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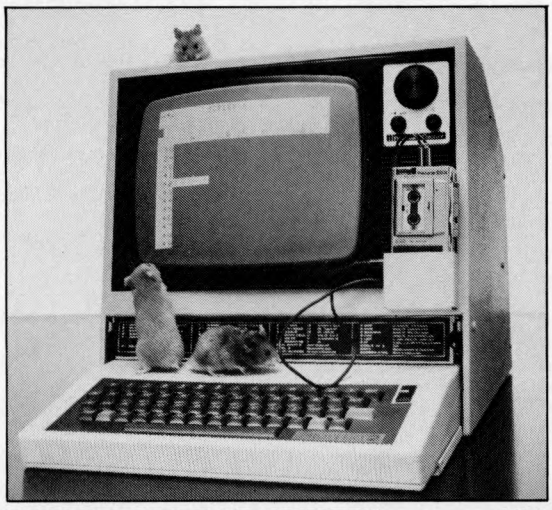

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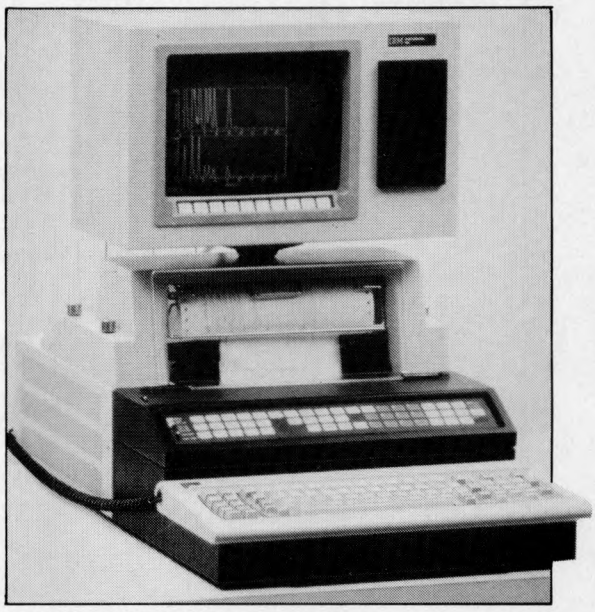

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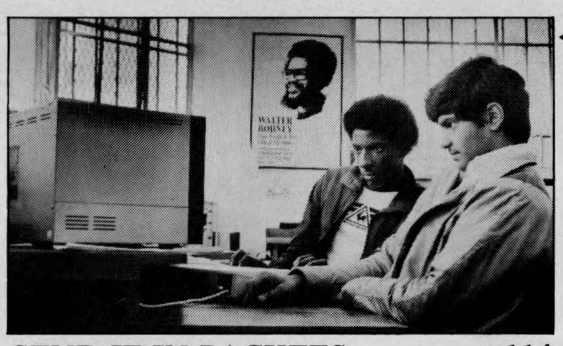

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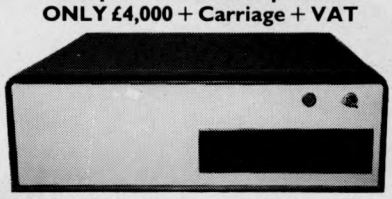

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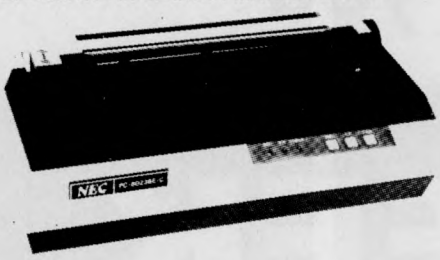

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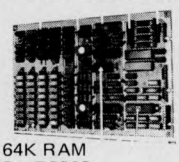

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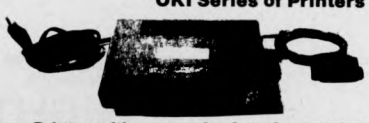

Suitable for any Printer with centronics interface and any Computer with serial interface. VL-964K simply plugs into centronics port of the Printer and converts to serial to plug into RS232 port of the Computer.

- **4K Buffer**
- **Selectable Baud Rates 150 to 9600**
- **Completely cased**
- **All IC's socketed**
- **RS232 Cable (150cm) and Connector**
- **Self test facility**
- **Own PSU for 220-240V operation – Mains Cable 200cm ready plugged**

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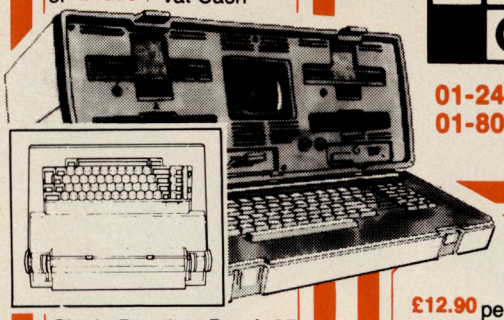

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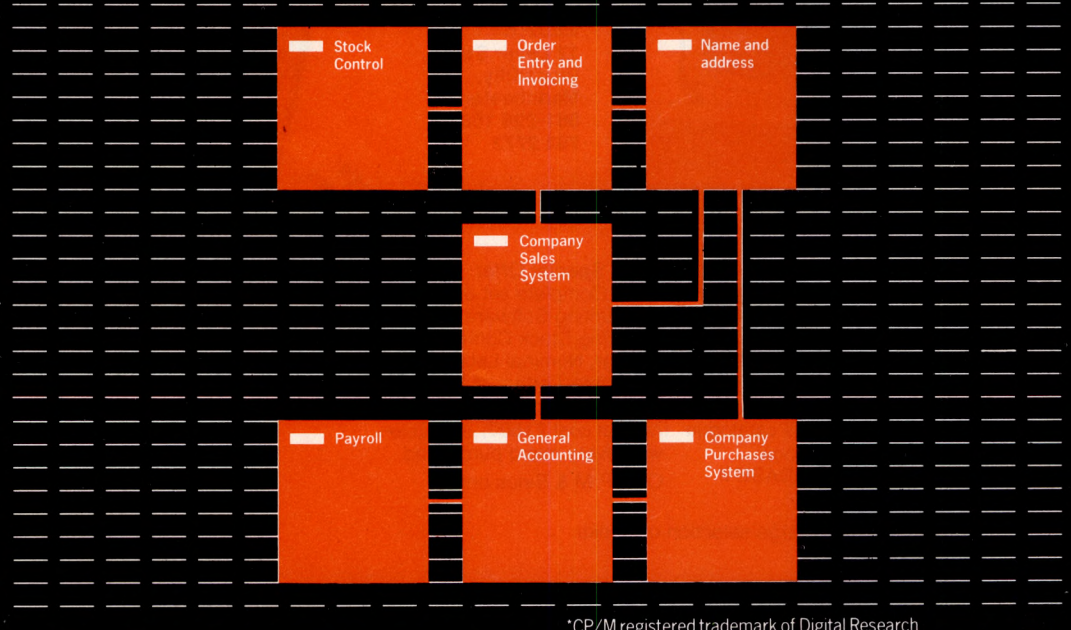

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74S04	30
74S08	40
74S10	40
74S20	40
74S27	40
74S32	70
74S74	75
74S112	80
74S132	110
74S133	60
74S138	100
74S139	115
74S155	39
74S158	195
74S175	260
74S188	140
74S189	140
74S194	195
74S201	250
74S225	240
74S240	390
74S241	250
74S244	290
74S257	170
74S260	50
74S262	850
74S287	225
74S288	210
74S289	200
74S301	000
74S365	000
74S470	325
74S471	620
74S472	1150
74S475	25
74S571	620

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75154	125
75182/3	99
75188/9	55
75332	140
75450	86
75451/2	52
75454	70
75491/2	65

TTL74

7400	11
7402	11
7404	13
7410	14
7411	15
7423	18
7414	20
7420	15
7422	20
7427	18
7430	14
7442	35
7447	40
7448	40
7473	24
7474	20
7475	25
7485	60
7486	20
7489	170
7490	20
7491	35
7492	25
7493	25
74100	80
74116	50
74121	25
74125	35
74126	35
74143	210
74148	60
74150	50
74151	40
74153	40
74154	55
74186	470
74188	250
74383	99

74LS

LS00	11
LS02	11
LS04	12
LS08	12
LS10	12
LS11	12
LS13	15
LS14	26
LS19	58
LS20	13
LS22	12
LS27	12
LS32	13
LS30	12
LS42	28
LS47	35
LS48	55
LS63	120
LS73	18
LS74	18
LS75	20
LS85	42
LS86	16
LS90	24
LS91	60
LS92	32
LS93	23
LS125	24
LS126	25
LS138	25
LS139	28
LS148	70
LS151	40
LS153	40
LS156	36
LS157	25
LS158	30
LS175	36
LS240	55
LS241	55
LS242	55
LS243	55
LS244	50
LS245	70
LS273	54
LS373	60
LS374	55
LS393	42
LS471	629
LS640	180
LS641	180
LS645	180
LS668	125
LS669	120
LS670	100
LS673	550

CMOS

4000	40
4001	10
4002	12
4009	24
4010	24
4011	10
4012	16
4016	20
4017	32
4018	45
4023	13
4025	13
4027	20
4034	140
4040	40
4051	45
4052	60
4053	50
4066	24
4068	14
4069	13
4070	13
4076	50
4077	13
4078	15
4081	13
4093	20
4099	75
4160	95
4161	99
4162	99
4163	99
4174	99
4175	105
4411	690
4412	790
4419	350
4450	350
4451	350
4490	350
4500	675
4504	75
4505	185
4508	130
4511	46
4519	30
4528	50
4549	375
4569	175
4583	90
4584	40
4585	60
4597	330
4598	290
4599	290
40101	130
40105	105
40106	25
40108	198
40110	198
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40245	195
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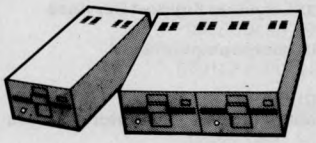

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40	70p	90p
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16pin	42p	100p
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2×25way	225p	
2×28way	210p	
2×30way	245p	
2×36way	295p	
2×40way	315p	
2×43way	395p	

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Angle	160p	210p	250p	355p
Pins	120p	130p	195p	295p

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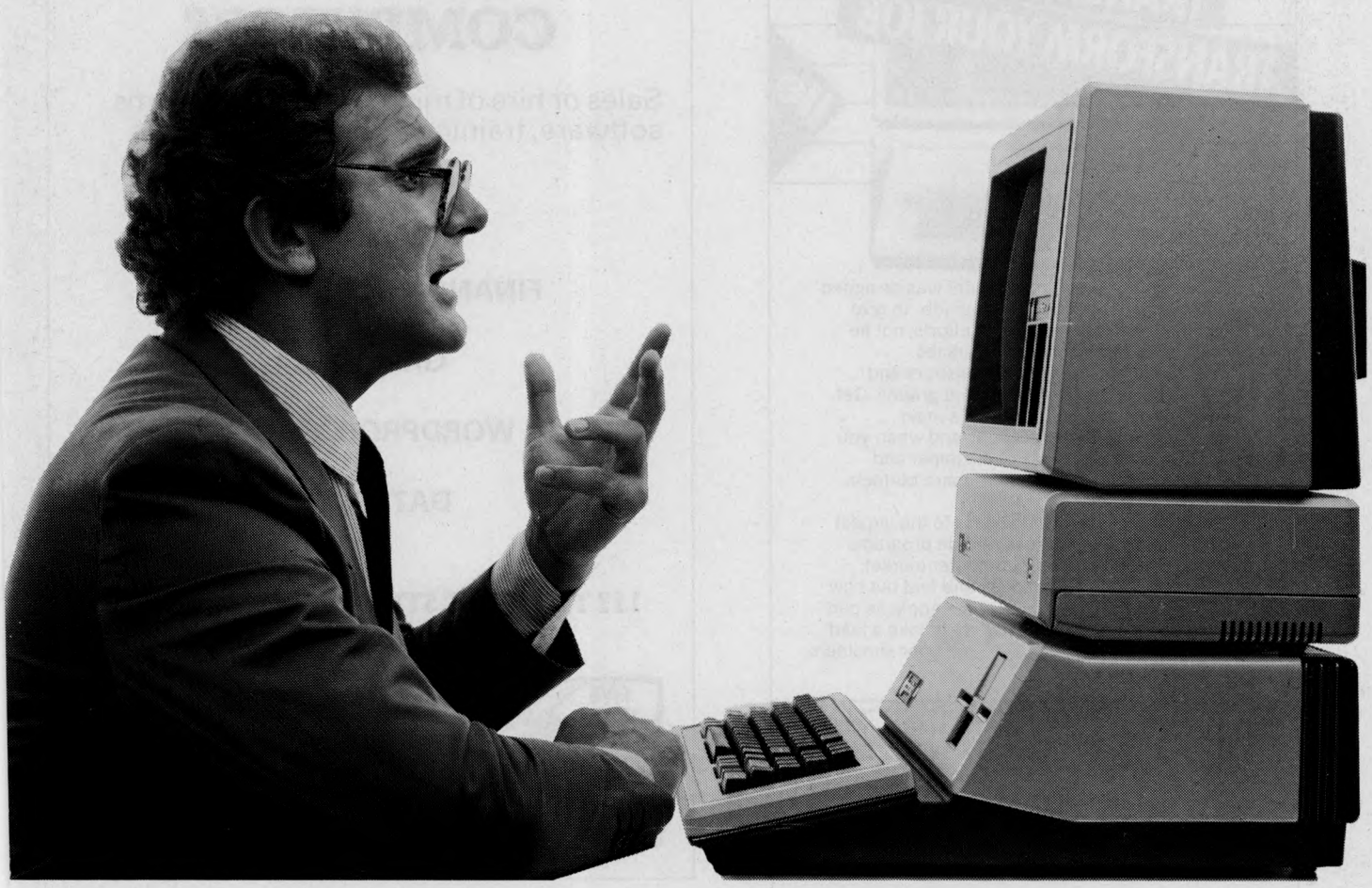

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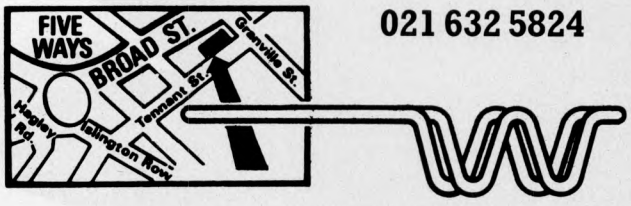

