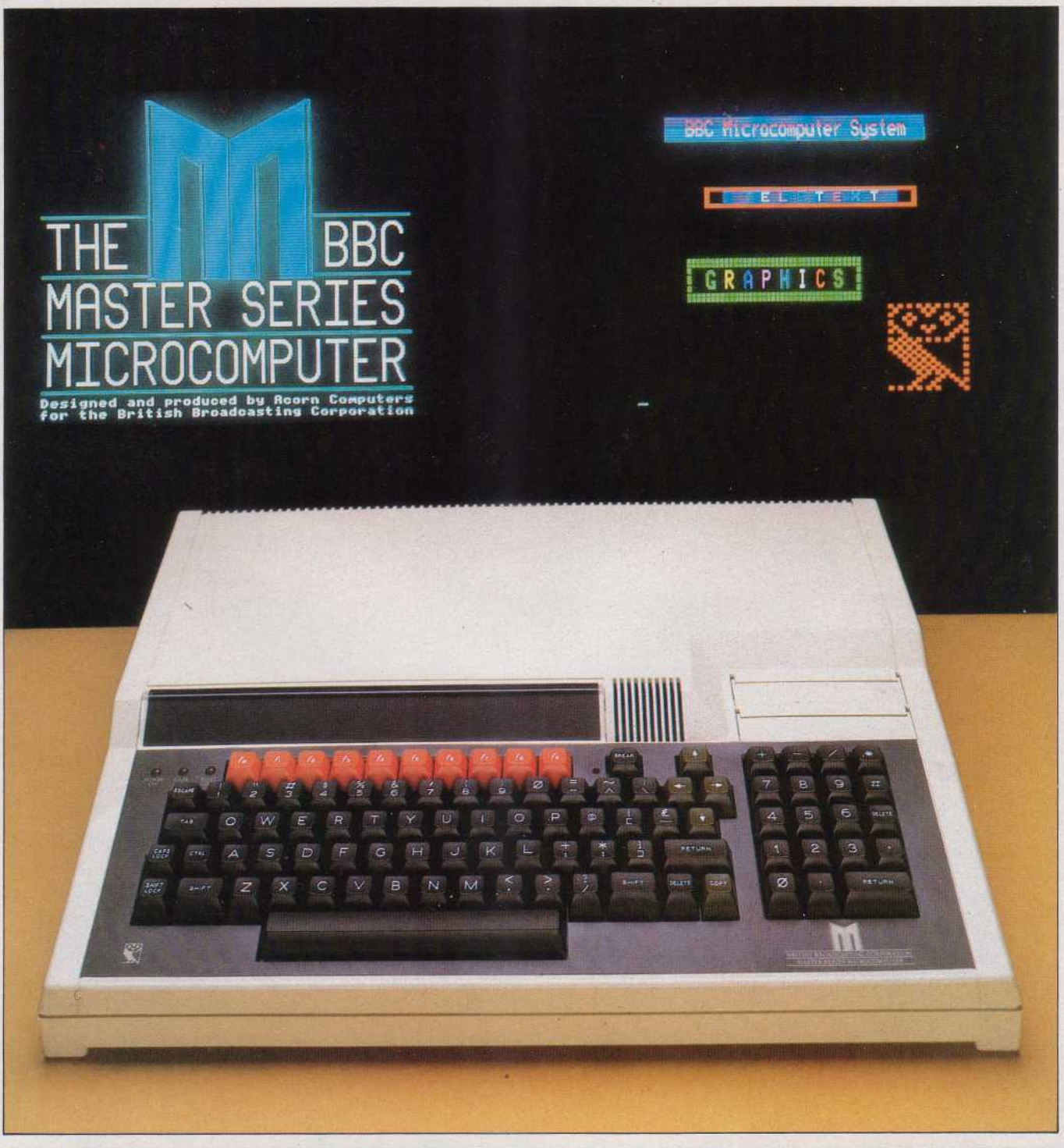
BBC Master 128

Its old-fashioned appearance notwithstanding, the MS-128 is the base model of Acorn's Master Series and is an attempt to upgrade and improve the popular BBC Model B. But what is the company offering in return for a high price tag? Nick Walker finds out.



