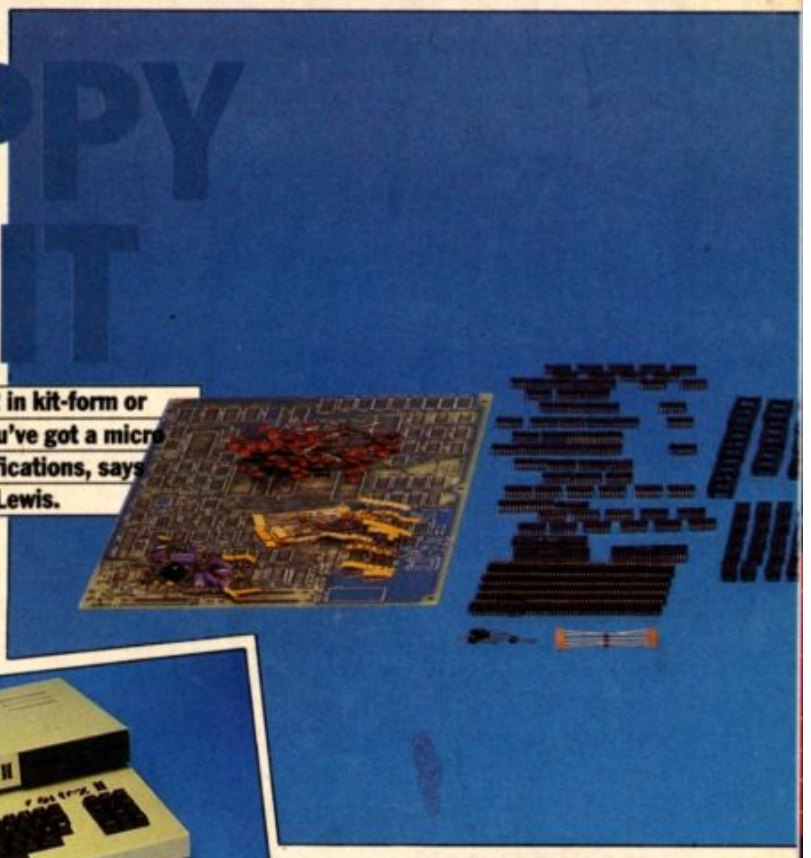
ZIPPY KIT

Buy the Cortex 2 in kit-form or ready-built and you've got a micro with great specifications, says Brendin Lewis.



Most, if not all electronics enthusiasts will have heard of Powertran Cybernetics (previously Powertran Electronics). Over the past few years they have produced many high-quality kits.

In 1982 Powertran released the Cortex, a low cost 16-bit micro with a real sting in the tail. On specifications alone, the system is up there with the best. Based on the Texas 9995 microprocessor, running at an astonishing 12MHz, the Cortex out-benchmarks almost all the popular microcomputers. Other features include 64K of RAM, high-resolution colour graphics with sprites, a floppy disk interface, serial and parallel ports, and an expansion bus known as the Ebus.

A few months back the Cortex was withdrawn for a refit, now the system is sold with a new smarter, slimline look and has been christened the Cortex 2.

For those of you adept with a soldering iron, good eyesight and a great deal of patience, the system comes as a kit. For those more prone to melt the table top rather than the solder, a ready-built and tested version is also available.

First impressions

The changes made to Cortex 1 to produce Cortex 2 are apparent as soon as you set eyes on the machine. The new model has a slimline look solely due to the removal of the full height floppy disk drives. The new model has half height drives in a separate cabinet which sits on top of the main unit. These drives are connected to the computer via two leads. The first is the low voltage power lead which plugs in at the back, the second is the 34-way ribbon cable which plugs in the side.

The cabinet is made of sheet metal, sprayed in light grey. The metal adds to the weight but still leaves it lighter than some so-called portables. The one thing to be said for metal cases is the added strength it provides.

Hardware

Towards the front of the machine are situated the keyboard, a number of LED indicators and two push button switches. The LEDs are marked; RUN, IDLE, MAP, and TIME and are dealt with in the 'In use' section as are the two switches marked RESET and RESTART.

