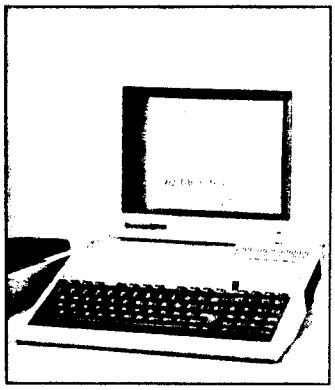
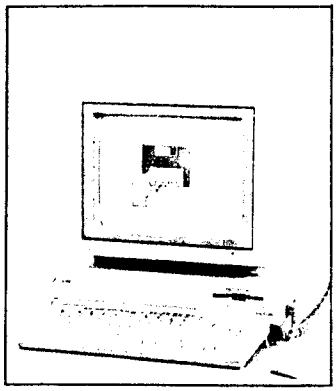
PERSONAL



MICROBEE 256TC.

Made in Australia, successful as a school computer. There is an excellent range of educational software for it but not so much for business. Very compact design but still very service-friendly. The guarantee is six months and a modem (see *Glossary*) was included in the 'Executive' package.

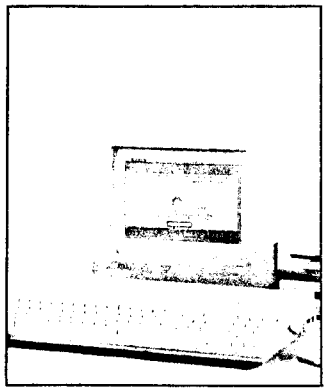
Recommended for educational use.



COMMODORE Amiga 1000.

Technically the most advanced in the test – best graphics and sound, built-in speech generator and PAL compatible video system which (with the appropriate software and hardware) lets you record computer images on your VCR, play tricks with images from your video camera or use the monitor as a high-quality TV monitor. Unfortunately, there is comparatively little business and educational software for it yet, but as an enthusiast's machine, it's ideal.

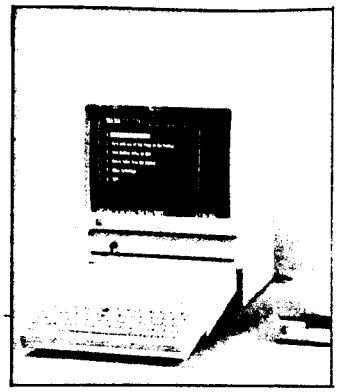
Recommended for entertainment use.



ATARI 520ST.

A fast-calculating computer with good graphics and sound. Because of the limited range of software, it isn't recommended for business or educational use, but a hobbyist gets many interesting features at a reasonable price. The keyboard looks neat but feels mushy. Too many modules and cables for comfort – needs a lot of desk space.

Acceptable for entertainment use.

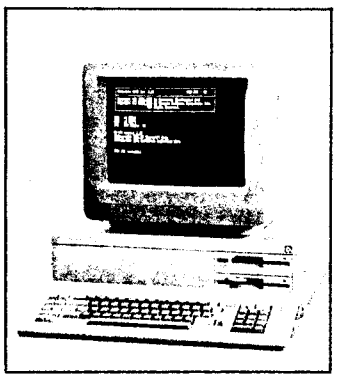


APPLE IIc.

A classic school computer, but a bit dated. The keyboard is cramped, the operating system old-fashioned and rather difficult to learn, and it is certainly not a good business computer. Furthermore, screen quality is not among the best. But at the time of writing, the range of educational software and games is second to none.

Recommended for educational use.

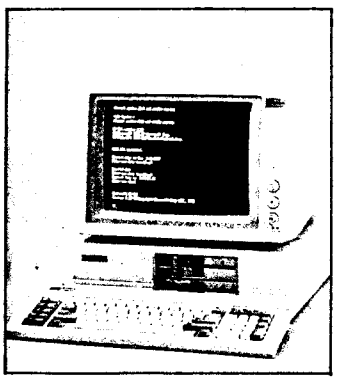
All computers are shown without their printers. The Commodore Amiga is shown without the add-on disk drive – it was out of stock at the time we bought.