Since its introduction in 1982, the BBC Model B has gained a reputation as the 'good all-rounder' among low-cost micros, and not without reason. The Model B is currently being used in more diverse applications than any similarly-priced micro. The thousands of available applications, combined with the BBC's comprehensive connections to the outside world, make the machine a capable small-business miero, a scientific control instrument, a communication system and a multi-purpose home computer, to name but a few of its uses. This all-round capability, coupled with a little financial help from the Government, resulted in the BBC becoming a natural choice for education establishments; so much so that seven out of 10 micros in UK schools are now BBCs.

Due to its firm establishment in such areas as schools, the BBC didn't become involved in the early round of price-cutting of home computers. Also, Acorn had a new cut-down version of the Beeb with which to compete—the Acorn Electron, launched in 1983. Sadly for Acorn, the Electron didn't make it, and another round of price-cutting left the Model B uncomfortably expensive. In line with other manufacturers, in 1985 Acorn launched a larger-memory version, the BBC B+ but, like the Model B, the price — £499 — could hardly be considered competitive.

Acorn's latest offering is not one, but a series of five machines called the Master Series. Like the original Model B, this series has the full backing of the BBC. The base model is the Master Series 128 (MS-128) which replaces the BBCB+ as the 128k derivative of the Model B (the Model B ceased production in 1985), and it is this machine that is the subject of this Benchtest. The other four machines are all based on the MS-128, and all but one can be purchased as an expansion to the base model. They are: a go-faster version, the MS-Turbo; a 512k 16-bit business version, the MS-512; a scientific 32-bit version, the MS-Scientific; and a stripped-down version for use as an Econet network workstation, the MS-ET.

Hardware

The MS-128 may have grown in all three dimensions, but it still looks very much like the Model B. The casing is finished in the same fawn plastic, and the keyboard is once again black with red function keys. Not that I'm complaining —the overall look reflects a high quality of construction and a good, solid feel. It is, however, in appearance, the most old-fashioned low-cost micro currently available.

There are, in fact, a number of external differences from the Model B, the most obvious of which is size. The perspex strip which holds function key legends is now raked sharply upwards to give 1½ins of extra height. This extra height, combined with a deeper case, forms a substantial plateau of fresh air

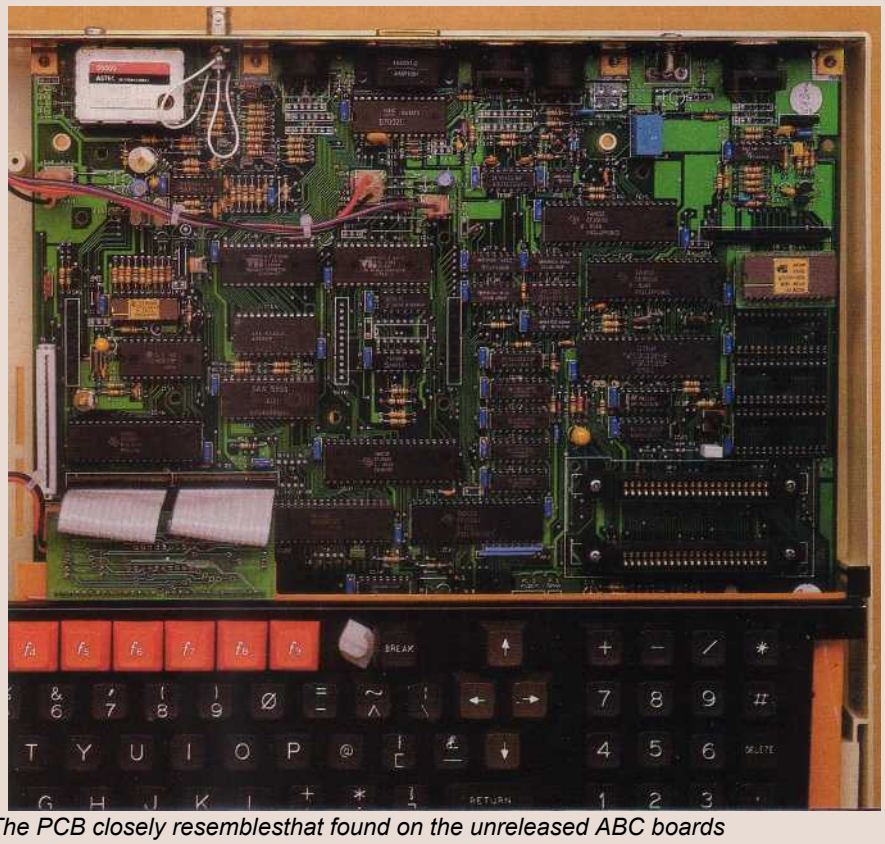
The keyboard features a cursor key diamond—a big improvement over the BBC B