The keyboard itself is of a simple construction with the minimum of frills. The main section contains all the standard alphanumeric keys, 55 in total. There is also a nine-key keypad containing cursor keys and various editing keys which are used by the Basic line editor.

Various connectors are apparent around the outside of the case but, unfortunately, there are no markings on the case itself to describe their function.

Working from the circuit diagrams and the PCB overlay diagrams, the following should be correct descriptions. On the right-hand side front are located the two connectors which make up the serial system. A 5-pin DIN socket is used to communicate with the cassette recorder (Powertran recommend a WH Smith model).

A 25-way 'D' type connector is used to interface the unit with any standard RS232 serial device. A 34-pin IDC conncetor is used to connect the new disk unit. This connector should really be on the rear of the system with the power supply connector and not in its current position on the right-hand side. Powertran supplies two types of disk unit for the Cortex with 125K or 1Mb unformatted capacities offered on single sided single density or double sided double density drives respectively.

At the rear of the unit are located the video outputs for both the UHF (a TV set) and RGB (optional extra) displays, in addition to the disk power supply connector.

The only other connector is the 'D' type for the Ebus and is situated this time on the left of the machine. This allows the machine to communicate with standard Eurobus expansion boards. On previous versions of the Cortex, the Ebus was not available due to design problems but I am assured that this one works properly.

