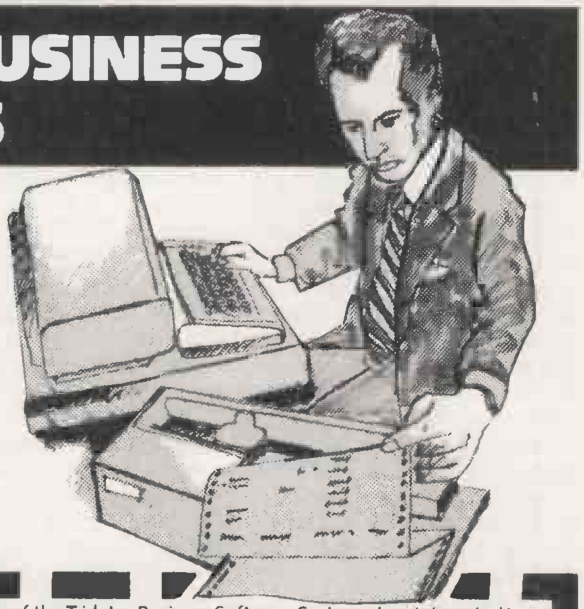

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