COMMODORE PC10-II.

An average IBM compatible. Its best point is a good keyboard. A minimum of software supplied.

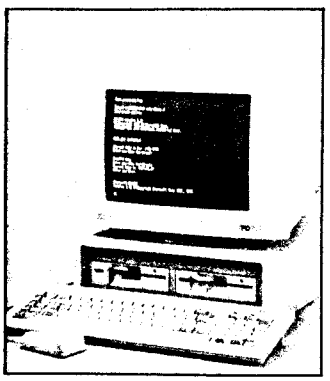
Acceptable as a small business computer.



DSE MULTITECH PC-500 System 2.

An IBM compatible with average performance but neatly built and with service, software and accessories easily available from the large Dick Smith Electronics chain of stores.

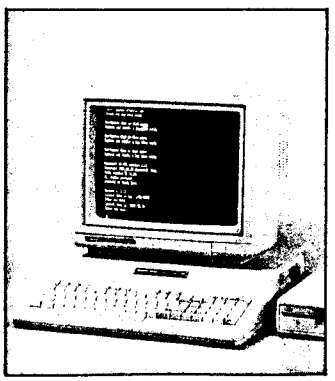
Acceptable for business use.



AMSTRAD PC1512DD.

Fastest among the IBM compatibles, recommended for business use and a good performer overall. Designed in the UK – where it is very popular – but made in Korea (the monitor comes from Taiwan).

Recommended for small business use.



TANDY 1000 EX.

An IBM compatible with an incompatible keyboard. The screen is very poor and the software supplied is of low quality. We disliked its unusual edge connections for printer and external disk drive.

COMPUTERS

Confused by the bewildering choice of computers and programs? Our test of eight popular brands cuts through the computerspeak to the facts.

Want to buy a personal computer? First, let's define it. A personal computer or 'PC' is a more advanced, useful and professional computer than the 'home computers' which flooded electronics shops a couple of years ago, but it is small and relatively affordable.

What can it do for you? What most people want is a machine for keeping records or for word-processing. It can be used to do the bookkeeping for a small business, the membership roll for a club, register data for research and calculate. With appropriate software it can write letters, reports, documents or a novel. It can teach children and adults anything from science and maths to music and what to eat when dieting. With some accessories, it can help severely handicapped people communicate and run their own affairs. It offers more advanced and realistic games than a home computer. Some PCs interact with or simulate musical instruments and can be used by composers and (with an extra software/hardware package) can be used for manipulating a video recording to achieve new creative effects.

All this may sound wonderful unless you are one of the many families with a 'home computer' gathering dust on a shelf after a couple of weeks of use.

However, buying a PC is a different matter. It has to be good, and you need a reason for buying it. It isn't in the impulse buying price range.

We used $3000 as a target price for everything you need to get started – a CPU (central processing unit) with two disk drives and serial and parallel ports, a colour monitor and a dot matrix printer, plus a software package with programs which put the computer to work on usable tasks from the beginning.

The CPU

The Central Processing Unit is the computer's brain. It contains a number of circuit-boards with sets of integrated circuits (chips) and other electronic components. Most have at least one disk drive built-in. Others have an integrated keyboard.

Disk drives

A single disk drive is sufficient for some uses but most programs work best with two disks and it is much more convenient for the user – a lot of disk swapping can be eliminated. As you would soon need a second disk drive it's better to get it from the beginning and maybe save a few dollars. The **COMMODORE Amiga** had to be tested with only the built-in disk drive – the add-on disk drives for it have been in short supply and we couldn't get one in time for the test.