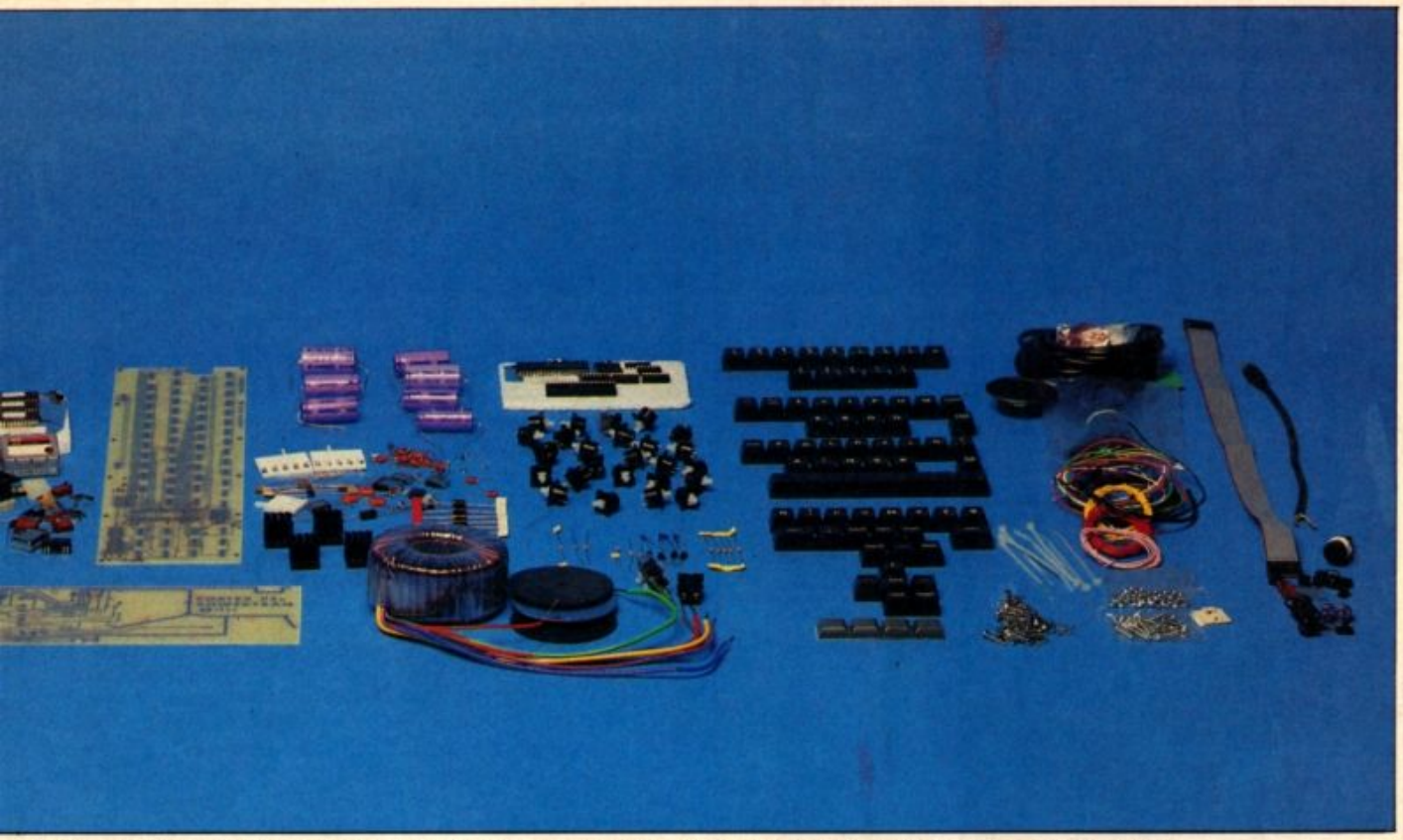
Documentation

These manuals are certainly not of the highest standard but they are readable and that's what counts. Three manuals make up the system documentation: a user manual, the disk operating system manual, and a construction manual if you're buying in kit-form. The user manual is written on the assumption that you actually built the system. No mention is made of the connectors or indicators which is a shame because some people will buy the ready-built version and will not be familiar with the system. What it does have is an in-depth description of Cortex Basic.

The construction manual is a photocopy of the original article which appeared in *Electronics Today International* as appears to be the norm with Powertran kits. This is quite adequate as it not only deals with descriptions and construction but also has an item on 'how it works' for each section of the project.

Construction

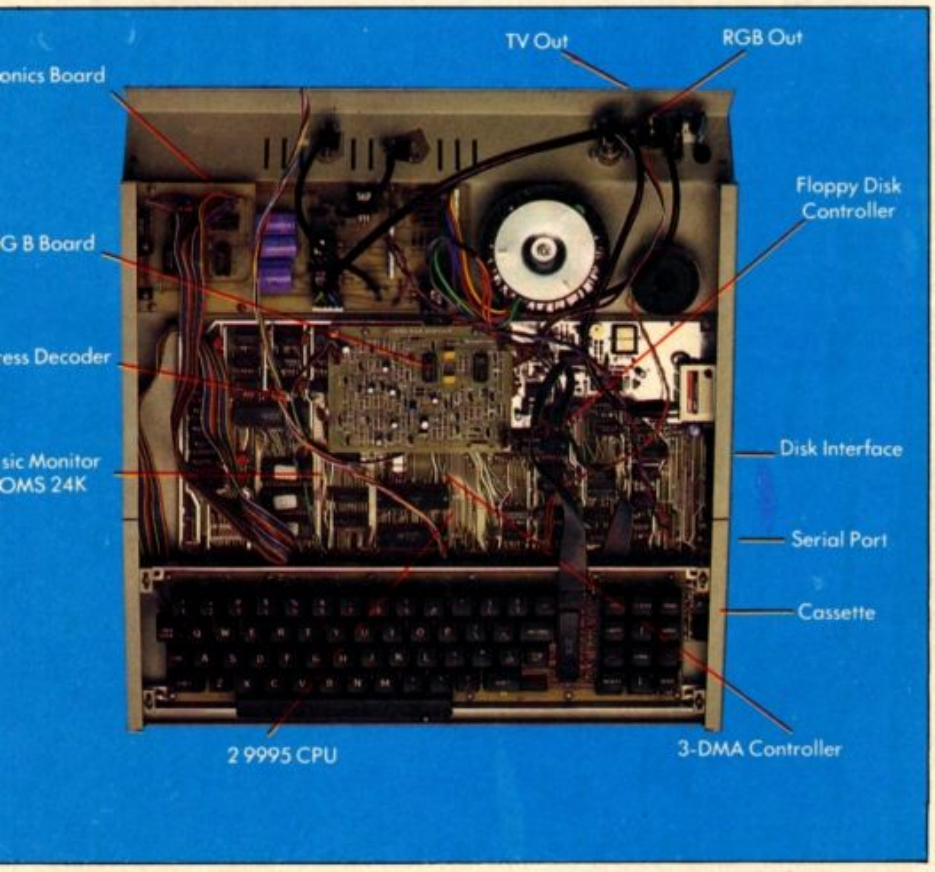
There is no reason why a system built from a kit should look any different from a professionally built machine. All components supplied to make up the



If you buy the Cortex 2 in kit-form, you will have to turn the resistors, capacitors and chips (above), into the machine on the left (inset).