on the MS-128. This is not, as original Beeb owners may suspect, to provide extra cooling, but to create sufficient space for expansion into the other machines of the range and internal peripherals. Incidentally, the steep angle of the function key legends makes it easier to use as it can now be read from an upright typing position, whereas on the Model B you have to bend forward to find the function you want.

I was told that the case, which is really quite large for its kind, would be able to support a monitor in order to reduce the total desk area needed for the system; it can't. A substantial area of desk space is needed for a complete system — in fact, more than traditional three-box business systems such as the bulky IBM PC, which is not really acceptable for a machine that may well find a home on a school desk or as a home computer. You may just be able to balance a monitor on it, but it hardly looks comfortable and I'm sure Acorn would frown at the idea.

To the right of the function key legends is a speaker grille, so sound output is noticeably louder and harsher than on the Model B, not having a solid case to muffle it. Happily for many users, it is now possible to switch off the sound without delving inside and disconnecting leads.

To the right of the grille is a small valley containing two cartridge sockets of the type found on, and compatible with, the Acorn Electron. My initial



The PCB closely resemblesthat found on the unreleased ABC boards

reaction upon hearing this was to cringe: while I'm generally in favour of the concept of cartridges, the computer industry has regarded them as nothing more than an expensive way of producing gamesfor games consoles. I know of no micro where they could be considered a success, including the Electron.

It was a £15 extra that convinced me that the MS-128 cartridges have a much better chance of success. The extra bit plugs into a blank cartridge, and allows you to insert standard BBC ROM software. There is now a vast quantity of ROM-based software available for the BBC, but the average Model B owner has only four or five ROMs to choose from. More ROMs than this, and you risk damaging both the chips and the sockets each time you want to use one that isn't in the machine. With these cartridges,there is now no limit to the amount of ROM software you can sensibly use, and you don't even need to take off the lid to use it. The extra cartridges for the Electron will run on the MS-128, and each cartridge in this mode can hold up to 256k of ROM.

Along the back of the machine are eight ports — from left to right these are: Econet network socket; audio output; cassette connection; RS432 serial port; analogue port for joysticks and other analogue devices; RGB colour monitor; composite monochrome monitor connection; and UHF television output. The only difference here from the Model B is the welcome addition of an audio output, so you can connect the machine to a hi-fi and do justice to its capabilities. Also on the back, to the far right, is an on/off switch.

Five more I/O ports exist on the base of the machine, the same five that gave the Model B its reputation as the most expandable low-cost micro available. The five ports are: disk drive; parallel printer; user port; 1 MHz bus for highspeed peripherals such as a Winchester drive; and the famous tube connection for second processors. It's nice to see that the tube hasn't been dropped on the Master series with its internal expansion eapabilities: you can still attach the likes of Acorn's own Z80 CP/M system and various third-party second proeessors. Also on the base there is a power supply output, which is usually used to power an external disk drive.