There are two disk sizes for PCs: 3½" (90 mm) and 5¼" (135 mm). The larger size is the current standard and the disks cost about half as much as the smaller ones. The trend in the industry is towards more 3½" disks, which usually store more information than standard 5¼" disks (it depends on how they are formatted by the computer) and are well protected against damage by a plastic 'shell'. You can buy add-on disk drives for both disk sizes for some computers – for example, **COMMODORE Amiga** and **TANDY 1000 EX**.

Monitors

We know some people disagree with our choice of a colour monitor. Yes, monochrome gives better resolution (more distinct letters) for less money – a lot less in the case of **DSE-MULTITECH**. If you want to use your PC for word processing or accounting and nothing else, buy a monochrome as long as the software doesn't depend on colour for its operation. However, if you also want to use it for games and educational purposes (as most people do), you need colour. So that's what we bought.

You can mix and match computers with monitors and printers to some extent and some package deals may combine one brand of computer with other brands of monitor and printer.

Keyboards

PCs come with QWERTY keyboards, that is, the same order as on a normal typewriter. But there are also extra keys for different computer functions, including the ones that move the cursor. Generally, the more keys, the better, otherwise you'll have to press two or three at the same time for some functions. If you use a mouse (see *Glossary*), you'll depend less on the function keys. Indicators for 'power' and 'caps lock' are helpful (see table).

Printers

There are several types of printers – what the home user can afford is usually the dot matrix type. Some computer brands have their own printers, others not, and even when they have, a package from a computer shop often includes a printer from a specialist manufacturer such as Brother or Epson instead of the 'original'. So we did not let printers influence the overall ratings of the computers in this test. The ones we bought were the types recommended by the retailers.

When you buy your printer, check that ribbons are easily available and don't cost the earth. (See also the printer test in CHOICE September 1986).

Setting up

To set up a PC system is as easy as connecting your HiFi. The **ATARI**

520ST system consists of eight separate components, plus the mouse. If you need a transportable computer, or need desk space for papers, this is one to avoid.

We found all handbooks easy to follow. **APPLE** has the best one – it's very easy to follow for a beginner. You'll soon be ready to use your computer – if there is nothing wrong with it. We got the systems working quickly except the **COMMODORE PC10**, which refused to boot (see *Glossary*), and the **MICROBEE**, which suddenly died. After we rang the **COMMODORE** hotline and got instructions about how to set some switches inside the computer, it worked satisfactorily. The **MICROBEE** was replaced by the manufacturer. The **AMSTRAD**'s disk drives were noisier than normal at the beginning but the noise abated and no servicing was necessary.

Testing

Computer performance was tested using two types of files – a word processing document and a spreadsheet. We measured the time it took for each computer to perform a number of normal operations – to load and save files, move rows and paragraphs, make calculations and find words.

Two computers – **DSE MULTITECH** and **TANDY** – could not run the test software with the standard memory (although they had no problems with the software supplied with the respective machines).

Both the 'routine' graphics (the definition and legibility of letters and

Glossary of computer terms

Backup: disks can be damaged, so all important disks should be copied to prevent loss of data.

BASIC: a programming language, Beginner's All-purpose Symbolic Instruction Code.

Bit: the smallest unit of information a computer can process.

Bootstrap: loading a computer with a program to make it ready for use. Reboot: to start up the system after clearing the random access memory ('warm boot'). 'Cold boot': to clear the memory by turning off and then turning on the computer.

Bug: mistake in a program or a malfunction in the computer.

Byte: a group of eight bits, usually representing one character. The capacity of a computer memory is stated in kilobytes (K). Each K is not 1000 but 1024 bytes.

Chip: integrated circuit.

Clock: a generator of pulses of current with great accuracy and high frequency which controls the timing of the computer.

CPU: Central Processing Unit, the computer brain. It has a memory, arithmetic logic circuits and a control unit which carries out different operations according to the program.

Cursor: not an angry computer operator but the bright little symbol that shows where you are on the screen.

Database: files of data stored in the computer, which can be processed using different software.