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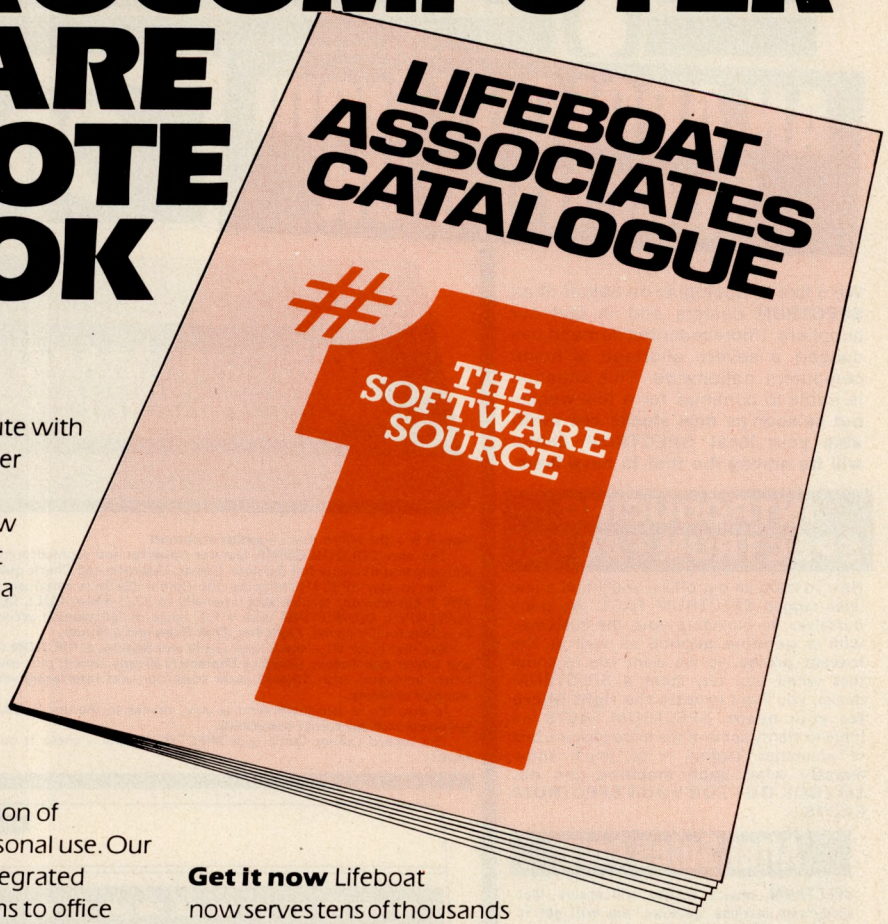

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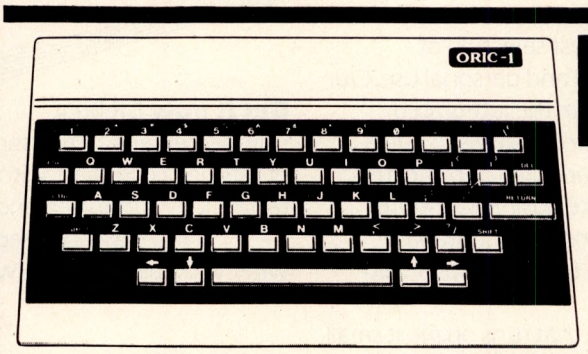

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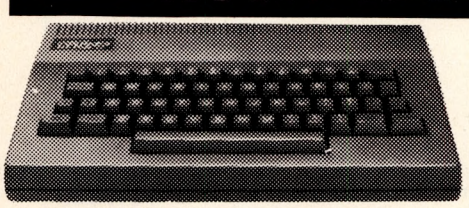

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Just look at this **super new LYNX Micro** – an **incredible** 16K + 32K video ram and that's **expandable** up to or beyond **96K.** For just **£225.00 INCLUDING VAT** the **LYNX** is **exceptionally versatile.** All **LYNX's** 'add-on' connections are **standard types.** The **high definition colour graphics** make it a **top-value choice** for the **home or office** (with expansion, the LYNX can become an 80 characters-per-line word processor!) Take a look at the **LYNX** – a **memorable bargain** from **SPECTRUM,** But please phone to check stock position **before making a journey** as this new machine is bound to be in **great demand.**

SPECTRUM FACTS
Maximum user RAM 13,700 Bytes approx.— in very short supply

JUPITER ACE

Outstanding value-for money! The **JUPITER ACE** uses easy to understand **FORTH** language. **Connects to your own TV. 3K RAM expandable to 19K. Full moving keyboard** with auto repeat and caps lock. **Full sound and chunky graphics.** Ideal for the home, office or schools etc. Supplied complete with mains adaptor, TV and cassette recorder connection leads etc. See it at your local **SPECTRUM** dealer **NOW!**



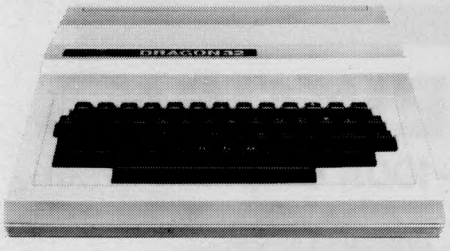
Spectrum LOW price £89.95 Inc VAT **£76.22** ex vat

SPECTRUM FACTS
Maximum user RAM 1,000 Bytes approx.

Not all stores carry every advertised item, please phone before making a journey – Prices correct at time of going to press E. & O.E.

HURRY! Limited stocks only-

DRAGON



Unbelievable value at only £199.95 from SPECTRUM! British built and designed it's one of the most impressive micros to appear for quite some time. Extensive facilities include highly advanced colour graphics. Just look at this top specification: Powerful standard 32K RAM (expandable to 64K Bytes). ■ 9 Colour, 5 resolution Display. ■ Extended Microsoft colour BASIC (as standard). ■ Advanced sound with 5 octaves – 255 tones. ■ Professional style editing, e.g. extract line, auto find reinsert. ■ Professional quality keyboard. ■ Centronics Parallel printer interface. ■ Serious programmer/user – the BASIC on this machine is similar to that found on machines costing 3 times the price! ■ Uses almost any cassette recorder. ■ Standard file handling ON TAPE.

Spectrum LOW price **£199.95** INC. VAT

(£173.87 exc. VAT)

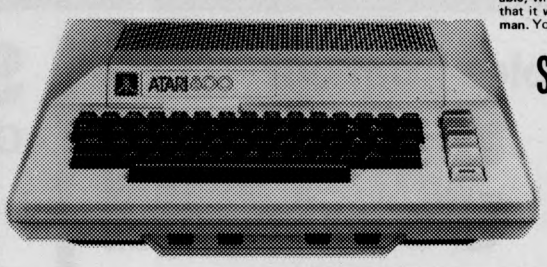
	EX VAT	INC VAT
CCESSORIES		
oysticks (pair).	£17.35	**£19.95**
assette Lead..	£2.35	**£2.70**
ARTRIDGES		
aserk	£17.35	**£19.95**
osmic Invaders	£17.35	**£19.95**
eteroids	£17.35	**£19.95**
ost Attack...	£21.70	**£24.95**
ive Hunter ...	£17.35	**£19.95**
arship Chamelion ...	£17.35	**£19.95**
ASSETTES		
alixo Island...	£6.91	**£7.95**
aphic Animator	£6.91	**£7.95**
iest.....	£6.91	**£7.95**
Madness and the Minotaur	£6.91	**£7.95**
Examples from Dragon Manual	£6.91	**£7.95**
Personal Finance	£6.91	**£7.95**
Dragon Mountain	£6.91	**£7.95**
Typing Tutor ...	£6.91	**£7.95**
Black Sanctum .	£6.91	**£7.95**

SPECTRUM FACTS
Maximum user RAM 29,679 Bytes

DISCOUNT Software for **DRAGON** Teach Yourself Dragon Basic **£6.95**

ATARI

ATARI 800 16K RAM



The top selling ATARI 800 at a sensational new LOW LOW price from SPECTRUM. It's the ideal home or business computer with an extensive range of EDUCATIONAL, GAMES, PERSONAL FINANCE and BUSINESS programmes and aids available. It features a typewriter keyboard, 16K memory that's easily expandable to 48K with convenient, slip-in ATARI Memory Modules. It's expandable, which means you can build the computer system you want today, knowing that it will grow to meet your needs tomorrow – making it ideal for the business man. You can add printers, programme recorders, disk drives and more.

Sensational **NEW LOW** Price

£399.99 INC. V.A.T.

(£347.82 excluding VAT)

SPECTRUM FACTS
Maximum user RAM 13,323 Bytes



ATARI 400
16K RAM

£198.95

INCLUDING V.A.T.
(£173 excluding V.A.T.)

SPECTRUM FACTS
Max. user RAM 13,323 Bytes
BASIC cartridge extra

£39.99 inc. VAT
(£34.77 ex. VAT)

ATARI DISK DRIVE
£299.00
INCLUDING V.A.T.
(£260 excluding V.A.T.)

ACCESSORIES, BOOK & GAMES for ATARI

	EX VAT	INC VAT
Accessories		
Thermal Printer	£173.00	**£198.95**
16K RAM Pack	£56.52	**£65.00**
Paddles (Pair)	£12.17	**£13.99**
Joysticks (Pair)	£12.17	**£13.99**
I/O Cable	£11.30	**£12.99**
Printer Cable	£24.78	**£28.50**
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Monitor Cable	£21.74	**£25.00**
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Power Adaptor 400/800 9v/6v S00705	£9.35	**£10.75**
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Word Processor (Disk)	£86.95	**£99.99**
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Mortgage & Loan	£13.03	**£14.99**
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INV. to programming 1	£17.38	**£19.99**
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INV. to programming 3	£19.99	**£22.99**
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Conversational German	£34.77	**£39.99**
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	EX VAT	INC VAT
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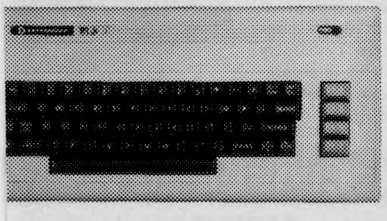
Kingdom	£13.03	**£14.99**
Scram	£17.38	**£19.99**
States & Capitals	£13.03	**£14.99**
Touch Typing	£17.38	**£19.99**
Music Composer (Cartridge)	£31.30	**£35.99**
Pop Demonstration Cartridge	£21.73	**£24.99**
Home Entertainment (Cartridge except where stated)		
Asteroids	£26.08	**£29.99**
Basketball	£21.73	**£24.99**
Blackjack (Cassette)	£13.03	**£14.99**
Caverns of Mars (Disk)	£26.08	**£29.99**
Centipede	£26.08	**£29.99**
Computer Chess	£21.73	**£24.99**
Missile Command	£26.08	**£29.99**
PAC Man	£26.08	**£29.99**
Space Invaders	£26.08	**£29.99**
Star Raiders	£26.08	**£29.99**
Super Breakout	£21.73	**£24.99**
Video Easel	£21.73	**£24.99**
Cribbage & Domino	£17.35	**£19.95**
European Scenic Jig-saw	£17.35	**£19.95**
Hickory Dickory Dock	£17.35	**£19.95**
Programming Languages & Aids		
Assembler Editor	£34.77	**£39.99**
Atari Basic Cartridge	£34.77	**£39.99**
Macro Assembler (Disk)	£52.17	**£59.99**
Pilot (Consumer)	£52.17	**£59.99**
Pilot (Educator)	£78.25	**£89.99**
Entertainer Kit (Star Raiders Missile Command & Pair Joysticks)	£60.86	**£69.99**
Programmer Kit (Basic Cartridge & Manuals)	£43.47	**£49.99**

Commodore VIC-20



Now a top quality home/business micro for the price of a games machine.

■ Memory expandable to 32K ■ High resolution (full PET type) graphics ■ 16 Screen colours and 8 border colours ■ Plugs in to your TV. or monitor ■ Add Disk Drive & Printer for impressive 170K Byte system ■ Can act as an intelligent terminal for a larger computer.

VISCOUNT SUPER X2
64K DYNAMIC RAM PACK for VIC-20
EXCLUSIVE TO SPECTRUM!

believable-but-true, now you can up grade your C-20 from 3.5K to a massive 67½ RAM. Enables to load up to 8 games or programs at a time & select which one you wish to use. Can be used conjunction with other expansions to increase al memory up to 152K-using the VIC memory ex-nsion board. The SUPER X-2 will make your VIC-the biggest little micro in town!

Spectrum LOW price **£114.94** INC. VAT

(£99.95 excluding VAT)

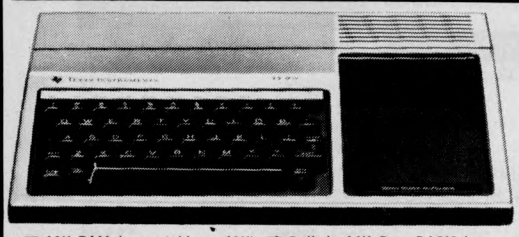
Spectrum LOW Price

£129.90 INCLUDING VAT

(£112.96 Excluding VAT)

SPECTRUM FACTS
Maximum user RAM 3,853 Bytes

TEXAS TI99/4A



SPECTRUM FACTS
Maximum user RAM 14,500 Bytes approx.

■ 16K RAM (expandable to 48K) ■ Built-in 14K Byte BASIC interpreter ■ 16 Bit Microprocessor ■ 16 Colour High Resolution graphics ■ Extensive range of solid state software command modules available from games to architectural aids.

Spectrum LOW Price **£154.95** INC VAT (£134.74 ex. VAT)

	EX. VAT	INC. VAT
TEXAS PERIPHERALS		
Speech Synthesizer.....	£40.50	**£46.58**
Peripheral Exp. System..	£122.00	**£14.30**
Disc Cont. Card	£124.30	**£142.95**
Disc. Drive.....	£234.74	**£269.95**
RAM Exp. Card	£179.57	**£206.50**
Matrix printer	£347.78	**£399.95**
Software Entertainment		
TI Invaders	£16.48	**£18.95**
Tombstone City.....	£19.96	**£22.95**
Attack	£19.96	**£22.95**
Parsel.....	£23.45	**£26.96**
Car Wars	£23.43	**£26.95**
Munchman.....	£23.43	**£26.95**
Adventure & Pirate.....	£31.26	**£35.95**
Education		
Number Magic.....	£12.13	**£13.95**
Addition/Subt. 1	£23.43	**£26.95**
Teach yourself begniners		
BASIC	£8.26	**£9.50**
Home Budget Management	£19.96	**£22.95**
. . . and many more		

MORE SPECTRUM LOW PRICES!

Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.

spectrum

A few examples from our

Software Selection

THORN EMI

Software for Atari	Inc. VAT
Submarine Commander	£34.44
Jumbo Jet Pilot	£34.44
Soccer	£29.84
Kickback	£29.84
Home Financial Management	£19.49
Darts	£19.49
Snooker & Billiards	£19.49
Pool	£19.49
Cribbage & Dominoes	£14.89
Humpty Dumpty/Jack & Jill	£14.89
Hickory Dickory Dock/Baa Baa Black Sheep	£14.89
British Heritage Jigsaw Puzzles, Vol. 1	£14.89
British Heritage Jigsaw Puzzles, Vol. 2	£14.89
European Scene Jigsaw Puzzles, Vol. 1	£14.89
European Scene Jigsaw Puzzles, Vol. 2	£14.89
Super Cubes & Tilt	£14.89
Figure Fun	£14.89
Cupute 4 & Reversi	£14.89
Owari and Bull & Cow	£14.89
Software for Commodore	
River Rescue	£25.24
Vic Music Composer	£25.24

GEM

Software for ZX81, Dragon and Spectrum	Inc. VAT
Monster Mine (for 4ZX 81)	£4.95
Monster Mine (for Spectrum)	£4.95
Monster Mine (for Dragon)	£7.95
Space Mission (for 4ZX 81)	£4.95
Space Mission (for Spectrum)	£4.95
Space Mission (for Dragon)	£7.95
Dragon Golf	£7.95
Dragon Character Generator	£9.95
Games, Pack I	£7.95
Games, Pack II	£7.95

SALAMANDER

Games for Dragon 32	Inc. VAT
Dragon Trek	£9.95
Wizard War	£7.95
Vulcan O/+	£7.95
Games Compendium DI	£7.95
Golf	£7.95

RABBIT

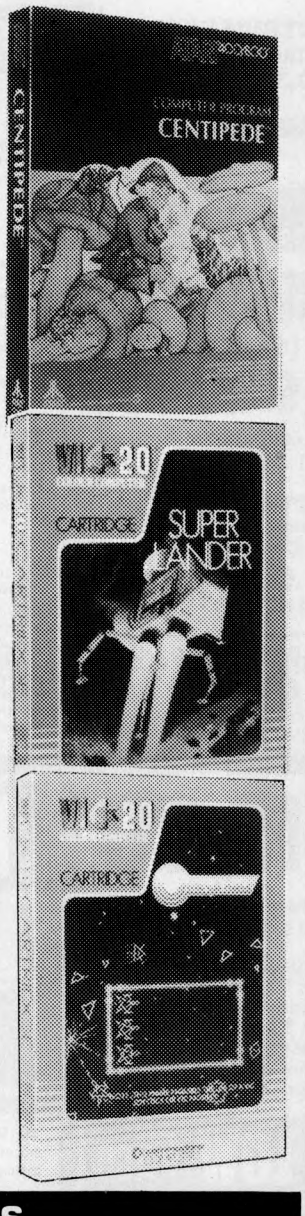
Software for Commodore VIC20	Inc. VAT
Space Storm	£6.49
Ski Run	£4.49
Dune Buggy	£4.49
Super Worm	£4.49
Jungle	£4.49
Cosmic Battle	£4.49
Frogger (3K)	£9.49
Rabbit Functions	£4.49
Code Breaker	£4.49
Night Flight (3K)	£4.49
Rabbit Writer (16K Cassette)	£19.49
Rabbit Base (16K Cassette)	£14.49
Myriad (3K)	£9.49
Charset/20 (3K)	£4.49
Skramble	£9.49
Space Phreeks	£9.49
Night Crawler	£9.49
Hopper	£9.49
Tank War	£7.49
Rabbit Base (16K Disk)	£16.49
Rabbit Writer (16K Disk)	£21.49
Rabbit Calc (16K Cassette)	£19.49
Rabbit Calc (16K Disk)	£21.49

KUMA

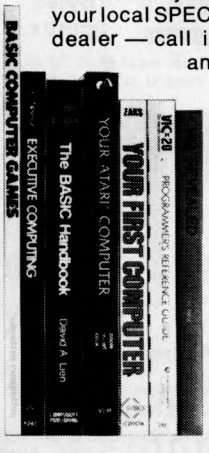
Software for Sharp	
Electron 22622	£9.20
Cribbage	£12.08
Adventure	£12.08
Chess	£16.68
Map of UK	£12.08
Music Composer	£12.08
Junior Maths/Stepping Stones	£6.33
Home Budget	£6.33

AUDIOGENIC

Programs for VIC-20	Inc. Vat
Amok	£6.95
Alien Blitz	£7.95
Golf	£7.95
Spiders of Mars	£19.95
Sattelite & Meteorites	£19.95
Bonzo	£7.95
Trashman	£19.95
Boss	£14.95
Tank Attack	£19.95
Word Craft	
Word Processing package	£125.00



Plus many more at your local SPECTRUM dealer — call in now and see!



BOOKS

SELECTION FROM THE COMPUTER BOOKSHOP	
30 Hour Basic for the B.B.C. Micro	£5.95
Let your B.B.C. Micro Teach You To Programme	£6.45
B.B.C. Micro Revealed	£7.95
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Vic Inovative Computing	£6.95
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Easy Programming for the ZX Spectrum	£5.95
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CPM Handbook	£11.50
Programming the Z80	£11.95
20 Best Programmes for the ZX Spectrum	£5.95
Getting Aquainted with your Vic 20	£6.95
Machine Code and Better Basic	£7.50
The Cambridge Colour Collection (Spectrum)	£6.95
Vic Revealed	£10.00
De RE Atari	£17.00
ATARI Operating system listing	£10.43

SEIKOSHA

GP-100A Graphic Printer



Now a top quality graphic printer **at a price you can afford.** The **SEIKOSHA GP-100A – Terrific value** at under **£200** from **SPECTRUM**. Standard Centronics compatible interface for easy link-up with most micros. ■ Full graphics capability. ■ Printing speed 30 chars/sec. ■ Double width character output under software control. ■ Graphics, character and double width character can be intermixed on same line. ■ Paper width adjustable up to 10" – tractor feed. ■ Print position addressable by character or dot.

Spectrum LOW price £229.94 (Price Ex. VAT £199.95)

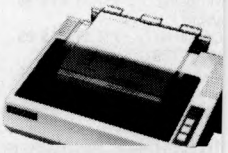
Cables and Interfaces available to fit most MICROS,

EPSON PRINTERS

Chosen by SPECTRUM for their reliability, the superb new **top quality** graphic printers from **EPSON**. New features include **super & subscript, underlining & deletion.** If you're looking for an **up-market** printer at a **down-to-earth-price,** call in and see the **EPSON** range at **SPECTRUM.**

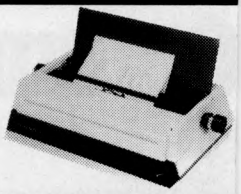
Model	EX. VAT	INC. VAT
MX80-T3	£329.00	£378.35
MX80 F/T Type III	£369.00	£424.35
MX100 Type III	£469.00	£539.35

Please see your SPECTRUM dealer for prices of INTERFACE/CABLE options.



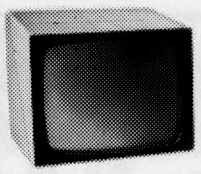
SMITH CORONA TP-I

The **smith corona tp-i** text printer is a microprocessor controlled high quality daisy wheel printer which delivers fully formed executive quality printout at a **speed of 120 words per minute.** It is a **LOW cost Daisy wheel** printer with Microprocessor Electronics, Serial, parallel or IEEE Interface.



ONLY £557.75
£485.00 ex. VAT.

ACCESSORIES



SANYO Colour Monitor
CDD3125N
ONLY
£228.85 inc. VAT
(£199.00 ex. VAT)

SANYO	Exc. VAT	Inc. VAT
SANYO 12" green monitor	£79.00	£90.85
Slim 3G Cassette Recorder	£26.04	£29.95
CTP 3131 14" Colour TV Set	£199.96	£229.95
C12 Cassettes	£0.43	£0.50
Single sided, single density disks	£1.70	£1.95
Double sided, double density disks	£2.94	£3.38
Single sided, double density double track disks	£2.57	£2.97
Disk head cleaner	£14.00	£16.10
Single part 11" x 9½" printer paper, box of 2,000 sheets	£11.35	£13.05

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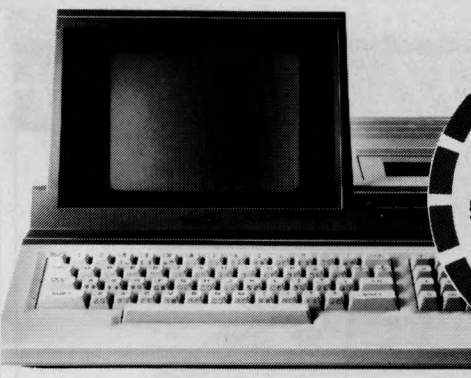

FREE!
£75 WORTH of software
with every **MZ80A** purchased

SHARP MZ-80A

Desk top genius! – the all-in-one SHARP MZ-80A. A personal computer designed with the serious user in mind. **ready to run the moment you get it home.** Built-in keyboard, CRT 9" display and cassette data storage with **48K RAM.** The BASIC with extra useful additions, offers quite a powerful micro for the home or business. ■ 4K Byte ROM + 48K Byte RAM + 2K Byte Video RAM ■ ASCII profiled keyboard + numeric pad ■ 2 page Video RAM allows screen to be scrolled up or down. ■ CP/M available

Spectrum LOW Price £546.25 Inc.VAT (£475.00 ex. VAT)

loppy Disks and Accessories
r MZ80A

win Floppy Disk Unit (inc. I/O ard, Disk, Cable)	£745.00	£856.75
ngle Floppy Disk Unit (inc. I/O ard, Disk, Cable)	£400.00	£460.00
win Disk Unit (only)	£590.00	£678.50
ngle Floppy Disk Unit	£400.00	£460.00
ible for F/D Drive	£25.90	£29.79

Printers and Accessories

for MZ80A, MZ80B and MZ80K 80 Col Tractor Feed Printer inc. Cable, I/O Card & Rom	£415.00	£477.25

SPECTRUM FACTS
Maximum user RAM 32,000 Bytes approx.

NEW ACCESSORIES from SPECTRUM

	Ex. VAT	Inc. VAT
POINTMASTER Competition Joystick (For ATARI and VIC Computers)	£13.00	£14.95
VISCOUNT		
Motherboards for VIC 20 Standard (Use 2 or more cartridges at a time)	£21.70	£24.95
As above, with buffer	£26.00	£29.90
16K RAM for VIC 20	£38.22	£43.95
32K RAM for VIC 20	£58.22	£66.95
CURRAH CHATTERBOX		
Voice Synthesiser for VIC 20	£49.95	£57.95
Full Keyboard for ATARI 400	NOW AVAILABLE	

SINCLAIR ZX-81



SINCLAIR ZX . £49.95
16K RAM pack £29.95
ZX Printer . . £59.95

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JPER TRIO ZX81	£7.95
RINTH 16K ZX81	£5.95
TMARE PARK/MUSIC 16K ZX81	£6.95
PUTACALC 16K ZX81	S7.95
ONAL BANKING SYSTEM 16K ZX81	£11.44
E INVADERS/RESCUE 16K ZX81	£6.95
KOUT 16K ZX81	£5.95
SY 16K ZX81	£5.95
SATROYDS 16K ZX81	£5.95
MERGE 16K ZX81	£5.95
BALL MANAGER 16K ZX81	£7.95

CASSETTES FOR ZX81	INC. VAT
TYPE— 10	
6 GAMES	£3.95
JUNIOR EDUCATION	£3.95
BUSINESS & HOUSEHOLD	£3.95
SKILL & JUDGEMENT GAMES	£3.95
JUNIOR EDUCATION	£3.95
FAMILY QUIZ	£3.95
TYPE— 20	
FANTASY GAMES	£4.75
SPACE RAIDERS & BOMBERS	£4.75
TYPE— 30	
SUPER PROGRAMS Nos. 1-8	£4.95
TYPE— 40	
BACKGAMMON*	£5.95
FLIGHT SIMULATION	£5.95
TYPE— 50	
ENGLISH LITERATURE 1	£6.95
ENGLISH LITERATURE 2	£6.95
GEOGRAPHY	£6.95
HISTORY 1	£6.95
MATHS. 1	£6.95
MUSIC 1	£6.95
INVENTIONS 1	£6.95
SPELLING 1 (6-11 YEAR OLDS)	£6.95
CHESS*	£6.95
BIORHYTHMS	£6.95

*Requires 16K Ram Memory Pack

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David Saunders Computer Centre, 51 Station Rd. 0252 20130 (Just Opening)

ALFRETON
Gordon Harwood, 69/71 High St. 0773 832078

ASHFORD
Ashford Computer Centre, 2 Station Parade, Clarendon Rd. 07842 44955

BANBURY
Computer Plus, 2 Church Lane. (0295) 55890

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Godfrey's, 28-32 East Walk, Town Centre. 0268 289379

BASINGSTOKE
Fisher's, 2/3 Market Place. 0256 22079

BATH
Software Plus, 12 York St. 0225 61676

BEDFORD
Stanad Ltd., 115 Midland Rd. 0234 49341 (Just Opening)

BIRMINGHAM
Sherwoods, Great Western Arcade. 021 236 7211

BOSTON
Fotosound Computers, 19 Dolphin Lane. 0205 64781 (Just Opening)

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Photosave, 18 Cheapside. 0274 308598

BRIDLINGTON
Bridlington Computers 8 Bridge St. 0262 75048 (Opening Soon)

BRIGHTON
Capricorn, 1 Queens Rd. 0273 29634

CAMBERLEY
Camera Arts (Micro Computer Division), 36 High St. (0276) 65848

CAMBRIDGE
KP Ltd., 12a Kings Parade. 0223 68087

CANTERBURY
Kent Micro Systems, Conquest House, 17 Palace St. 0227 50200

CARDIFF
Randall Cox, 18-22 High St. Arcade. 0222 31960

CHELMSFORD
Maxton Hayman Ltd., 5 Broomfield Rd. (0245) 354595

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Coventry Micro Centre, 33 Far Gosford St. (0203) 58942

DARLINGTON
McKenna & Brown, 102 Bondgate. (0325) 59744

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C T Electronics, at **Camera Thorpe,** The Spot. 0332 44760

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ASP Micro Systems, 185 Upper St., Islington. 01-359 9095

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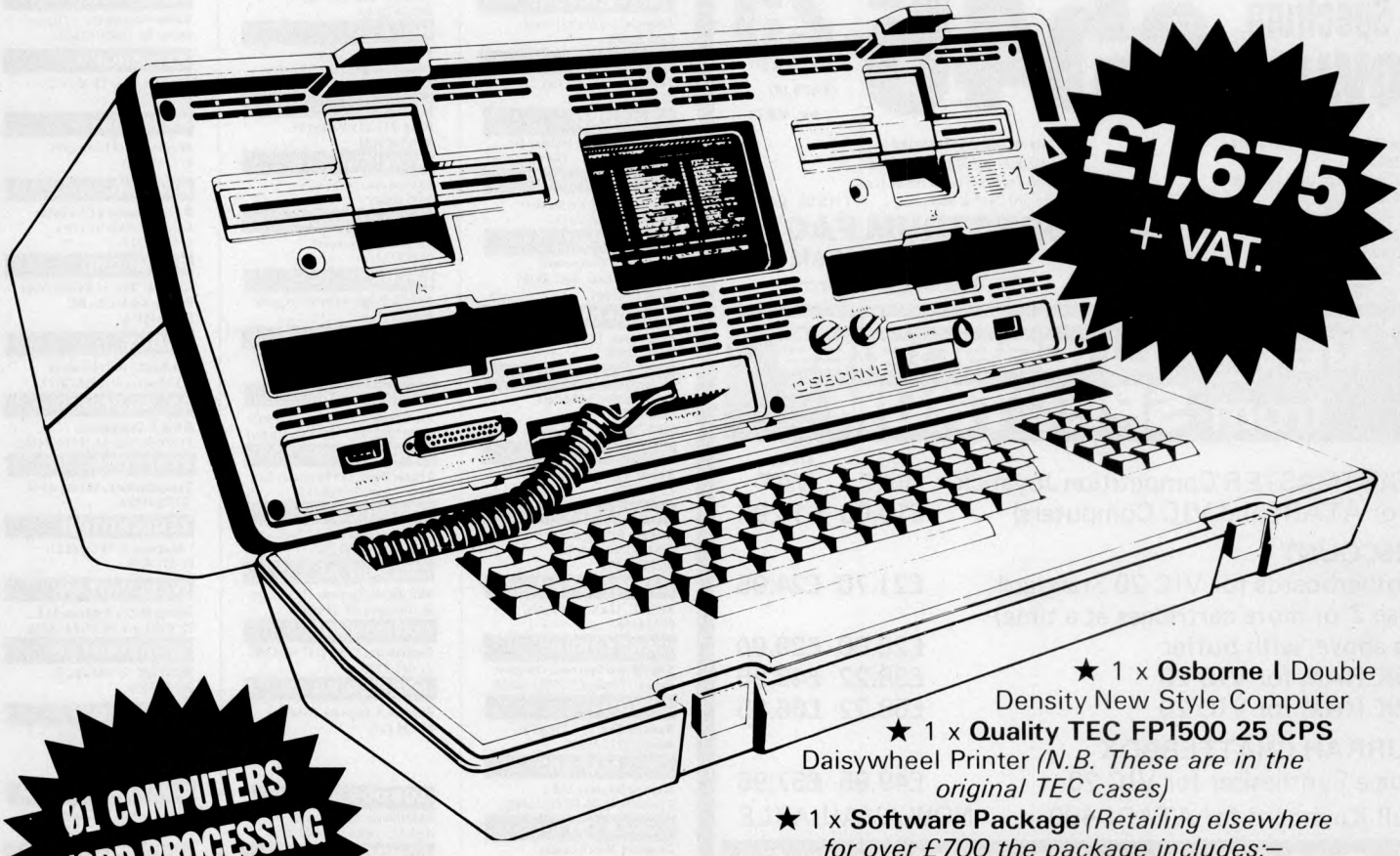

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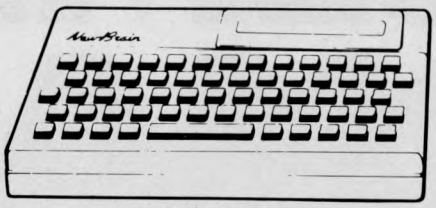

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Some typical applications:–

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* Comparing rent/lease/buy options
* Processing the results of scientific experiments or field studies
* Engineering calculation models
* In fact, anything that involves repeated re-calculation of results presented in tabular or spreadsheet format.