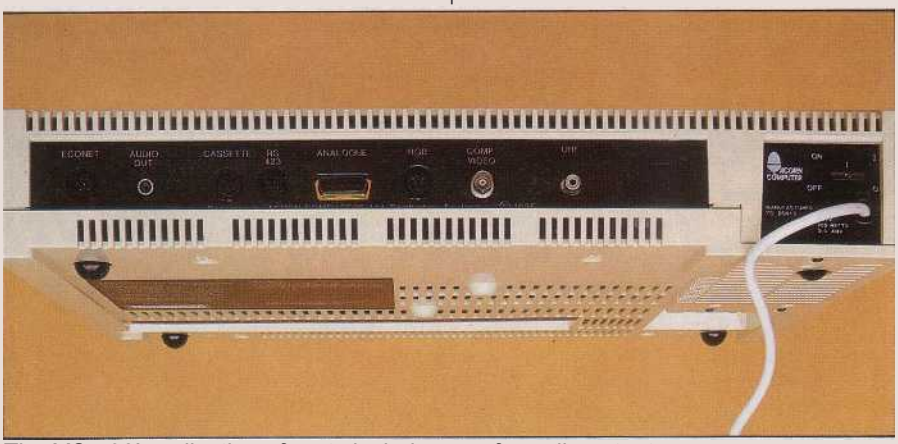
I was disappointed to see that these five ports are still the awkward backward ones found on the Model B, and still inaccessibly positioned on the base of the machine. More than a few users have cursed these sockets as difficult to use; teachers in particular have grown to hate them, as many schools have to fasten them down to stop pupils walking away with them. Once the micros become immovable, the ports become inaccessible.

The keyboard is an integral 93-key, full-stroke affair, which both looks and feels good for the price. Some typists find that it is lacking a positive feel and is rather hollow, but it was adequate for my two-fingered efforts. Much of the keyboard is finished in black, and at the top right-hand side there are four brown keys which form a cursor key diamond—which is a big improvement over the Model B's peculiar arrangement. At the top of the keyboard there are 10 red function keys, giving a total of 40 functions when used alone and in combination with Shift and Control. To the right of the main keyboard there is a 19-key numeric keypad consisting of 10 numeric keys, four arithmetic keys, a decimal point, an equals sign, a delete key, a comma and a Return.

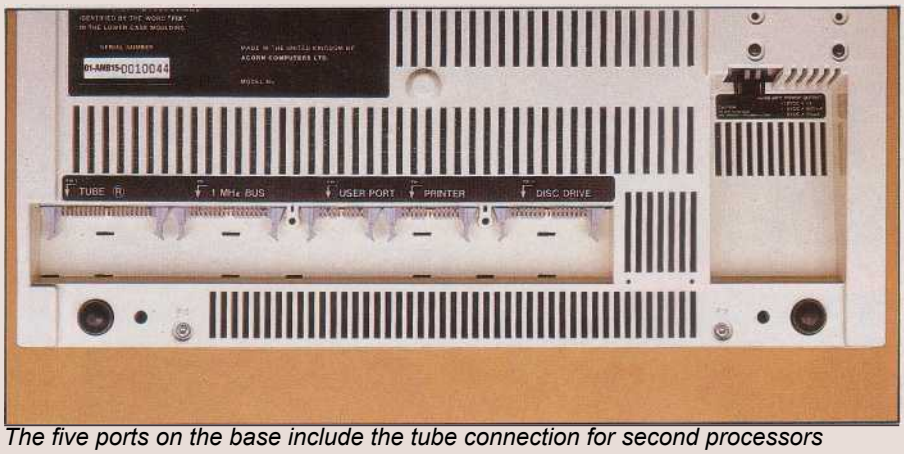
To get inside the machine you remove five Philips screws from the base, turn the machine over and lift off the lid. Once again you will be greeted by what Acorn elaims is a totally new PCB but, while certainly differing from the Model B, it looks very similar to the board found on the unreleased ABC machines. The board is much less cluttered than the Model B's due to the use of six custom CMOS gate array chips. Even so, the board still contains an excessive amount of chips, which must make the machine expensive to produce. I would have thought that after four years of production, it would be possible to drastically cut the number of chips. An Atari 520ST, for example, is a 16-bit 512k RAM machine and yet it only contains a fifth of the chips of the MS-128.

The processor in the MS-128 is a 65C12, a version of the good-old 6502 running at 2MHz. It will not only run standard 6502 programs, but also adds some new commands to the instruction set. RAM, as you might expect, is 128k, made up of four 64k by 4-bit DRAMs. A single ROM chip of 128k contains the operating systems, two disk operating systems and a number of bundled applications. The six custom chips comprise: memory eontroller chip; peripheral bus controller; cathode ray tube controller multiplexor; keyboard controller; chroma chip; and I/O controller.