Cortex are of a high standard and if constructed properly give the desired high-quality appearance.

But taking on the task of actually building a kit that's as complex as the Cortex involves certain skills not normally associated with the average computer end user. The most important of these is the ability to use a soldering iron; though identifying and handling of components is also important. Another factor, almost as important as the soldering skills, is patience. Don't expect to sit down and build the system in one session; it is possible but not recommended. A simple rule of thumb to follow is that the more time you spend on building the system, the more likely you are to have a finished product that works.



One of the first things you notice when looking at the Cortex PCB is that all the integrated circuits are socketed. There are two schools of thought on this subject (ignoring the obvious increase in cost) for it can be argued that sockets don't provide a good electrical contact for long periods. This is true, but in this case, matters such as ease of construction, repair and modification of the board far outweigh the disadvantage of having to re-seat a chip occasionally.

While building a project from a kit, it's surprising how much one learns about that project. This knowledge then builds confidence to take on the task of taking on a hardware modification. A socket system gives such an option and is a facility rarely available to the average user.

The construction of the review system was excellent except for one small detail. Whoever built this system broke one basic rule of assembly, *ie* to make sure all cables which connect between the main unit and the lid of the system are long enough for the lid to be removed and placed to one side. Of course the system must still be able to operate with the lid removed. In this case, only the LEDs, reset buttons and two power supply regulators are mounted on the lid and it was the cables running to the LEDs that was cut too short.

Processors

The system itself is based on the Texas

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Instruments TMS9995, probably an unfamiliar microprocessor to most users. It was in fact one of the first true 16-bit microprocessors. It has one main drawback which is a limited memory addressing range. It can only address 32Kwords (16-bit) which is the equivalent of 64K bytes. These days, this seems a very small amount when compared with the 8086 (IMb) and the 68000 (16Mb) though it is still the same as the Z80 and the 6502.

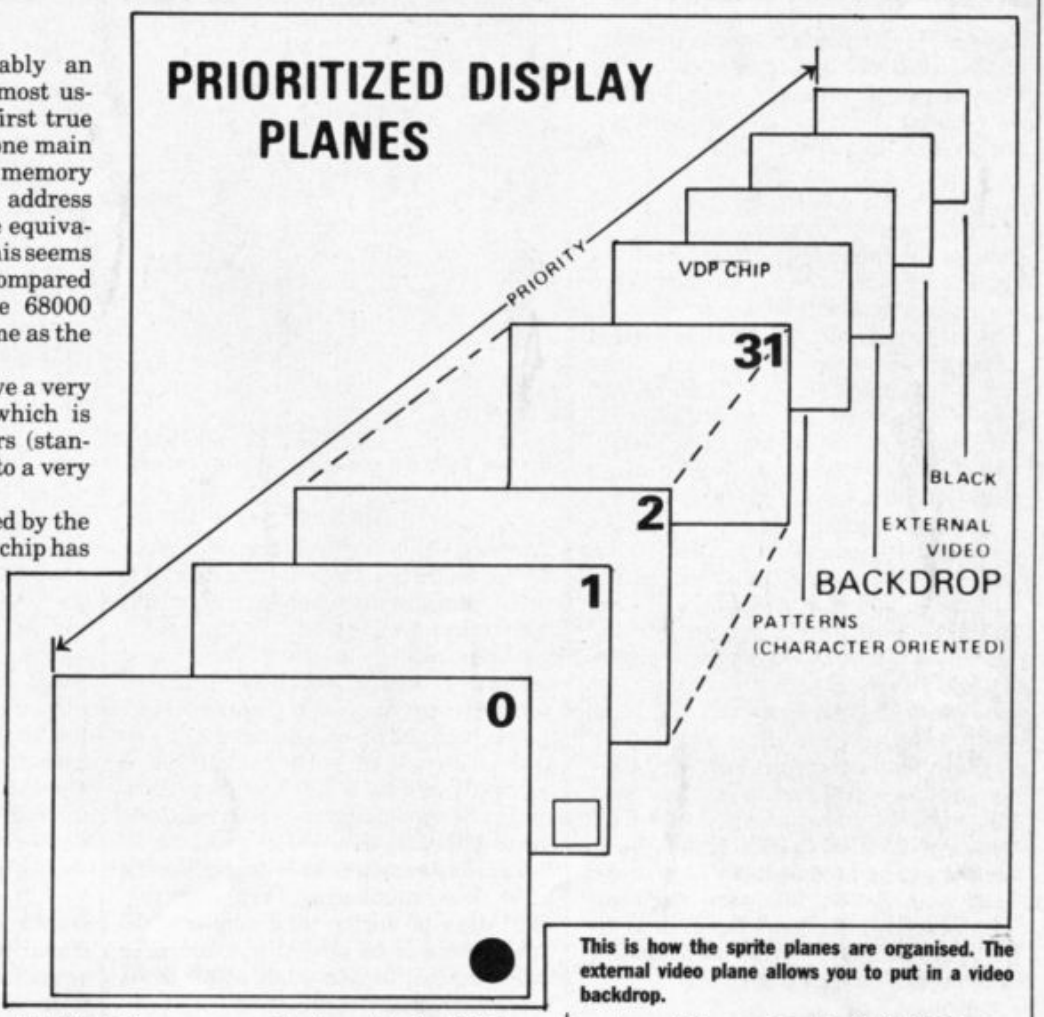
It does on the other hand, have a very high clock speed of 12MHz which is faster than all these processors (standard models only) which leads to a very fast machine.