Floppy disk or diskette: a magnetic disk which rotates in the disk drive while being recorded or read. They are available in three sizes and with normal and double density.

Formatting: pre-magnetising a disk to make it ready for use (and erasing any previously recorded data).

Hard copy: output printed on paper.

Hard disk (or Winchester disk): a non-removable disk used instead of a floppy disk drive. A hard disk rotates much faster and can store much more information than a floppy.

Hardware: anything tangible in a computer system.

High (or double) density disk: a disk with a higher number of smaller-sized magnetic particles than in a normal type; with more particles per square mm, the high density disk can store more data.

Icon: screen symbol representing a file, program or procedure .

Interface: an adapter connecting two devices which converts signals so that the devices can work together.

K (Kilo-): prefix meaning 'one thousand' except in terms of memory storage, when it is 1024 (2^{10}).

Light pen: used for computer graphics. The pen is connected to the computer. By moving it across the screen, the operator can draw, move and change sections of the picture.

Modem: (modulator-demodulator) a device for data transmission from one computer to another over the telephone; electrical signals are converted to audible and back again.

Mouse: a computer-connected device which, when it is moved around on the desk, moves a pointer around the screen. The pointer selects procedures or new positions for the cursor.

Operating system: a program working as an intermediary between the software you are using and the computer. It interprets the commands from your program and passes them on in a form the CPU understands. The most common operating systems for PCs are CP/M (Control Program for Microprocessors) and DOS (Disk Operating System).

Peripheral: any device in a computer system except the CPU.

Pixel: the little dots (picture elements) on the screen that make up a graphics image. High resolution screens have smaller pixels, a higher number of them, and give a more detailed image.

Port: an input/output connection point on a computer.

RAM: random access memory – stores program and data for short-term use. Data are erased when the computer is switched off – before that, they have to be saved by recording on, for example, a disk.

'Real soon now': industry term used for software or hardware which is not yet available but will be coming . Often 'real soon now' is a lot later than promised and sometimes the goods fail to materialise at all. Bugs are discovered in software, unexpected teething troubles in electronics. So don't pay in advance for products that don't yet exist and maybe never will.

ROM: read only memory – a permanent memory for instructions, fixed when the computer is manufactured. It cannot be erased or changed by the operator.

Software: programs to be used in computers, usually supplied in the form of a disk or tape and printed instructions.

Spreadsheet: program primarily intended for handling numbers, for example in accounting.

Videotext: an information service displaying text on a TV screen, using either a broadcast signal or a coded telephone signal. With a computer and a modem, you can access information about sharemarket, race results or your own bank balance and interact with other computers – for example, pay your bills by transferring money from your account to others.

Word processor: computer software for writing text in letters, reports and documents.

figures) and graphics from special software were evaluated. The quality of whatever sound each machine offered was evaluated, and we also measured the noise from fans and disk drives. (**AMSTRAD** and **MICROBEE** were very quiet, but the **COMMODORE PC10** cooling fan is more than audible and the **TANDY**'s disk drive is noisy.)

Our user tests were performed by a consulting computer expert, a scientist from our electronics laboratory and professional typists.

All computers passed our electrical safety tests.

Interference with radio transmission is a problem. The **AMSTRAD**, **COMMODORE Amiga** and **DSE-MULTITECH** caused annoying interference on the AM band, while **COMMODORE PC10** and **MICROBEE** permitted reasonable enjoyment listening to AM. None interferred with FM radio or television (tested on both UHF and VHF).

Performance

The **AMSTRAD**, **MICROBEE** and **TANDY** were the fastest in the word processing and spreadsheet tests, with **COMMODORE PC10** and **DSE-MULTITECH** following.

COMMODORE Amiga had the best graphics followed by the **ATARI** – these two were superior to all others in this department.