Not content with the external expansion facilities of the Master Series, there are more internal ports and sockets on this machine than any other similarly-priced micro. Three sockets are provided for ROM chips, two 32k and one 16k, but with the two cartridge slots these only need to be used for software that you require every time you use the machine. Personally, I'd be tempted to use the 32k sockets in their second role as two 32k bank-switched RAMs, and leave the 16k socket empty. Sockets are



The MS-728's collection of ports includes one foraudio output



The five ports on the base include the tube connection for second processors

also available for two processors, an internal parallel modem (freeing the RS432 port for other tasks) and two sockets allowing easy installation of an Econet network board. Given all this posible internal expansion, it's not surprising that the machine has developed a 'hump' to incorporate them.

A small black plastic box in the lower right-hand corner contains a speaker and a long-life Lithium battery, which maintains a real-time elock and 50 strategic bytes of RAM when the machine is switched off. Most of the left-hand side of the machine is occupied by a hefty power supply, which is essential when you consider how much power is necessary. This power supply doesn't get as hot as the original Model B's, which is quite often seen with its lid off, just to keep it cool.

The MS-Turbo has a 65C102 processor, which is a derivative of the 6502 running at 4MHz. It also has an extra 64k RAM and a special high-speed version of BBC Basic. With this combination, the MS-Turbo is claimed to have an average of 4:9 seconds on PCW's Benchmarks, which ranks it alongside the fastest 16-bit business micros that are many times more expensive. One obvious use for this machine is as a fast file server in an Econet network. The MS-512 is Acorn's business machine, offering an internal 16-bit 80186 second processor running at 8MHz. Top of the range, at least in price terms, is the MS-Scientific, which uses a National Semiconductor 32016 32-bit processor, also running at 8MHz. The MS-ET (Econet Terminal) is a cut-down and cheaper version of the MS-128 without the bundled ROM software, especially for use on an Econet network.

System software

It's a tribute to the original system software on the Model B that it has been possible to considerably expand the software on the MS-128 and yet maintain a high degree of compatibility. The latest version of the BBC operating system is known as MOS (Machine Operating System) and is now 35k in size, spilling over its allocated 32k into the ROM banks.

One of the biggest problems facing manufacturers of the new generation of 128k micros is how to make 8-bit microprocessors, such as the 6502 that was originally designed to access a maximum of 64k, address all the extra RAM. The MS-128 uses as convoluted a method as the rest, but to be fair it was never really envisaged, when the original micros were designed, that one day they might have to address 128k of RAM. It's hardly surprising that odd chunks of RAM are grafted on throughout the memory map.
The original memory map consisted of 32k user RAM, a 16k gap for sideways ROMs and a 16k operating system. This is maintained in the MS-128 and supplemented by a 20k block of RAM, which can be switched into the top 20k of user memory. A 12k block of RAM used by MOS sits uncomfortably across the ROM and 0/S border; the remaining 64k is broken into four 16k blocks which compete with the ROM to fill the 16k gap.

The bulk of the new operating system features cover graphics capabilities, which are explained in detail in the 'Applications software' section, with reference to their incorporation into Basic. A number of other features have been incorporated for the existing BBC programmer, and these consist of 17 OSBYTE calls, two OSWORD calls, 12 sideways ROM service calls and 43 base VDU functions. There are too many calls to discuss them all in detail, so I'll just describe one or two of the more interesting ones that can be accessed from Basic using the *FX command.

*FX 108 switches in the 20k chunk of RAM, known as the shadow memory, into the user area. Extreme care is required if this is done from Basic, as you are probably overwriting a screen, a stack pointer and variable tables. *FX 210 disables sound output; and *FX 22, *FX 23, *FX 142 and *FX 143 allow you to poll and service the ROM installed on the 128 from within a Basic program. The list goes on, covering many of the features that experienced Basic programmers asked for after the Model B.