Video on the Cortex is handled by the TMS9928 video processor. This chip has its own 16K of memory leading to a graphics resolution of 256×192 with 16 colours on the screen at one time.

Also implemented on the 9928 is a sprite capability with up to 256 being allowed. These sprites can be defined as an 8×8 or 16×16 (64 sprites only) pixel grid. An option to magnify these is also available. The command MAGØ maps each sprite pixel to one pixel on the screen, while the command MAG1 maps each sprite pixel on to a 2×2 grid on the screen thus allowing a single sprite to fill a 32×32 grid on the screen. As is usual with sprites, software is available to check for collision between sprites while hardware within the video processor takes care of which sprite is 'in front' of any other when displayed.

One very interesting feature of the graphics processor is that one colour is defined, not as a colour, but as transparent. This allows the background colour to be seen 'through' the sprite.

The idea of one image being in front of another is possible because of the way in which the 9928 implements its graphics.



This is how the sprite planes are organised. The external video plane allows you to put in a video backdrop.

The screen can be thought of as 36 planes on top of each other—rather like placing 36 photographic slides on top of each other and looking through them. Thus a sprite placed on plane 8 would cover an image of a sprite on plane 9.

One of the 36 planes is set aside for an external video expansion board. This board mixes a video signal from, for example, a video recorder with that of the computer. Thus it is possible, albeit difficult, to do things such as make a car in a video game hit a real wall.

Because the graphics memory is separate from the user memory the system still provides the full 64K bytes for use. Well, nearly all, as a small area of memory is set aside for memory mapped I/O allocation.

Firmware

Basic comes as standard on the system and is stored in ROM along with the system monitor. All firmware is held in 3×8K EPROMs which, again, are not part of the main memory map. Instead, these EPROMs are known as phantom memory.