We also tried functions which couldn't be directly compared as only one or a few PCs had them. For example, we used the **MICROBEE** modem on Telecom's Viatel service – it worked well – and tried the **Amiga's** voice synthesiser, which speaks English well but is less successful in some other languages.

Ergonomics

A separate keyboard is a great advantage as different people want the screen at different distances depending on their eyesight. The angle of the screen may have to be adjusted to avoid reflections from windows or light fittings. Some have an adjustable base which is an advantage.

Adjustable tilt for the keyboard can also be an advantage but keys with a positive, distinctive feel and a convenient layout may be more important.

The 'Industry Standard'

Standards are usually rules agreed upon in an industry and sometimes enforced by law. With PCs, it's different – the prevalent standard is the IBM PC, which means a compatible computer will be capable of using the same programs as the IBM PCs, will be able to communicate with IBMs or other machines built to the same standard and can use the same accessories (or peripheral equipment, if you prefer computer-speak). IBM equipment is covered by a multitude of patents which will not expire until today's PCs are in museums, and some manufacturers have taken a different approach by buying licences from IBM, circumventing or infringing patents.

Most clones or compatibles can run all the more commonly used software written for the PC DOS operating system used by IBM. Compatibility differs with different brands and models. Among IBM compatibles in our test, the **TANDY** was the least compatible, being difficult or unsatisfactory to run with some software because its keyboard differs from IBM's.

What we bought...

We had $3000 as a price guideline and bought the most popular budget-priced PCs from major manufacturers. Prices are not directly comparable – the software supplied with different package deals differs from minimal to extensive, and there were also differences in hardware – for example, the **MICROBEE** 'Executive Solution Package' includes a modem which can be used for data communications such as Viatel access, electronic banking, etc.

We exceeded $3000 in one case – by choosing a rather expensive monitor for the **DSE MULTITECH**.

...and what we didn't buy

We could not buy some of the well-known brands of PCs at our guideline price. IBM, NEC and Olivetti were too expensive.

Future shocks?

You must be prepared for some expenses shortly after the initial purchase. You'll probably spend quite a bit on software – games or educational programs for the kids, more businesslike ones for yourself. You may also find that you need to upgrade your system to be able to use the software you want or to run what you have more efficiently.

Service costs must also be taken into account. Guarantee was only three months for most brands when we bought our computers but **AMSTRAD** and **DSE-MULTITECH** now have one-year guarantees and others may follow suit in a year. If there is something wrong with the electronics, it will probably show during the first weeks and be fixed under warranty.

The monitor should be expected to be at least as reliable as a TV set. The computer should be reliable in a dry and reasonably dust-free environment. Disk drives have moving parts, which may need servicing sooner or later. The keyboard may have to be cleaned or adjusted.

You can reduce the risk of unexpected, costly breakdowns by doing what you can to protect the whole system from dust. Don't put your coffee cup on the desk next to the computer – a spill into the keyboard may be expensive. Cigarette ash and smoke don't do much for computers, either.

Obsolescence may be a major cost factor. Technology develops fast in the computer field and a reasonable prediction would be that most manufacturers will maintain the current price level for a PC system but build in more features and improve performance when component prices fall.

If you buy an IBM or IBM compatible, you have a computer built to a standard the industry will have to stick with for quite a while, so you can be sure software, disks and other supplies will be available for a long time to come. However, new

When you buy your printer, check that ribbons are easily available and don't cost the earth.

For people with disabilities
The computers in our test have been assessed for use by people with disabilities. However, the uses and requirements vary widely from person to person and to describe all possibilities you'd need to write a book (let's hope somebody does!). If you'd like more information drop us a line, or contact the Independent Living Centre on (02) 808 2233 for an appointment. Its experts can make an individual assessment of the possibilities and problems in each particular case.

software may be written mainly for new machines with improvements within the standard which may not be possible to build into yours.