Two disk operating systems are included in the 128k ROM: the original DFS (Disk Filing System), and Acorn's new hierarehical filing system ADFS (Advanced Disk Filing System) . DFS needs little explanation: it's Acorn's original and generally very good filing system that had one major fault—there was a limit of 31 to the number of files in the disk directory. Originallythis wasn't too serious on a small micro, but as third-party manufacturers produced bigger-capacity drives, it proved more of :a problem. ADFS was launched in 1985 as the solution.

Happily, by making the filing system truly hierarchical, Acorn has produced a system dealing with all types of disk drives, including Winchesters. The two systems are incompatible, although DFS commands will work under ADFS, so you will have to switch in DFS when running original Model B disks. I suspect that users of the MS-128 will happily forget all about DFS for their own work when they have experienced the advantages of ADFS.

As well as a hierarchical file structure, ADFS gives an increased formatted capacity of 160k per 40-track disk and 320k per 80-track disk; the use of both sides of a single disk as one entity (provided the hardware and disk design allows); and faster access to certain types of files, particularly on an Econet network.

The 50k of battery-backed RAM provides a surprising amount of start-up options and system configurations. The easiest way to set these is via a program found on the ' Welcome' disk and cassette called Panel, which closely resembles the control panel found on the Apple Macintosh. *CONFIGURE is the BBC-like unfriendly way, but Panel provides a friendly, icon-driven way to configure 18 functions, including: setting of the real-time clock; screen adjustment to fit your particular TV or monitor; start-up graphics mode; disabling of boot load on pressing Shift Break; disk drive select (5¼in, 3½in, 3in and Winchester); and Default filing system (CFS, RFS, DFS or ADFS). As they are in a separate area of battery-backed RAM, these options are retained even when the machine is switched off.

There is no real difference between the system software for the MS-Turbo and the MS-ET from the MS-128. The MS-512, however, needs an operating system for its 80186 operation, and for this Acorn has chosen Digital Research's DOS+ which gives supposed compatibility with both the MS-DOS 2.1 and CP/M 86 business operating systems. DOS+ is not IBM PC-compatible, but it should be able to run generic MS-DOS applications such as WordStar that do not rely on specific IBM-like hardware. The MS-512 is also bundled with the GEM friendly user interface and the applications of the GEM collection. The MS-Scientific runs the PANOS operating system in line with its program development roots, and this makes it compatible with the Cambridge Workstation from Acorn.

Applications software

As you would hope for any machine that is so similar to the BBC Model B, the Master Series range is compatible with Model B software. The official Acorn blurb says that Model B software will run with little or no modification on the Master Series, but the big question is: how much commercial software will need that little modification, as users

Benchmarks

BM1	0.5
BM2	2.3
BM3	5.7
BM4	5.8
BM5	6.4
BM6	10.3
BM7	16.2
BM8	28.2
Average	9.42

All timings in seconds. For a full listing of the Benchmark programs, see page 185, January 1985 issue.

can hardly be expected to perform it themselves.

My experiments suggest that about 90 per cent of existing software runs without problems, but only 60 per cent of disk-based software ran with no trouble. Acorn says that my figures are somewhat pessimistic but, whatever the truth, I suggest that before upgrading from a Model B, you check that your most important applications run satisfactorily. For people considering the purchase of an MS-128 as their first micro there isn't much to worry about, as I'm sure third-party software producers will quickly modify their programs to run on both systems. Acorn could help in the transition period by publishing a list of incompatible software.

Even 90 per cent compatibility means that there is a vast selection of applications software available, covering probably the widest range of subjects of any low-cost micro. Acorn is publishing seven catalogues, three of which are available at the time of writing —general interest, scientific, and by far the most substantial, education.

Five applications are included in the machine's 128k ROM: BBC Basic Version 4.0; EDIT, a program and text editing program; the VIEW version 3.0 word processor; the Viewsheet spreadsheet; and a terminal emulation program.

BBC Basic is widely regarded as the best Basic available. It is two years since I've done anything serious with BBC Basic, but at the time I did agree that it was the best on any micro. In those two years, rival manufacturers have added to their Basics many of the features that set BBC Basic apart from the competition. It took half an hour with BBC Basic to convince me that it's still the best; its structuring facilities and procedure definition facilities have yet to be matched, and, what's more, it's fast. Enterprise Basic is its nearest rival.