Program Availability Chart:–

	Database	Stock Control	Mailist	Invoices & Statements	Spread sheet Analysis	Cashbook Accounting	Word processor	Home Accounts	Commercial Accounts
Sinclair Spectrum 16k or 48k	●	●	●					●	●
Dragon 32k or 64k	●				●			●	
VIC20 (16k+)	●	●	●	●				●	●
Sinclair ZX81 (16k+)	●								
Grundy Newbrain	●								
Texas TI99 4A	●								
Osborne 1	●								
Sharp MZ80A	●	●	●	●				●	●
Sharp MZ80K	●	●	●	●				●	●
Sharp MZ80B	●	●	●	●				●	●
BBC micro model A or B 32K	●	●	●	●	●	●	●	●	●

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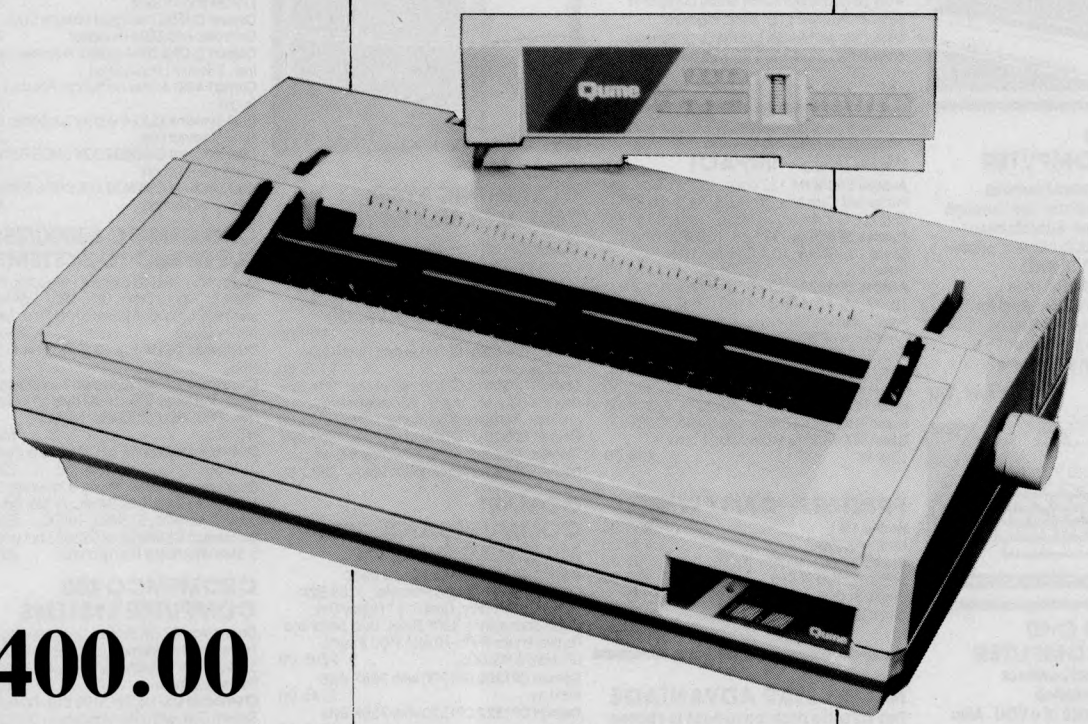

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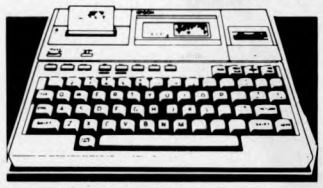

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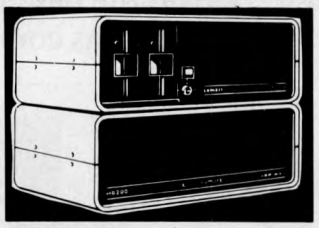

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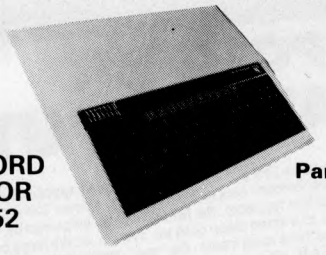

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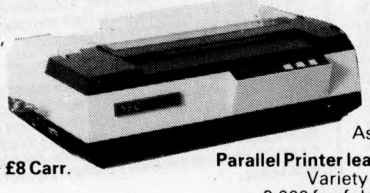

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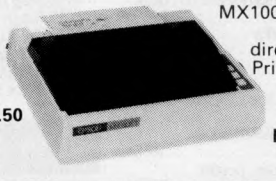

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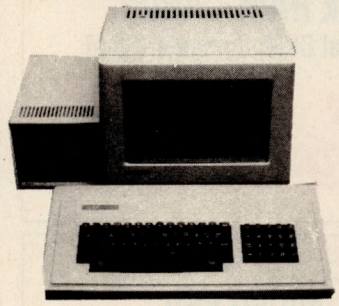

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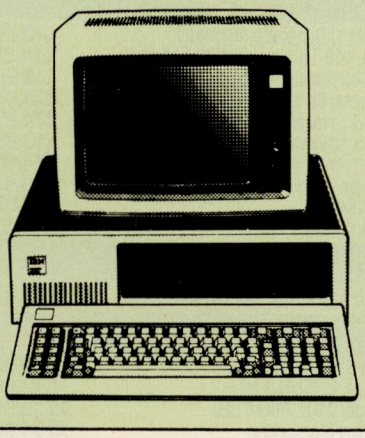

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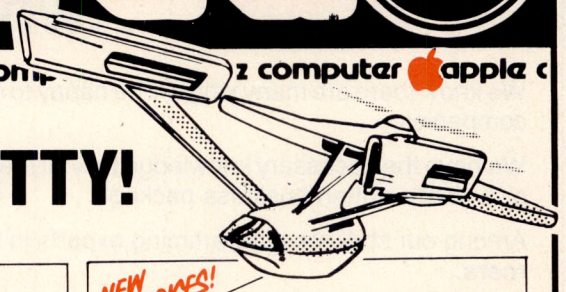

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NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

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We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.

Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.

It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.

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So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9", 12" and 24" monitors plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and 5¼" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 Assembler and COMAL, 2 additional V24 ports, analogue ports and parallel ports.

From now on the sky's the limit.

Software that's hard to beat.

A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

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To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you'll know where to go next.

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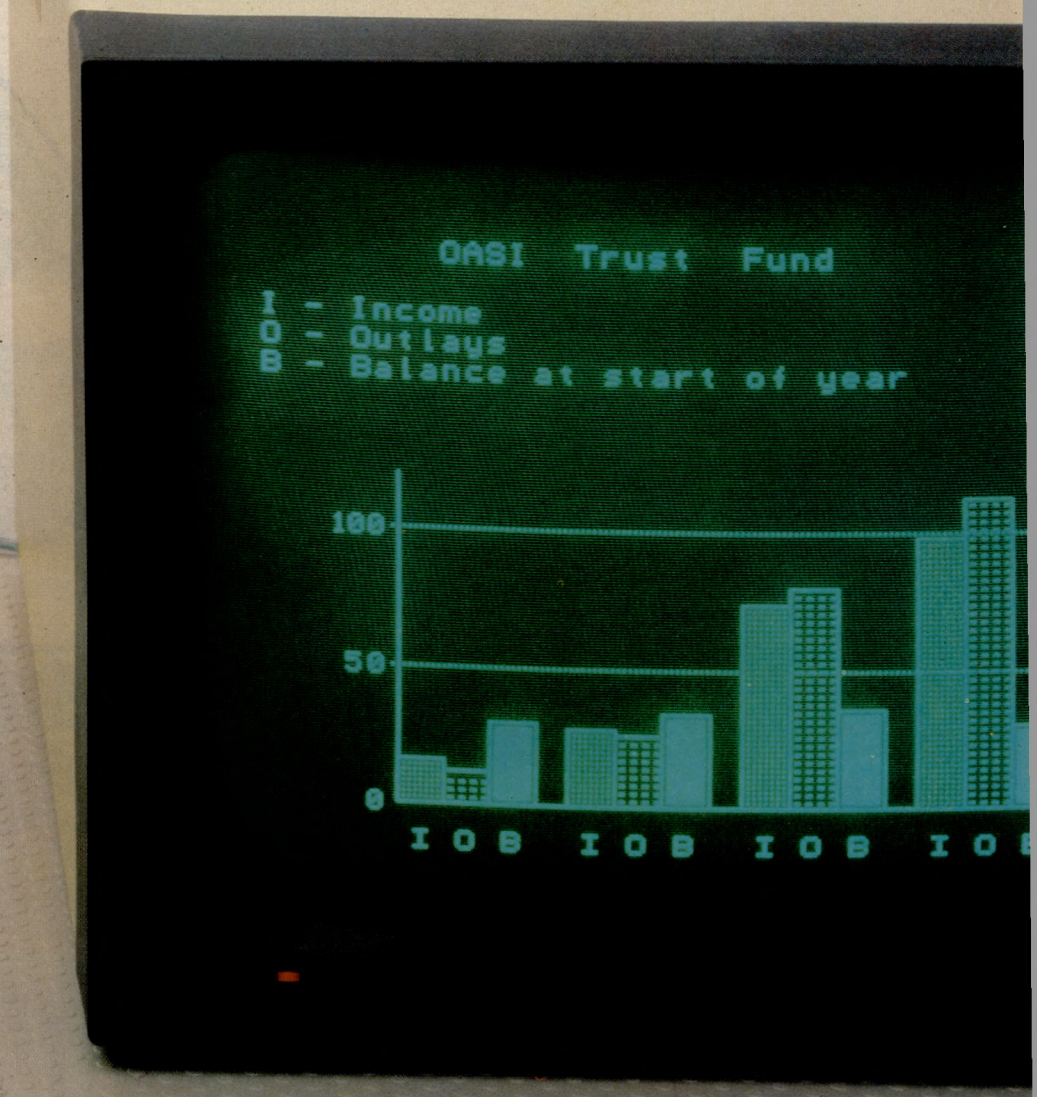

Technical Specifications

The NewBrain is a fully specified professional computer built to the highest standards of engineering and reliability. Chosen by leading OEM suppliers. Designed to facilitate easy expansion for use with the CP/M operating system, and the addition of 5¼ flexible and Winchester disks, 12 green phosphor professional standard monitor, 80 cps professional quality dot matrix printer with pin addressable graphics.

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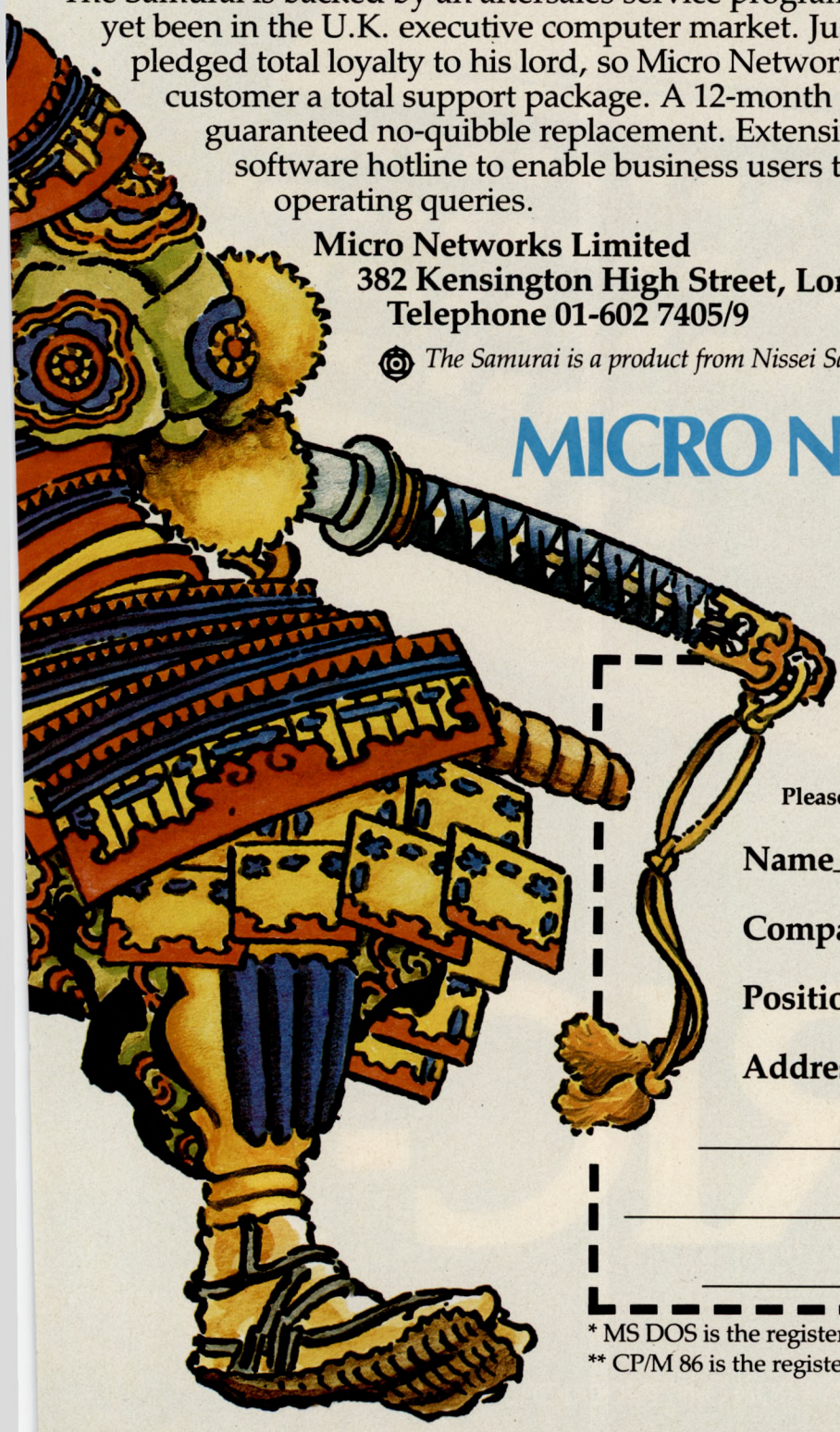