The risk of being left in the lurch after a short time is greater with the non-IBM-compatibles, particularly if you choose one of the less common brands on the market. Many computer manufacturers are losing money in today's competitive market, and some will have to get out in the near future, possibly leaving customers without service backup.

The success of a computer – including its life as a marketable product and its resale value – depends to a great extent on the software available for it, and the software specialists wouldn't write special programs for a model they don't believe will sell in numbers great enough to make it worthwhile.

Trends

Among features beginning to appear in computers for home use is the ability to connect to home video and – with a connection for MIDI (Musical Instrument Digital Interface) which works with synthesisers, other instruments and audio systems. Composers use personal computers for writing music, and with a video digitiser and an Amiga, your home videos can be transformed from the ordinary to something very different on the screen.

Conclusion

If you know exactly what you are going to use your computer for, it isn't difficult to choose.

If you need a *business* computer or a home machine to complement the one you use in the office, the rule-of-thumb is to pick your software first and then look for a machine which runs that software fast and reliably and is convenient to use. You'll probably (but not absolutely necessarily) be looking for an IBM compatible or – if you can afford it – an IBM or possibly APPLE Macintosh.

All the computers we tested can be used for office work like word processing, but the ones we recommend for business use do it more efficiently than the others. Likewise, there are educational programs for IBM compatibles, but the computers we recommend for this use have more to offer.

Some of the business software you may be interested in requires more memory capacity than, for example, 256K. So don't buy a new software package without checking – before you buy the computer, try to find out whether you'll need more memory and check the cost. The difference in cost for expansion can be dramatic – for example, it was cheap with the **DSE Multitech** but very expensive with the **TANDY** (see *Cost for memory expansion*).

Cost for memory expansion

AMSTRAD: 512K to 640K	$139
APPLE:	
128K to 256K	$385
128K to 1Mb	$730
COMMODORE Amiga:	
512K to 1Mb	$690
to 2Mb	$1000
to 9Mb	about $4000
DSE-MULTITECH: 256K to 512K	$64
TANDY: 256K to 640K	$660

The **COMMODORE Amiga** has a standard RAM of 256K but is sold with the expansion to 512K on the Australian market, almost a necessity for word processing because its software needs a lot of memory capacity.

Of the IBM compatibles in our test, the **AMSTRAD** performed best. The software supplied was comprehensive and easy to use, but did not include word processing.

Our second choice for business use is **DSE MULTITECH PC-500**. It wasn't as fast and easy to use as the **AMSTRAD** (a new PC-500 version launched October 15 is claimed to be much faster) but it is a neatly built computer with good features and we got an integrated software package containing word processing, spreadsheet, file management and a communications program.

For *educational purposes*, the choice may be more difficult. **MICROBEE** scored slightly better in our test than **APPLE** but both work well. Choose the same brand as the one used at school...or if the school hasn't got a computer, get the **MICROBEE** because it's Australian made. If you want to trial a **MICROBEE** you can rent their 'Executive Package' for $100 a month.

For *entertainment*, the **Amiga** is a clear winner. It has lots of possibilities, some still unexplored due to the limited supply of software. It can also perform some basic office functions like word processing and budgeting. The **Amiga** was also just in front in our overall points rating – a weighted score for usability, performance and user support – but this rating is really beside the point if you want to run software which isn't available for it.

October 1986 results

APPLE Macintosh Plus MOOIAP. Expensive ($5460 when tested), but **recommended for business and educational use.**

DSE MULTITECH MPF-PC/500. Good value ($2732), **recommended for business use.**

IBM XT 5/60. Recommended for business use on the basis of performance – but about twice as expensive ($5195) as the similar **DSE MULTITECH PC 500.**

What to buy

(in performance order)

RECOMMENDED	**($)***
COMMODORE Amiga 1000 (incl add-on disk drive)	2299
MICROBEE 256TC 'Executive Package'	3641
AMSTRAD PC1512DD	2948
APPLE IIc	2330
DSE-MULTITECH PC-500 System 2	2441**
ACCEPTABLE	
ATARI 520ST	2443
COMMODORE PC10-II	1750***