When the system is first powered up, the dynamic RAMs are checked for

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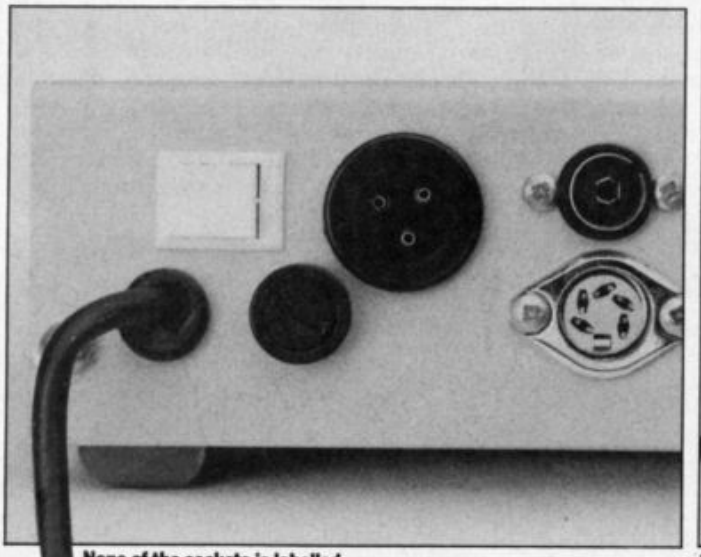
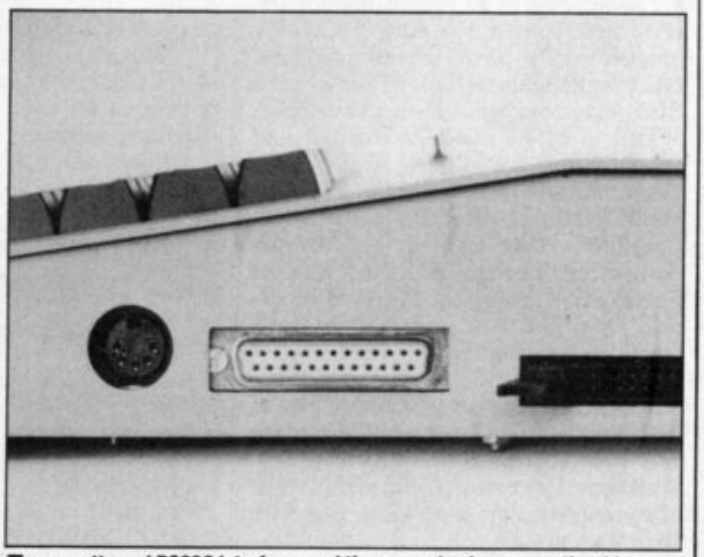


None of the sockets is labelled.



The cassette and RS232 interfaces and the expansion bus are on the side.

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correct operation and then the contents of the EPROMs are copied into RAM. This allows far greater system flexibility because Basic can be overwritten if the system is running 9995 machine code only.

Though Basic is the language fitted with all new systems, it is possible to change the language simply by replacing the EPROMs. Two other languages are presently available for the Cortex. The first is fig-Forth (available from Lombard Systems of Bedford). The language comes on two 8K EPROMs, which replace the first two Basic ROMs. To enhance the Forth package, a utilities disk is also available containing an editor and various I/O utilities.

For those who don't wish to replace the Basic ROMs permanently, Forth is also available on an auto run disk with all the utilities included. With this version, the Basic 'boot' command is used to load Forth on top of the Basic interpreter. UCSD Pascal P-code system is also available. This includes the operating system, full screen editor, assembler, compiler and debugger. Further extensions allow multi-tasking and support for extended addressing via the Ebus which will allow a full megabyte of memory to be accessed. All very nice, I hear you P-code followers thinking. True, except that it weighs in at £535. With the standard Cortex kit at £300, it does seem a bit excessive.

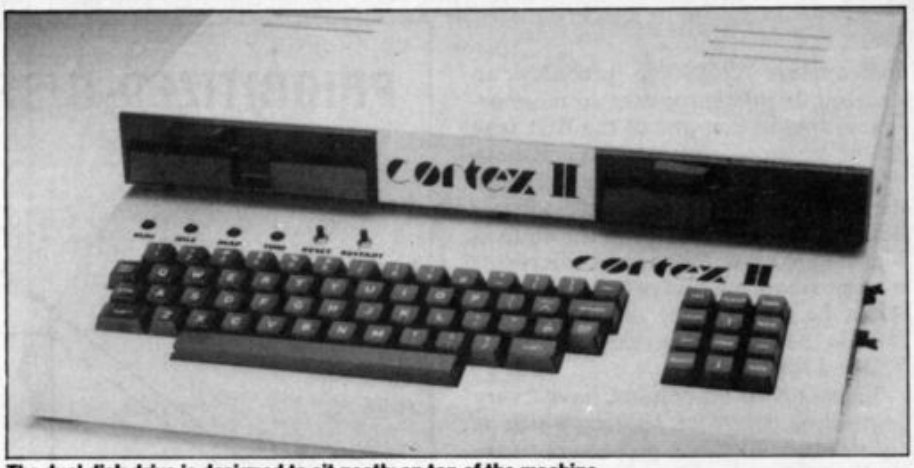
Software

A number of companies are now offering software which will run on the Cortex, and Powertran itself has commissioned an independent software house to write a new disk operating system.