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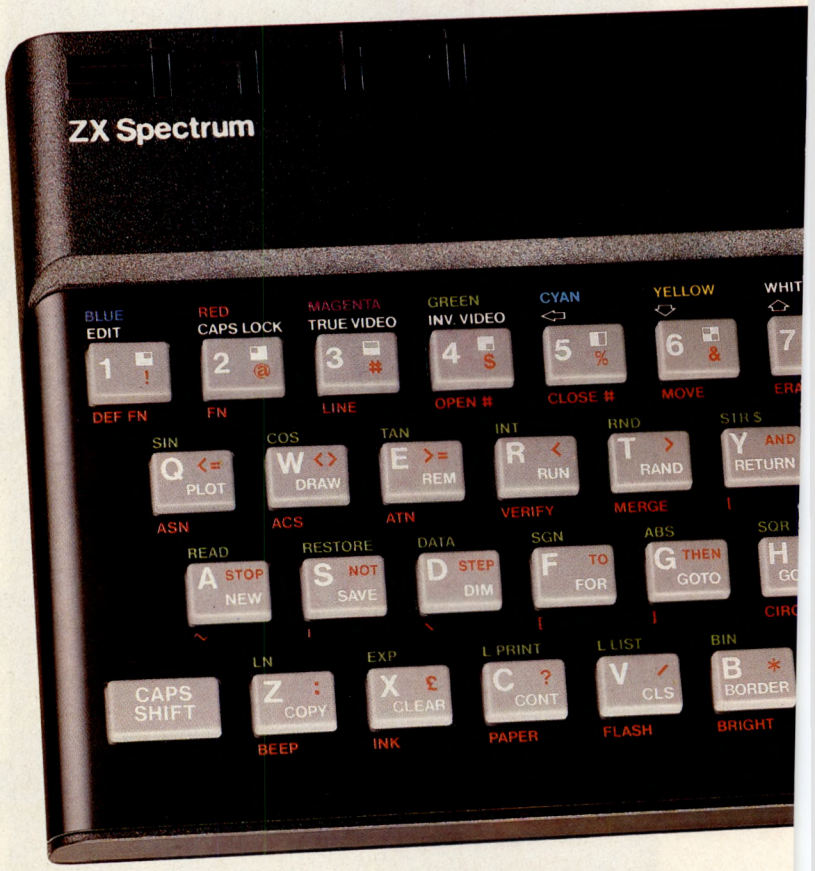

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You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

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You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.



Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um



ZX Spectrum software on cassettes – available now

The Spectrum software library is growing every day. Subjects include games, education, and business/household management. Flight Simulation...Chess...Planetoids...History...Inventions...VU-CALC...VU-3D ...Club Record Controller...there is something for everyone. And they all make full use of the Spectrum's colour, sound, and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

ZX Expansion Module

This module incorporates the three functions of Microdrive controller, local area network, and RS232 interface. Connect it to your Spectrum and you can control up to eight Microdrives, communicate with other computers, and drive a wide range of printers.

The potential is enormous, and the module will be available in the early part of 1983 for around £30.

sinclair

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey GU15 3PS. Tel: Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

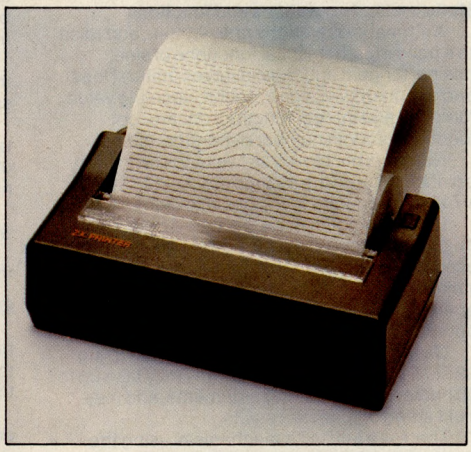
The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

The transfer rate is 16K bytes per second, with an average access time of 3.5 seconds. And you'll be able to connect up to 8 Microdrives to your Spectrum via the ZX Expansion Module.

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.





How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
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Sinclair ZX Spectrum–technical data.

Dimensions

Width	233 mm
Depth	144 mm
Height	30 mm

CPU/ memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.

16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/ speaker.

Graphics

Point, line, circle and arc drawing commands in high-resolution graphics.
16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive–or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

Mathematical operations and functions

Arithmetic operations of +, –, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.

Numbers are stored as five bytes of floating point binary – giving a range of $+3\times10^{-39}$ to $+7\times10^{38}$ accurate to $9\frac{1}{2}$ decimal digits.

Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

String operations and functions

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.

A very powerful string slicing mechanism exists, using the form a$ (x TO y).

Variable names

Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette interface

The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.

IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.

Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY.
ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

sinclair

ZX Spectrum

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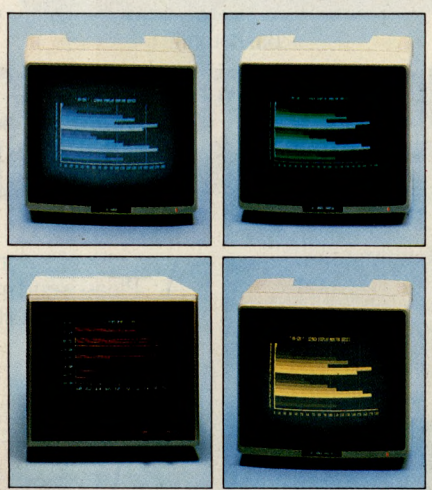

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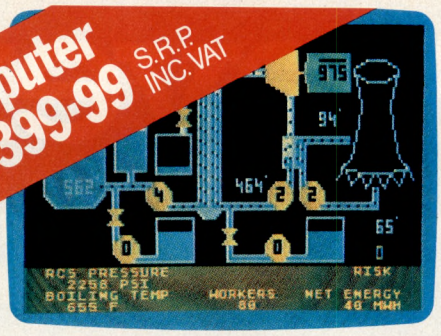
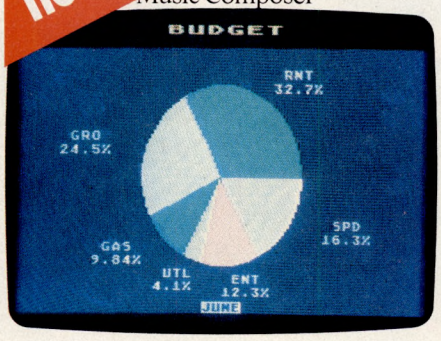
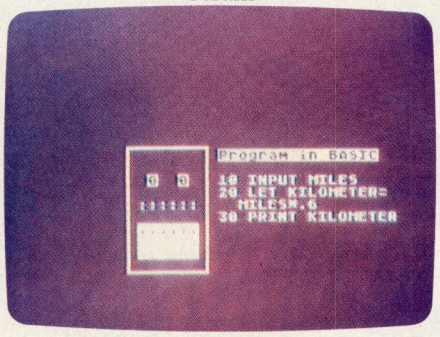


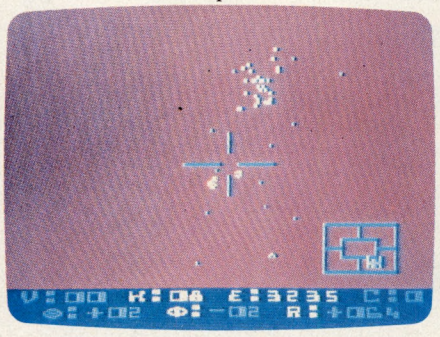
Scram



Graph-it



Intro to BASIC 1



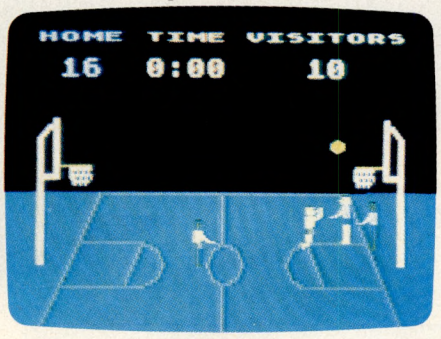
Star Raiders



European Countries



Missile Command



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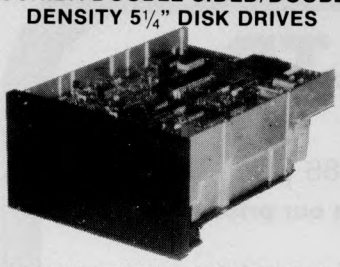

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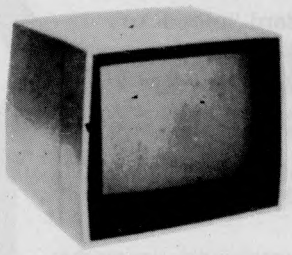

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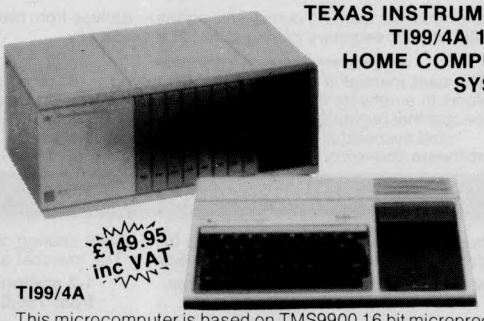

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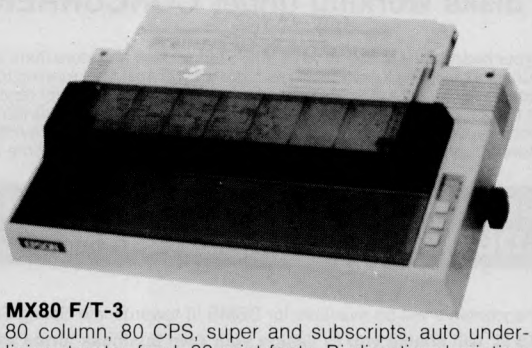

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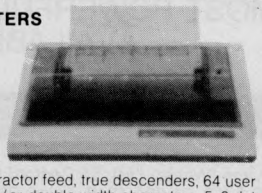

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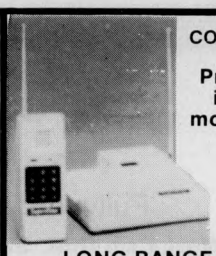
GP-250X New 50 CPS, 80 column, tractor feed, true descenders, 64 user defined characters, double height and/or double width characters, 5x8 dot matrix, parallel and serial (RS232) interface.
GP-250X ..... **£239 + VAT = £274.85**



CORDLESS PHONES
Not licensible in UK
Prices from £79.35 inc. VAT for the model shown on the left.

LONG RANGE TELEPHONE

This is a long range (2-5 miles) cordless extension phone with intercom facility between portable hand set and the base station. You can receive all incoming calls and dial out to anywhere in the world from the hand set from any location within 5 mile radius of your home or office. The maximum range is achieved by using roof top optional antenna (not included).
Long range extension phone.. **£249 + VAT = £286.35**
Optional rooftop antenna ..... **£45 + VAT = £51.75**

MEDIUM RANGE TELEPHONE

Similar specifications to the above model but with operational range of ½ mile to 2½ miles (with rooftop antenna).
Medium range extension phone **£179 + VAT = £205.85**
Optional rooftop antenna ..... **£45 + VAT = £51.75**

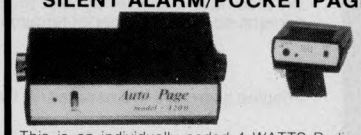
SHORT RANGE TELEPHONE

This is a short range cordless telephone for use within the house or from the garden. You can receive and make calls from the hand set. Range approx. 600 feet.
Short range telephone ..... **£69 + VAT = £79.35**

40 MILE RANGE CAR TELEPHONE

This mobile telephone fits into your car and enables you to receive and make calls to anywhere in the world from within 40 mile radius of your home or office (use rooftop antenna.
Car telephone ..... **£1195 + VAT = £1374.25**

SILENT ALARM/POCKET PAGER



This is an individually coded 4 WATTS Radio transmitter and pocket pager receiver. The alarm system has connectors for door contacts and vibration sensors. 2 vibration sensors are included. It has a range of 2 miles. Ideal for protection of vehicle or property. Power requirements for transmitter is 12V dc. Not licensible in UK.
Price ..... **£75 + VAT = £89.70**

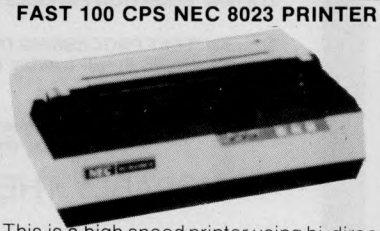
OKI MICROLINE PRINTERS



MICROLINE 80
Fatures: 80 columns, 80 CPS, friction and pin feed. Unidirectional block graphics. Centronics parallel interface.
Price ..... £189 + VAT = £217.35

MICROLINE 82A
FeaturesL 80 columns, CPS, friction and pin feed, bidirectional printing, parallel and serial (1200 bauds) interface.
Price ..... £329 + VAT = £378.35

FAST 100 CPS NEC 8023 PRINTER



This is a high speed printer using bi-directional logic seeking operation, 7x9 matrix for alphanumerics, 8x8 for graphics and bit image printing. Programmable paper feed, original plus three copies, Greek characters and high resolution graphics. The print quality is exceptional, and the price is affordable.
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The invoicer (95 pounds)★★
The address mailer (95 pounds)
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Each module is a set of 'task drives' designed for minimal learning curve. This software derives from modules of 'DBMS III' and runs reports without your secretary having to touch a single key

Consider the advantages in these features: The user manual is contained in FIVE pages • All reports are generated by robot funcions • Reliability Tested (benchtest PCW June) • Works in a network multi-user environment • Fast easy data entry • Files are re-organised and sorted automatically • Produced by the same people that originated 'BUSiness', 'DBMS II', 'DB-CALC', 'AUTOLOAD AND RECOVER' etc and sold successfully over the past five years.

Also see our advertisement next page, the software above comes free with a system purchase (excluding items marked ★★ and DBMS III)

The G80/86 networks

Based upon one hard disk and multiplexor module the G80/86 networks feature full network sharing of data resources by adding different stations that may be as various as Sirius/Victor 9000/IBM/Superbrain/Pet/N'star/Sanyo. The low-cost startup of a network could be simply:

1 hard-disk of 5 mgbytes	**1 multiplexor**	**1-2 stations**
1750.00	**695.00**	**from 795.00**

We also have a special 'spooler module' as well as software controllable port expanders and modems for output to telephones, printers, and screens so that a number of terminals may share the resources of one printer, as well as be able to send files over the telephone at any time (day/night) to both store on the hard disk and print out as well.

Imagine a terminal at a remote site, being able to send/receive its files to/from the main network's hard disk/printer overnight to be examined and processed the next day.

The commands are literal English. Like: (send file 'ledger' to port 'B' (the modem) at 11.30) only from G.W. Computers (the leaders in database).

Call us on 01-636 8210 or 01-631 4818 and leave your address for our standard 'infopacks'.