*pre-publication price check.
**improved version but package now doesn't include software
***package does not include printer

PERSONAL COMPUTERS (in performance order)

Brand & model	COMMODORE Amiga 1000	MICROBEE 256TC	AMSTRAD PC1512DD	APPLE IIC	DSE-MULTITECH PC-500 System 2	ATARI 520ST	COMMODORE PC10-II	TANDY 1000 EX
Distributor	Commodore Business Machines	Microbee Systems	Mitsubishi Electric AWA	Apple Computer	Dick Smith Electronics	Mobex	Commodore Business Machines	Tandy
Origin[1]	Japan	Aust	Korea	Singapore	Taiwan	Taiwan	Taiwan	US
IBM compatible	no	no	yes	no	yes	no	yes	yes
Package price paid ($)[2]	2549	2999	2948	2580	3178†	2757†	2689	2997
Separate price(s)[3]	p: 650 (Epson)		p: 599	c: 1495 d: 550 p: 535 (Epson)	c: 1645 m: 949 p: 549	c: 1799 d: 499 p: 399 (Epson)	c: 1500 m: 539	c: 1499 d: 499 m: 599 p: 400
Guarantee (months)[4]	3	6	3	3	3	3	3	3
Memory capacity	512K	256K	512K	128K	256K	512K	640K	256K
Expandable to	9Mb	–	640K	1Mb	512K	–	–	640K
Operating system	AMIGA DOS	CP/M SHELL	MS-DOS 3.2, GEM	Pro DOS 1.1.1	MS-DOS 3.1	TOS GEM 1.2	MS-DOS 2.11	MS-DOS 2.11
Type of disk drive	one built-in one separate	both built-in	both built-in	one built-in one separate	both built-in	two separate	both built-in	one built-in one separate
Disk size (inches)	3½	3½	5¼	3½	5¼	3½	5¼	5¼
Formatted disk capacity Kbytes	880	776	360	143	360	360	360	360
Type of keyboard	separate	integral	separate	integral	separate	integral	separate	integral
Number of keys	89	92	85	63	84	85	85	90
Monitor screen Diagonal size (mm)	335	290	330	335	330	295	333	335
FEATURES Dedicated ports[5]	mouse/ joystick (2) audio	none	joy stick/ mouse(2)	audio	240V AC	MIDI, mouse/ joystick(2)	none	mouse, joystick (2), audio
Clock with battery backup		✓	✓		✓			✓
Mouse included	✓		✓			✓		
Modem		✓						
Keyboard indicators	caps lock	power	caps lock num lock	power disk use	caps lock num lock scroll lock power	power	caps lock num lock	caps lock num lock power
Volume control	✓		✓	✓		✓		✓
Channels	2	1	1	1	1	1	1	1
Software supplied	ba ds	ds tc wp	ba pa	ba ds	db ss tc wp	ba wp	ba	ba ss db tc pa wp

1 when components in a system are of a different origin the origin of the CPU is listed

2 all prices rounded to nearest dollar. The package included CPU, 2 disk drives, monitor and printer except Commodore Amiga (1 disk drive) and Microbee which included a modem

3 c – CPU incl. keyboard, d – disk drive, m – monitor, p – printer. Add-on disk drives only for machines with single disk drive.

4 distributors claim guarantees for Amstrad and DSE-Multitech have been extended to 12 months

5 all machines had serial and parallel ports except the Apple which had no parallel ports. Some machines had dedicated ports for mouse, joystick, light pen, etc, but with others these could be connected via the RS-232 (serial) port.

† cable required (for Atari $60, DSE Multitech $35)

ba BASIC
db database
ds demonstration software
pa paint
ss spreadsheet
tc telecommunications
wp word processing
K kilobyte
Mb megabyte

✓ recommended

✓ acceptable