Version 4.0 of BBC Basic is compatible with earlier versions, but also incorporates some of the features of the new operating system, particularly in the area of graphics. The original BBC had eight graphics modes with resolutions of between 20 x 32 and 640 x 256. The MS-128 has eight additional modes, 128 to 137, which behave in exactly the same way as the original modes but consume none of the 32k user memory. The screen data in these modes is stored in the shadow memory. Existing BBC users who have seen practically all their usable memory gobbled up by a hi-res screen may find this reason enough for the purchase of an MS-128, and the scope for applications is vast.

The other command that has been expanded on Version 4.0 of BBC Basic is Plot, whose functions now include circle outline, circle fill, circular arc, parallelogram fill and rectangle fill, to name but a few.

View and Viewsheet were previously available as ROM software for the Model B. Both programs are competent efforts, and include most of thefeatures found on their more expensive business competitors. Having these bundled with the MS-128 will make more users realise the usefulness of the two most common business applications—the spreadsheet and the word processor. Teachers in particular will be able to demonstrate to their pupils the applications they will probably use in the future.

The remaining two programs, Edit and the terminal emulation software, are useful but not particularly exciting. Both programs are of the type that are often required in addition to a commercial piece of software or hardware.

Documentation

I suppose I've been spoilt by previous Acorn documentation, but I was disappointed with the MS-128's Welcome Guide. A further three technical manuals are available from Acorn at extra cost.

Prices

The prices for the Master Series are as fbllows: the MS-128, £499; the MS-ET, £399; the MS-Turbo, approximately £625; the MS-512, approximately £1000; and the MS-Scientific, approximately £2000. Only one upgrade price has been announced at the time of writing — the MS-Turbo upgrade at £125. The Master Series comes under the Government discount scheme when purchased for schools, which in the case of the MS-128 means a saving of £105.

The MS-128, the MS-Turbo and the MS-ET will be available immediately, whereas the MS-512 and the MS-Scientific will not be available until the second quarter of 1986.

Conclusion

The MS-128 continues the Model B's tradition as a 'good all-rounder' in all areas bar one — price. At £500 it represents good value when compared with previous BBC machines but not, sadly, when compared with the competition. The machine has sufficient features to be of interest to schools and educational establishments, to existing BBC users and new users, and I expect it to maintain Acorn's position as the leader in this field. I don't expeet it to produce a rush of new home users purely due to the price; if Acorn had bundled in a good-quality disk drive, then the picture might have been different. It's possibly the best 8-bit micro available, but it's far too expensive.

I won't comment on the other machines in the range until I've seen them, but one thought did strike me. The MS-512 looks like being a very interesting machine — but what a shame it isn't IBM-compatible. I realise the technicalities involved in such a machine's production, but a £1000 micro that is both IBM and BBC compatible would really be something to be reckoned with. END

Technical specifications

Processor:	65C12 running at 2MHz
ROM:	128k
RAM:	128k
Mass storage:	N/A
Keyboard:	93-key full-stroke, including numeric keypad
Size:	18ins × 17ins × 4ins
Weight:	13lbs
I/O:	Two cartridge sockets, disk interface, Econet socket, parallel printer interface, serial RS432 interface, user port, 1MHz bus, tube, analogue in, RGB, composite video, TV and cassette.

In perspective

The Master Series 128 is in the serious hobby/small business area of the market, and as such is not without competition. The Amstrad 6128 offers a colour monitor and a disk drive at £100 less than the base-model 128; it also runs CP/M Plus, opening up a wealth of business software. True, the 6128 cannot offer anything near the same expansion facilities as the MS-128, but is this feature worth all that extra cost?

More up-to-date in terms of technology is the Atari 520ST which offers a 16-bit processor, 512k of RAM and a friendly Mac-like interface in an all-in package, with monitor and disk drive for £750. The ST has nothing like the established software base of the BBC, however.

It is in the area of education that the MS-128 has least competition. I sense a movement towards 16-bit-like business machines, but Acorn also has a very competitive entry in the field — the MS-512.