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With an IBM PCM Modem, dot matrix and daisy printer, to start your day with our robot task disks working under CONCURRENT CPM 86 (tm)

Enter virtual console 0 and telephone your head-office to call all yesterday's ledger files and store them locally on your hard disk. Now switch to virtual console 1 and while console 0 runs concurrently for about an hour, get a 1000 mail-shot running to the daisy printer. Now switch to virtual console 2 and while consoles 0/1 run concurrently, get the 'robot task' of producing a stock-re-order report out to the fast dot matrix. Now switch to virtual console 3 and while consoles 0/1/2 run concurrently, do some programming, or file-reorganising, or any other task you might require. Four virtual computers all running concurrently on one computer, batch processing to various devices or else queue-spooling their output through print buffers of up to 500k storage and spreading the load through time on fewer printers.

Advance notice introducing forward developments of DBMS III 'TURN-KEY' software

Three enhancements will be available for DBMS III towards late Spring/Summer 83

1) a new 'FORMS DBMS III' will enable you to design your own business forms with embedded formulae (ie: quantity, price for invoices) to suit your own particular stationery

2) a new 'EQUATION PARSING DBMS III' will enable you to set up field formulae (as in calc-programs) so that DBMS III will overlap areas of all the 'calc-type' programs currently available

3) a new 'TEXT PROCESSING DBMS III' will enable you to set up letter files, that may be merged with address files for mail-shots so that DBMS III will overlap areas of all the 'word-processing type' programs currently available in a rudimentary manner

That means a DATABASE program, totally resident in the RAM of your machine, leaving you with all the disk space for data, capable of 'calc' and 'text' processing as well as the already unsurpassed features incorporated in DBMS III

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G. W. COMPUTERS LTD

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****** THE NEW DBMS III (series III of the world's first 'task-robot-programs') ******
****** FEATURES ******

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1400 character record sizes
mathematical scratchpad
record relational indexes
translateable to any language
User-defineable reporting
field protection/classification
sorts 'alpha or numeric' any window
either-or.same as.greater.smaller

32000 records per filename
20 main/200 sub fields per record
field and record related formulae
'Jump-to' any of 32000 records per file
random/binary/key/multiple field search
'if-then' questioning
file protection/password entry
speed of 500 records per 20 seconds
range match.not match.integer match

12 online file architectures
240 fields using cross-referencing
cross-record calculations
'Jump-to' any record in 12 files
User-defineable files/field words/sizes
endless 'either-or' matching
formulate/recall on selection criteria
12 interrogation question types
short filing output/audit trails

ONE OF THOUSANDS OF DIFFERENT TASKS ON WHICH THIS PROGRAM MIGHT BE EMPLOYED

DBMS'S MACROS WORK FROM THE MOMENT YOU INSERT THE 'TASK DISK' IN THE COMPUTER'S DRIVE
Simply design your file, give its fields your words, setup your report mask, and then enter your records. Switch to 'automatic drive' and formulate any task you wish the program to fulfill, the task is stored as a macro. Take a copy of the program on another 'task disk' and from then on, the task disk will function without a single keystroke. Think of a number of such 'task disks' such as "stock-re-order reports"; "stock-valuation reports"; "sale-mail-shots"; "production-process-analysis"; "patient history analysis"; "research-analysis"; "budgetting" "purchase/sales-analysis"; "personnel-file-analysis"; "vehicle-location control"; "librarian analysis"; "plus more?"

Previous issues showed examples of 'employees-short-list', 'garage stock re-order', 'sales analysis', 'librarian's list'. Here is an example of a hospital's patient index and some reports it might generate.

The record may look like this:
1- record number (23)
2- patient (John Smythe)
3- date of birth (1.5.45)
4- date of last visit (12.2.82)
5- symptom (epigastrium ache)
7- diagnosis (peptic ulcer)
8- test type (barium meal)
9- prescription (100mg carbenoxolone sodium 3 * daily)
10- effect/other (minor improvements/test for surgical treatment)

One report might be: select??
all records where patients have had symptoms of 'epigastrium ache'
associated with nausea or vomiting
not diagnosed as peptic ulcer.
Print a list of those where there were barium tests made and the effect.

Another report might be: select??
all records in the file where the diagnosis of ailment was peptic ulcer or duodenal ulcer, and then where the treatment was carbenoxolone sodium and in the first instance list those where there was no improvement; after which list those where there was an improvement

DBMSII (WITHOUT MACROS) AND DBMS III ARE FULLY IMPLEMENTED UNDER CPM-86 (tm) AND MS-DOS (tm) ie: <SIRIUS/VICTOR/IBM> DBMSII IS 395.00 (or 250.00 by mail order ex. training). DBMSIII is 575.00 (or 295.00 by mail order ex. training).

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All prices marked £ are 8/16 bit machines

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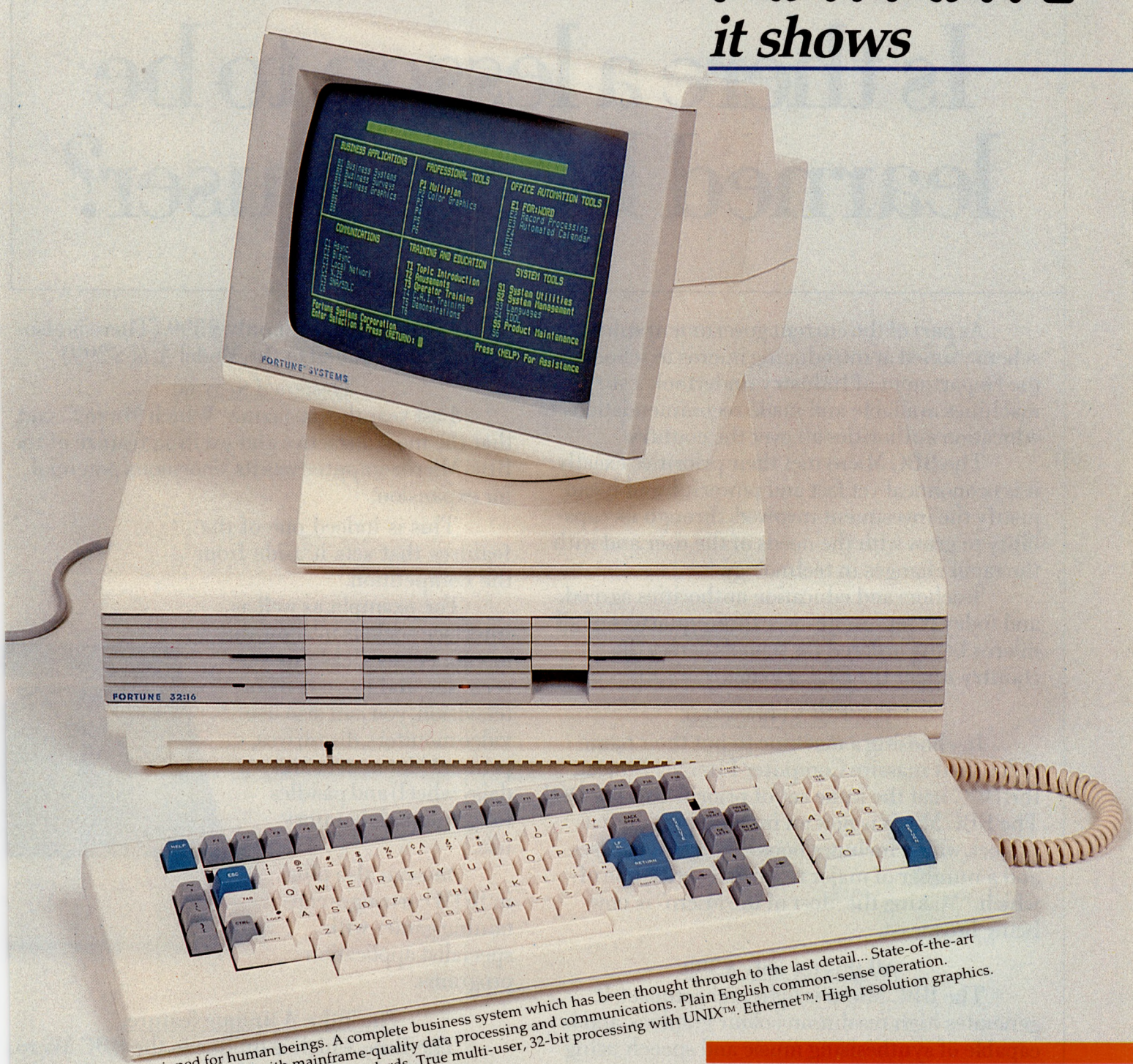

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Three out of every four computers going into schools are BBC Micros. Is there a lesson to be learned by every user?

As part of the current government subsidised scheme aimed at introducing micros to schools, the Department of Industry undertook a survey of machines available and made recommendations to education authorities all over the country.

The BBC Micro met their priorities exactly: it is economical yet fast and powerful, and it can justify the investment involved, through its capability to grow with the needs of the user and with the rapid changes in technology.

Teachers and education authorities agreed, and today it represents over three-quarters of all micros being ordered for schools across the country under the DOI scheme.

The BBC's choice too.

In choosing a machine to put their name to for their massive Computer Literacy Project, the BBC had the same set of priorities as the DOI. The BBC Micro is now an integral part of that project, which includes books, software, courses and a number of major television series, one of which, "Making the Most of the Micro" is now being broadcast.

All this for only £399.

The BBC Micro is light and compact. It generates high resolution colour graphics, and is capable of synthesising music and speech using its own internal speaker. The keyboard uses a conventional layout and typewriter feel.

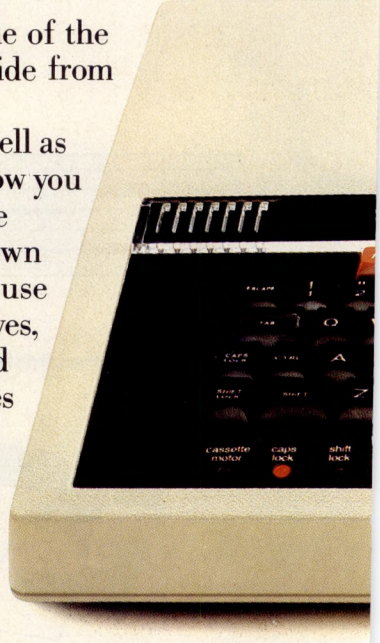
The most sophisticated version (called Model B) is available for only £399. (There is also a basic model available, the Model A, at £299.)

Designed to grow.

Last year the magazine "Which Micro?" said that the most attractive and exciting feature of the BBC Microcomputer was its 'enormous potential for expansion'.

This is indeed one of the features that sets it aside from the competition.

For example, as well as interface sockets to allow you to connect to a cassette recorder, and to your own television, you can also use video monitors, disc drives, printers (dot matrix and daisy wheel) and paddles for games or laboratory use.



You can also plug in ROM cartridges containing games with specialist application programs.

The Tube. A unique feature.

The Tube, which is unique to the BBC Micro, provides for the addition of a second processor via a high speed data channel. The possibilities are enormous. For example, the addition of a second

3MHz 6502 processor with 64K of RAM doubles processing speed. While a Z80 with 64K of RAM opens the door to a fully CP/M* compatible operating system, with all the benefits for business applications.

Linking up with other computers.

The BBC Micro also offers a facility of immense potential value to schools, colleges and businesses. It's called Econet® – a system which uses telephone cable to link with other BBC Micros. A number of machines can then share the use of expensive disc drive and printer facilities.

Make full use of Prestel & Teletext.

With special adaptors you will not only be able to turn your TV set into a Prestel terminal and Teletext receiver, but you can also take data and programs direct from these services. (The programs, which are known as telesoftware, are already being broadcast by BBC's Ceefax service.) This is another first for the BBC Micro.

BASIC plus.

A sophisticated version of BASIC has been chosen for the BBC Micro, which incorporates features normally found only in more advanced high level languages. However, there is also a facility allowing access through a simple command to another language – for example, PASCAL, FORTH and LISP.

*Trademark of Digital Research.



A full range of software.

Applications software for the BBC Micro already cover a very wide field. Packages covering games, education and business applications are available on cassette. All developed to the same high standards set by the hardware.

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If you are a credit card holder and would like to buy a BBC Micro B, or if you would like the address of your nearest stockist, just phone 01-200 0200.

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FACT Ricoh Flowriters perform **all** your processing and printing needs while leaving the host computer free for other work.
FACT Ricoh Flowriters do all this, give you exceptional print quality, yet **cost the same as ordinary daisy wheel printers!**

FEATURES
- Internal microprocessor
- 8K buffer under full program control
- Includes RS232, Centronics and IEEE 488 interfaces
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- Auto-bidirectional and logic seeking high-speed printing
- Graphics capability down to 1/120"
- Built-in proportional spacing tables
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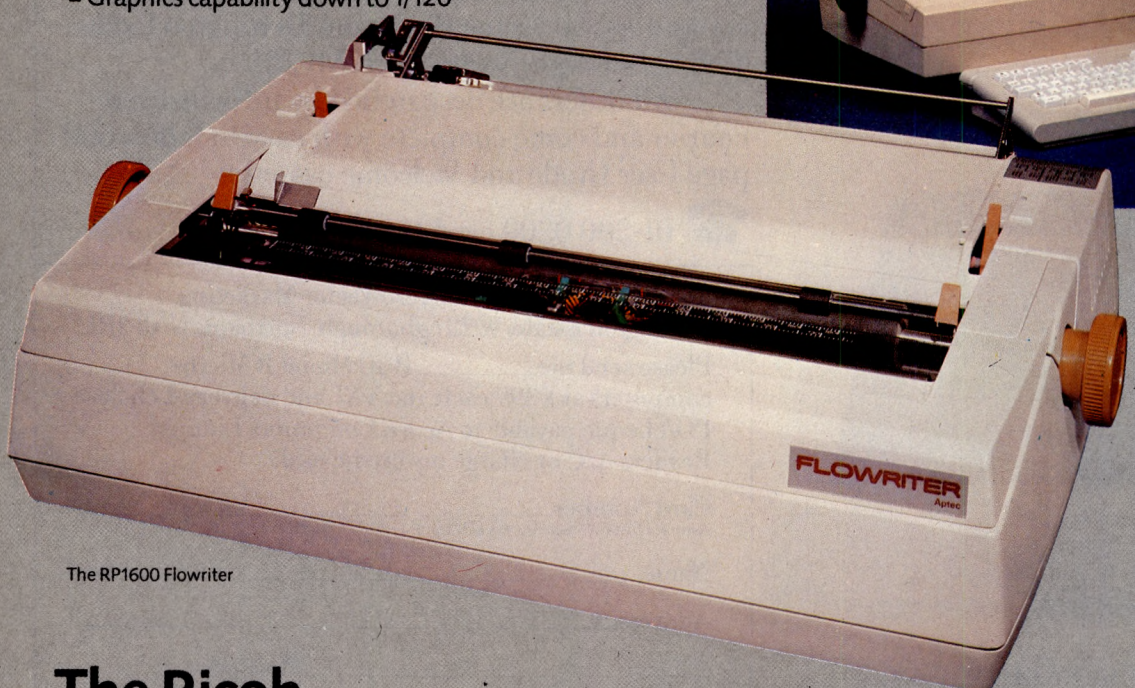
- 128-character printwheels, wide choice of fonts
- Wide range of accessories – sheetfeeds, tractor feeds, ribbons, printwheels
- Detachable keyboard option for using Flowriter as an intelligent typewriter or KSR terminal

For intelligent printing that frees the host computer **and** gives you exceptional print quality and speed, find out more about the Ricoh Flowriter – the printer that **knows** it's a computer, yet costs the same as those that aren't!