Microprocessor Engineering (0703-775482) offers a number of software packages which run on the Cortex. MDEX is a disk operating system with a disk-based version of Basic which is similar to Microsoft Basic. EDIT is an editor based upon a number of mainframe-based editors including SOS. RESCUE is a set of three programs for processor, memory and disk diagnostics. It also includes a disk editor/ recovery program. SPL is a systems programming language similar to 'C' for which a ROM-based nucleus is being developed.

This is by no means a full list and needless to say, a number of games are also available. No doubt, more will be made available after the competition that Powertran ran in its August newsletter. Though this was the first Cortex user group newsletter it seems that they will run about every three months, as the next was due in December.

Topics include all the latest updates in both hardware and software, plus hints and tips from present Cortex owners. Well done, Powertran—I'm all in favour of companies that keep close ties with their user groups.



The dual disk drive is designed to sit neatly on top of the machine.

In use

There should be few problems with using Cortex Basic For the first time user. But those familiar with standard Microsoft Basic may take a little time to get used to it. Contained within the Basic is a line orientated editor which is initiated whenever a syntax error is encountered. Being brought up on a version of Basic totally devoid of editing facilities, I normally retype the whole line automatically so using this type of editor is quite a luxury.

The Basic itself is excellent allowing auto line numbering, renumbering, definition of sprites and allowing 16 parameters to be passed to a machine code routine, to name but a few of its many facilities.

On the system disk supplied by Powertran were three simple demo programs, all using sprites. The sprite moving sections of the demos were smooth and fast considering that they were in Basic, obviously another pointer to the overall speed of the system.

When coming out of a program I noticed that the text on the screen was different to that displayed when I loaded it. This is because the Cortex works in two distinct modes, text and graphics. When in text the normal 24 × 40 display is used, but when in graphics mode the characters are actually plotted onto the screen, thus allowing only 24 × 32 characters on the screen. Typing the command 'text' is all that's required to swap back to text mode.

Though the system itself is fast, the disk drives themselves are quite slow. Together with this, the disk operating system is cumbersome and long-winded to use. I won't delve any deeper into the workings of this particular DOS as it is in the process of being replaced.

As mentioned previously, there are a number of LED indicators on the top of the case. The first two show how much of the time the system is actually running code and how long it is sitting idle. The MAP LED shows when memory mapped I/O is taking place. The final one, marked TIME, flashes continually and I could find no details about it. None were given in the construction manual so I assume this was not available on the Cortex 1.

Verdict

Building from a kit, in this case, offers a cheap way to obtain a powerful and versatile micro, but it must be said that it is not just putting pieces together jig-saw fashion.

Buying the Cortex 2, in whatever form, must be looked on as something of a challenge. The reason for this is that a lot of software development has to be done by the user because it cannot be bought off the shelf. Incompatibity is the main cause. Though there are a small number of other 9900 series machines on the market, each is a small fish in a large ocean compared with the likes of Commodore, Acorn and Sinclair. So don't expect a new game or package to appear every week, because it won't. Software is being written, but not in vast quantities.

Though the Cortex is primarily a home computer, there is no reason why it should not become a small business micro if relevant software were to become available.

The disk capacity is large enough, the speed is more than ample, and printer ports and high-resolution graphics are also included.

Specifications

Price	Basic kit £299, built £399, £1,195 with all the options
Processor	TMS9995 12MHz
ROM	24K for Basic and Monitor
RAM	64K plus 16K for graphics
Screen	24 × 40 text, 256 × 192 graphics
Keyboard	64 keys including nine key keypad
Interfaces	RGB, Centronics, Ebus, Floppy disks external video input
Distributor	Powertran Cybernetics 0264-64455