The RP1300 Flowriter



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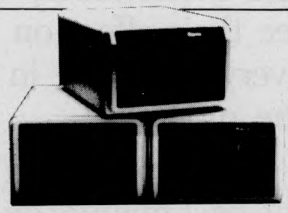

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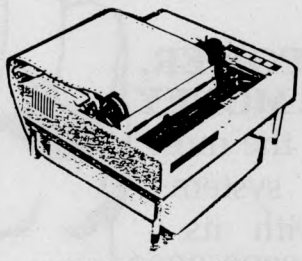

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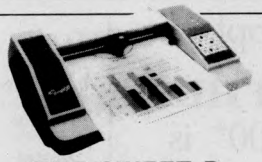

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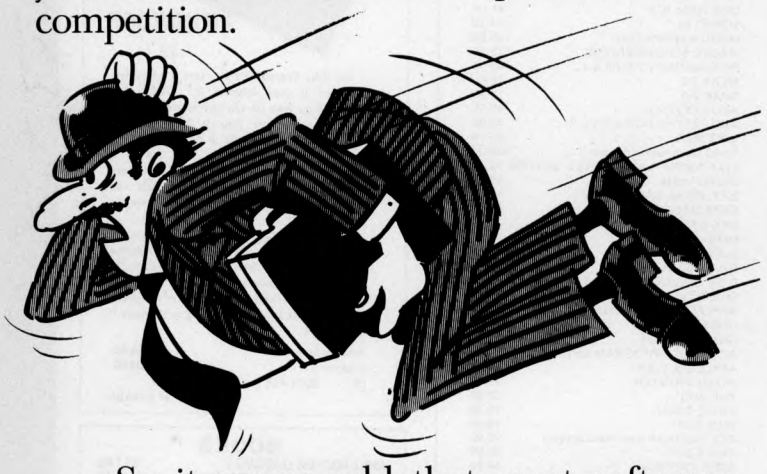

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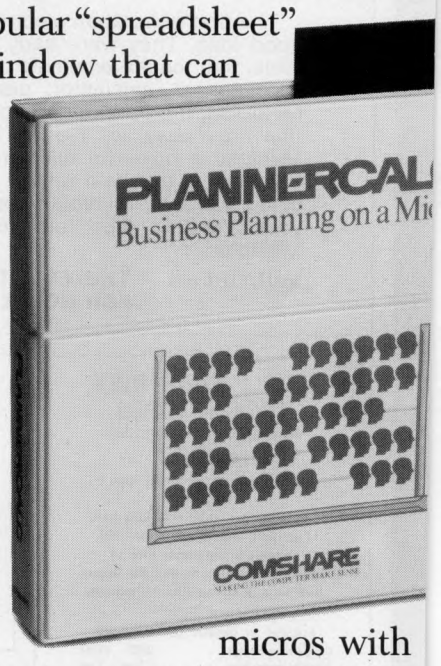

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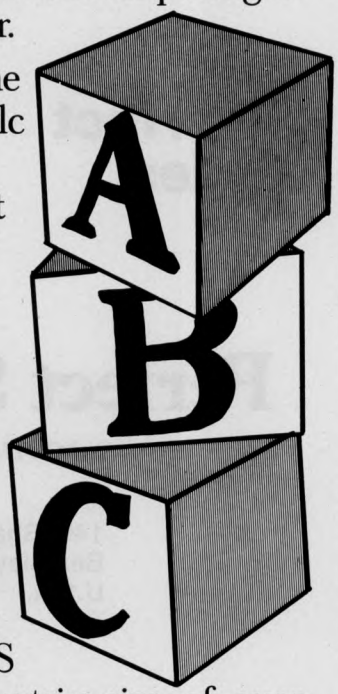

It works on exactly the same system as PlannerCalc and models written on PlannerCalc run without modification on MasterPlanner.

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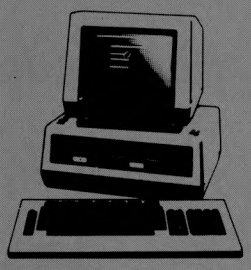

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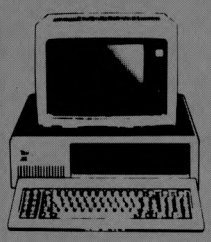

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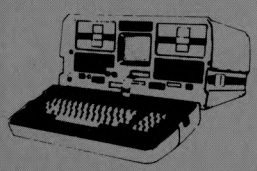

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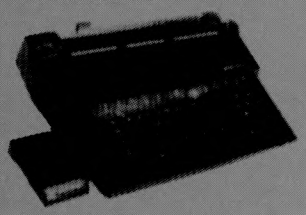

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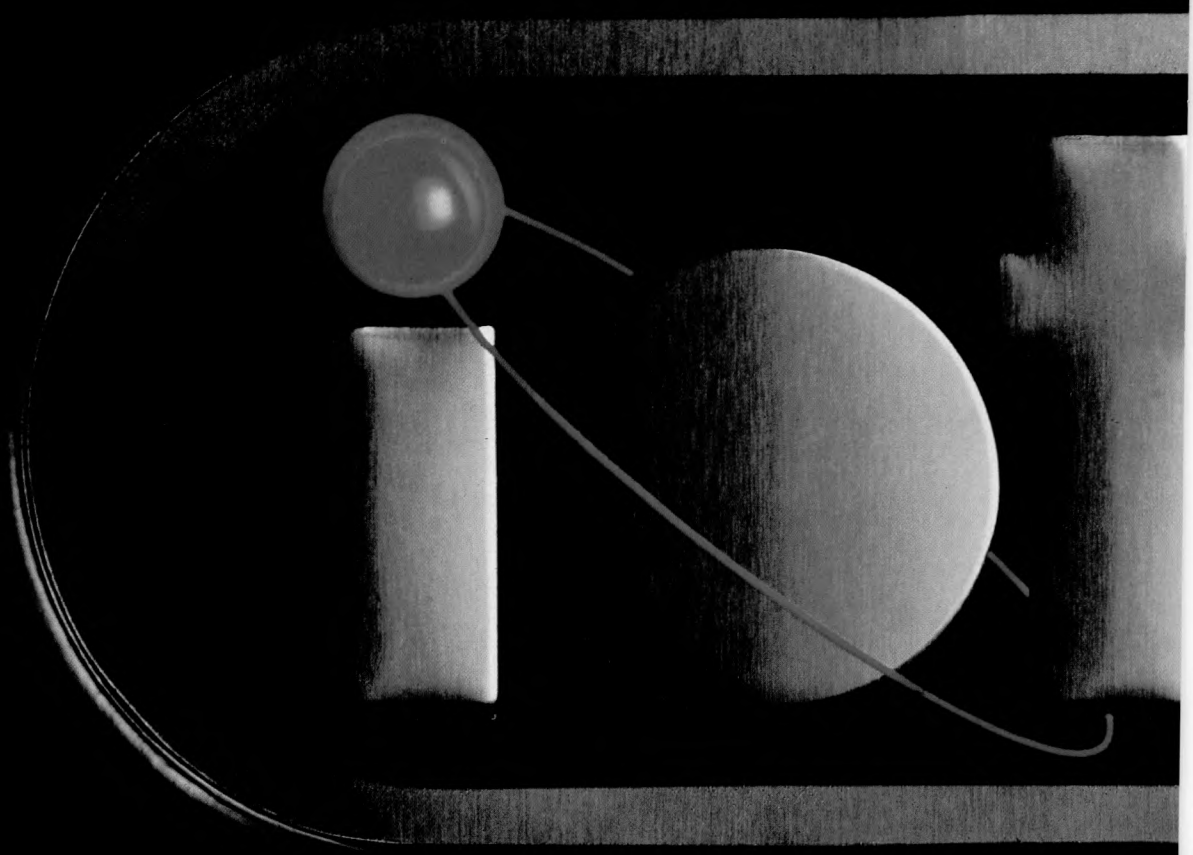

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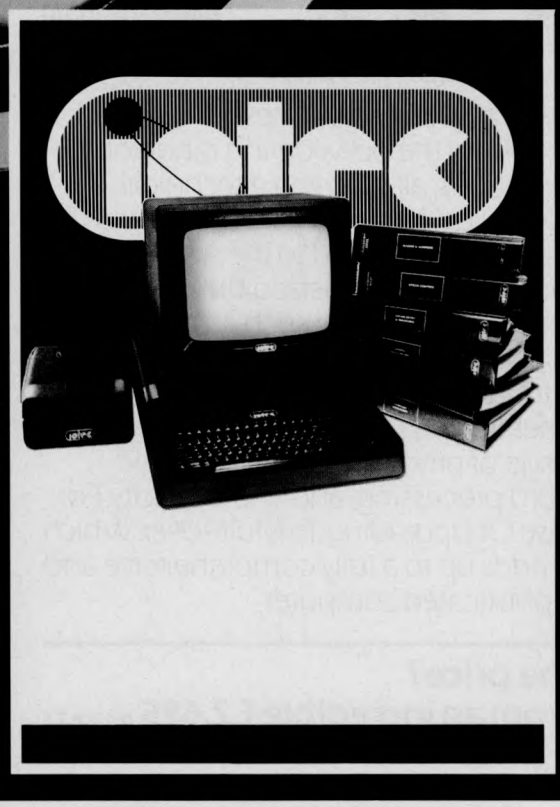

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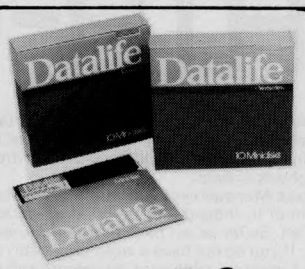

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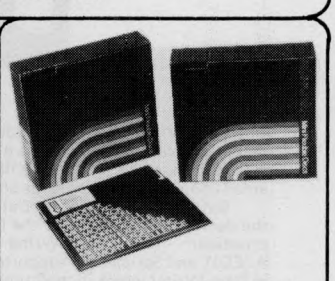

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Data-Writer approaches Database Management in an entirely different manner in that, subject to one or two requirements, it is not concerned as to how the database came about or the form of it. Indeed, one of the most attractive features of the program is that the data itself can even be written on a word processor — not by Data-Writer at all. So far as we have been able to ascertain, any word processor may be used that writes a plain ASCII file. Certainly AJEDIT and Scripsit are supported. If you do not have a word processor, or do not wish to use it for the manufacture of your database, then there are sections in Data-Writer which in themselves constitute mini word processors and enable the user to manufacture a database very easily.

In the foregoing paragraph we use the words "word processors" in the plural, and this gives a clue to a rather important feature of Data-Writer. The whole concept of the software is that it is a **Management** program. A number of earlier databases have suffered very seriously from what the author no doubt thought was economic writing, in that if a section of a program (for instance the word processing section) is used by a number of sections, only one is included and is accessed by various sections. At first sight this might indeed appear to be economic writing and we suppose in fact it is, but the result is that the disks are continually thrashing around as access is made to them. Disk access is probably the slowest task that the CPU carries out and if it is done frequently it slows the program down very considerably. Many past Database Management programs have suffered from this deficiency. Data-Writer on the other hand has a mini word processor in each section of the program where it is needed. This has the great advantage of obviating the necessity for the drives to be thrashing around, but almost as importantly means that the format of the mini word processor can be changed for the various sections of the program, so that the best advantage can be made of it in each. Thus every section is entirely separate and gives a very high degree of efficiency and user friendliness.

There are very few restrictions with Data-Writer. The number of records which one can handle in any given database is, essentially, unrestricted although any that span disks would have to have different names. In any event as the Sort section of the program does have a restriction of sorting 4,500 records at a time, this effectively imposes a restriction on the length of the file if one intends to be able to sort it all at one time. The maximum number of fields permitted to a record is 20 and the maximum number of characters per field depends on whether you use the Entry section of Data-Writer to enter your data or whether you use a word processor. In the latter case the maximum number of characters per field is 240. In the former it is 35. The maximum number of characters per field label or title is 20.

Data-Writer has a very powerful mathematical section whereby many complex mathematical functions can be carried out on your data. Up to 20 equations may be defined per run. The section will have available 10 scratch pad memories for use and as the calculations are carried out in double precision they will be carried to 16 decimal places.

Data-Writer also contains a very powerful "Mail Merge" section. Almost any personalisation can be added to a letter or report, and once again the letter or report may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be of any length up to 6,000 characters, which we believe is about two and a half A4 sheets.

The Sort is a two level one and supports the extraction of stipulated data from a field. It is what might be called of fair speed. The two key levels make it powerful but as the Select section is so good, the Sort does not get used as often as would be the case in other Databases.

Data-Writer is made up of 10 sections or sub-programs as follows:

Entry	Manage	Maths	Sort	Letters
Edit	Statistics	Select	Labels	Reports

We have aleady mentioned many of them, others such as Edit are self-explanatory. The Labels section enables you to create pretty well any form of label required, including the ability to have them printed up in a from one to four across format. The Letters section enables you to create a form letter in Data-Writer if you do not wish to use an external word processor. Statistics is a method for searching the database for errors, and as the title suggests, extracting essential statistics from it.

The important sections not yet touched upon are Manage and Select. Taking the latter first, this section enables you to create a sub-set of the database by selecting from the file contents. It is immensely powerful and supports nine equivalency relationships, such as "less than" or "greater than" etc. Furthermore, the two logical relationships AND and OR may be used freely. In this way one can Select from the database to pretty well any specification required. The Management section of the program enables the user to completely re-structure his database without having to Edit it manually. New fields may be added or old ones deleted. They may be re-arranged or even appended one field to another. Indeed, this can be taken even further in that the whole database may be merged or split as required.

The Reports section enables the user to write reports such as inventories, accounts, bibliographies, insurance coverage report, in fact an endless list of applications. Because the Report section contains its own Text Editor, the report contents and format can be controlled at will and literally an infinite number of formats may be adapted.

Data-Writer is one of the most powerful Database Management systems that we have seen available for a microcomputer and certainly is the most powerful that we have seen for the TRS-80 and Video Genie machines. Once the database has been manufactured, either by Data-Writer or a word processor, one has complete and utter control over it and the ability to manipulate any part of it; not only the ones mentioned above, but many others which we have not had the space to list. Data-Writer is compatible with the Model I and Model III Tandy machine, the original Video Genie, together with the Genie I and II. A version for the Model III Genie will be available shortly.

Data-Writer is Compiled Basic, hence its DOS compatibility is dependent upon the compatibility of the Microsoft Compiler. Due to Microsoft's disinterest in supporting any other DOS apart from TRSDOS and the non availability of a Tandy Model III Compiler, we recommend customers to use Data-Writer with TRSDOS or LDOS on the Model I and the proprietary DOS supplied on Data-Writer for the Model III. Other DOS's may well be compatible after patching and as we have said the criteria is whether they are compatible with the Microsoft Compiler.

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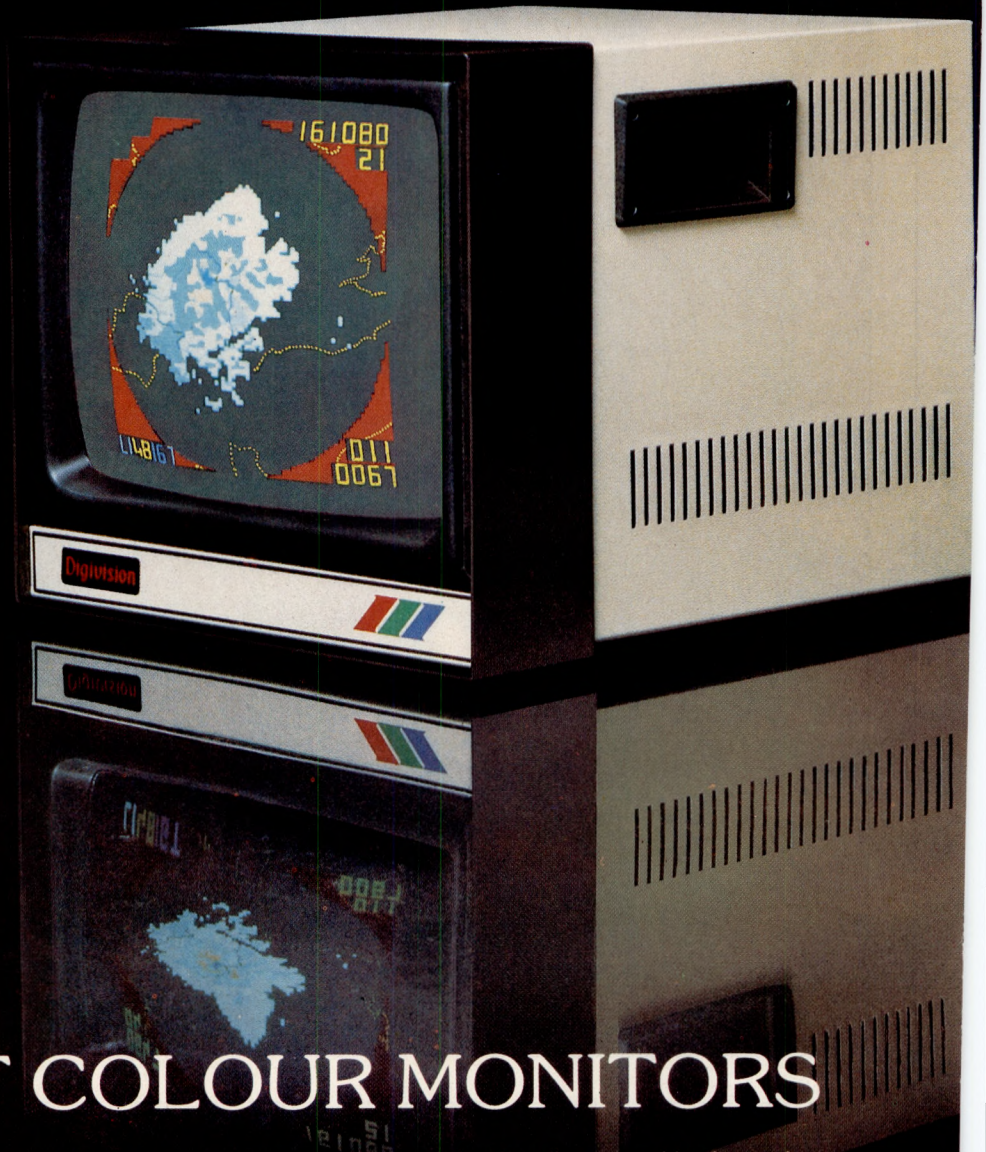



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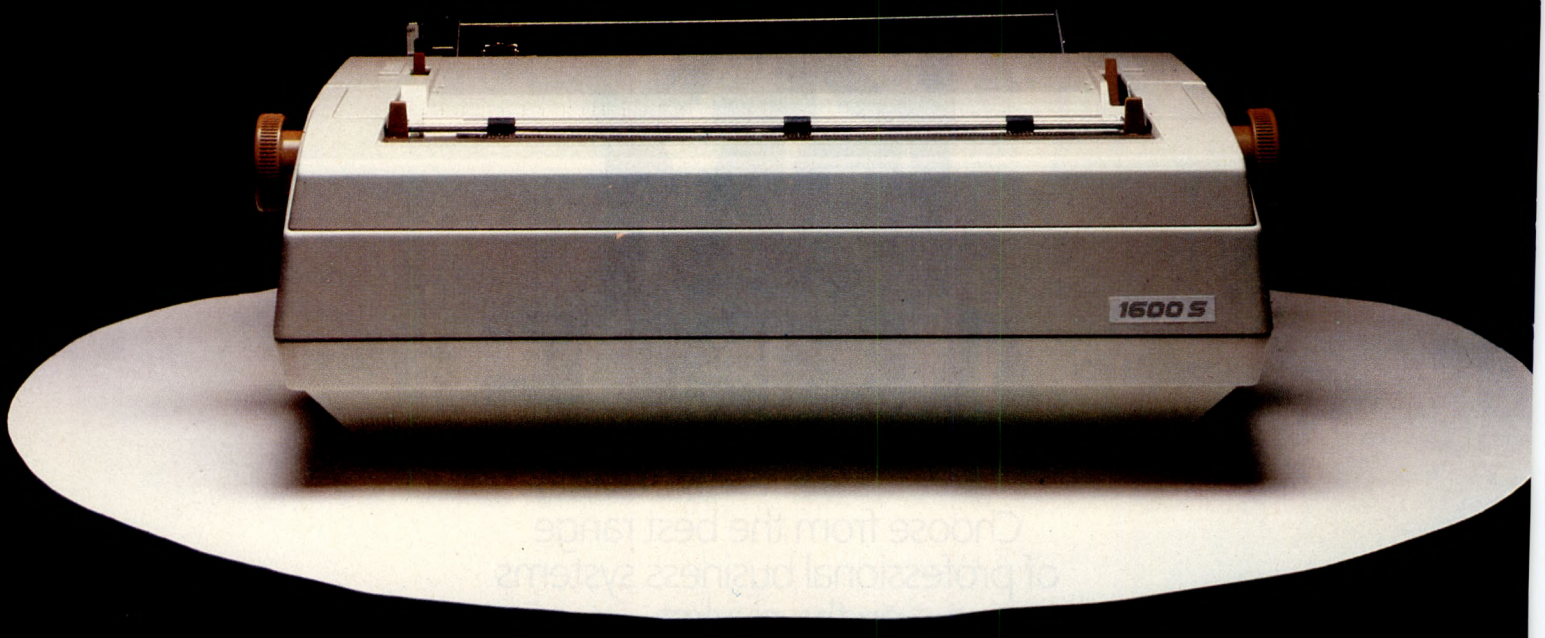

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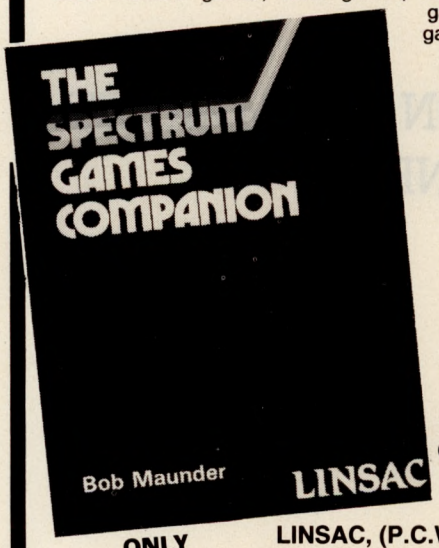

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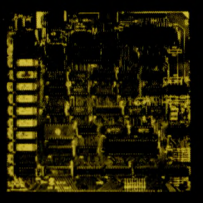

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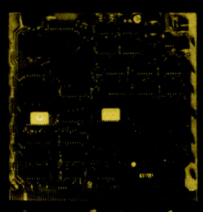

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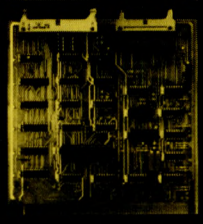

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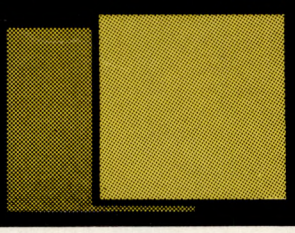

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EXTENDED MICROSOFT COLOUR BASIC (as standard). Featuring: ADVANCED GRAPHICS (set, line, circle, paint, print, draw, rotate and print using). ADVANCED SOUND 5 octaves, 255 tones. AUTOMATIC CASSETTE RECORDER CONTROL. FULL EDITING with INSERT and DELETE.
9 COLOUR, 5 RESOLUTION DISPLAY.
USE WITH ANY U.H.F. TV and/or separate P.A.L. monitor.
PROFESSIONAL QUALITY KEYBOARD. Typewriter feel. Guaranteed for 20 million depressions.
PRINTER (Centronics parallel).
JOYSTICK CONTROL PORTS.

FIRE YOUR IMAGINATION.

Learning how to use the Dragon 32 won't cause you to experience any problems. Learning what you can use it for will cause you to experience something entirely different.

Delight. Surprise. Fascination. And challenge.

The Dragon offers a range of some of the most popular computer games in the world. From those celebrated space battles to mind-boggling adventures in seemingly unfathomable dungeons and caves.

As if by magic, a simple typed message will command the Dragon to create your own drawings. Then it will colour and paint them in a variety of colours.

And it's clever enough to create virtually any image you want - circles and arcs as well as straight lines.

The Dragon will also play and compose music with you, with a range of 5 octaves. And it works with any UHF TV or PAL monitor.

LEARNING THROUGH PLAYING.

All of this makes the Dragon the ideal machine to build your children's interest in the world of computers as they become increasingly more vital. School-children already enjoy using computers.

The Dragon is the first computer specifically for the family - so by enjoying yourselves at home, you and your children can soon become expert enough to create your own programs.

Listed here is a sample of some of the more popular cartridges and cassettes available from Dragon's vast range of software.

GHOST ATTACK	Cartridge. An exciting maze game for one or two players.
PERSONAL FINANCE	Cassette. Keep track of family finances, create address lists and directories.
METEROIDS	Cartridge. Guide your ship through the treacherous asteroid belt. Requires skill, fast reactions and concentration.
CHESS	Cartridge. With 9 levels this is nearly impossible to beat.
CALIXTO ISLAND	Cassette. Avoid the eerie goings-on and escape from this evil island.
ASTROBLAST	Cartridge. Shoot the enemy spacecraft before they get you. (Action packed.)
COMPUTA VOICE	Cassette. Make your Dragon speak. Using phonetic sounds, even regional accents can be produced.
TYPING TUTOR	Cassette. Teach yourself to type accurately. Improve your speed and accuracy.
BERSERK	Cartridge. A challenging shooting game based on the popular arcade game.
GRAPHIC ANIMATOR	Cassette. Create simple cartoons on the screen, then animate them.
COSMIC INVADERS	Cartridge. Dragon version of famous arcade game. 15 levels of difficulty.
MADNESS AND THE MINOTAUR	Cassette. A real-time adult strategy game, descend into the labyrinth of King Minos in search of treasure.

BRILLIANTLY SIMPLE GUIDE.

The Dragon is living proof that you don't have to be an expert in computerspeak to be an expert in computers. It comes with the easiest-to-understand instruction manual ever written for a home computer.

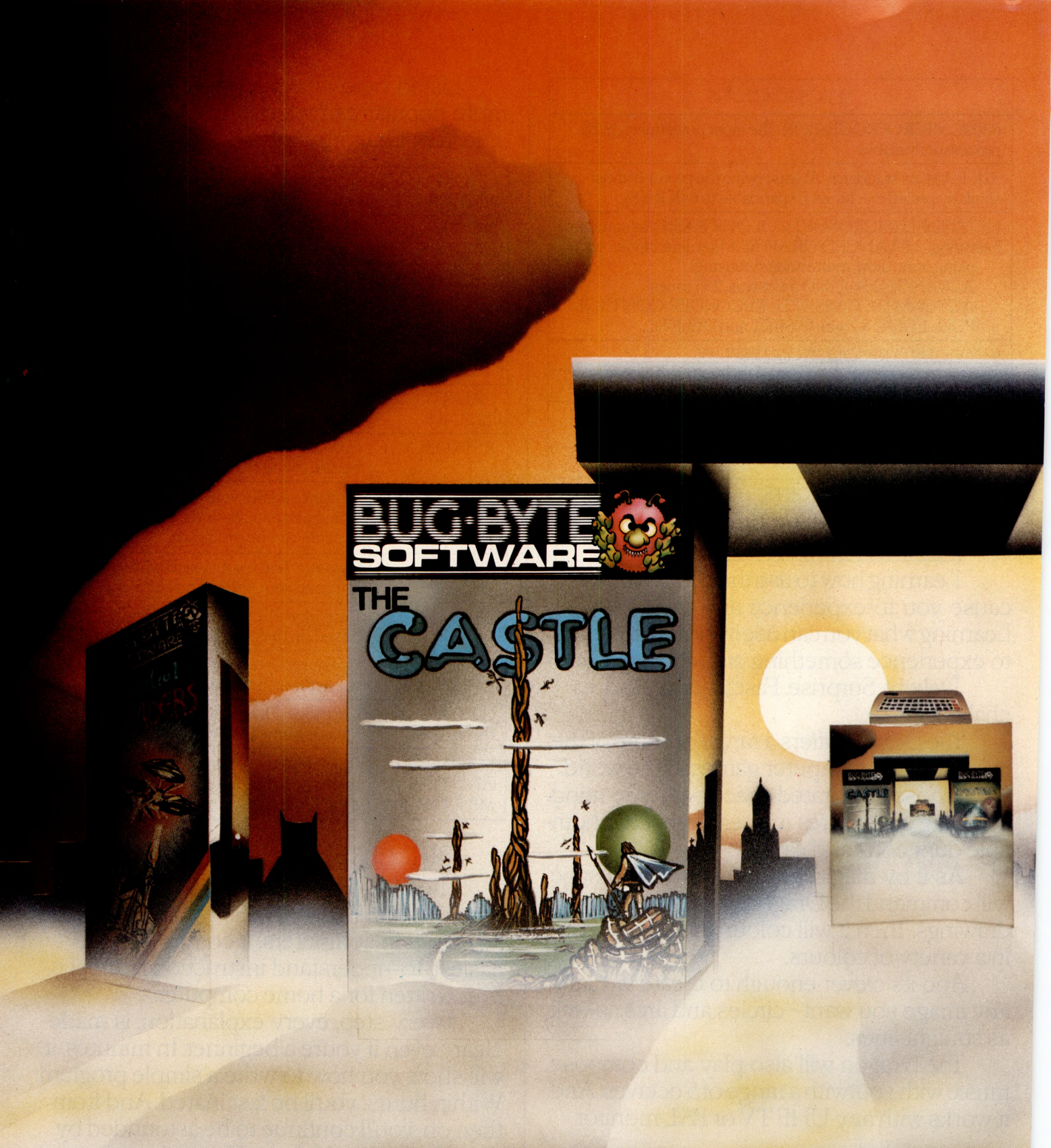
Every step, every explanation, is made clear - even if you're a beginner. In minutes, it will show you how to write a simple program. Within hours, you'll be fascinated. And from then on, you'll continue to be astounded by the new world which the Dragon's power and versatility will open up to you.

See the new Dragon 32 in your High Street. At under £200, it's not just the first family computer. It also has all the features an expert could wish for.

Except perhaps the jargon.

DRAGON 32

The first family computer.



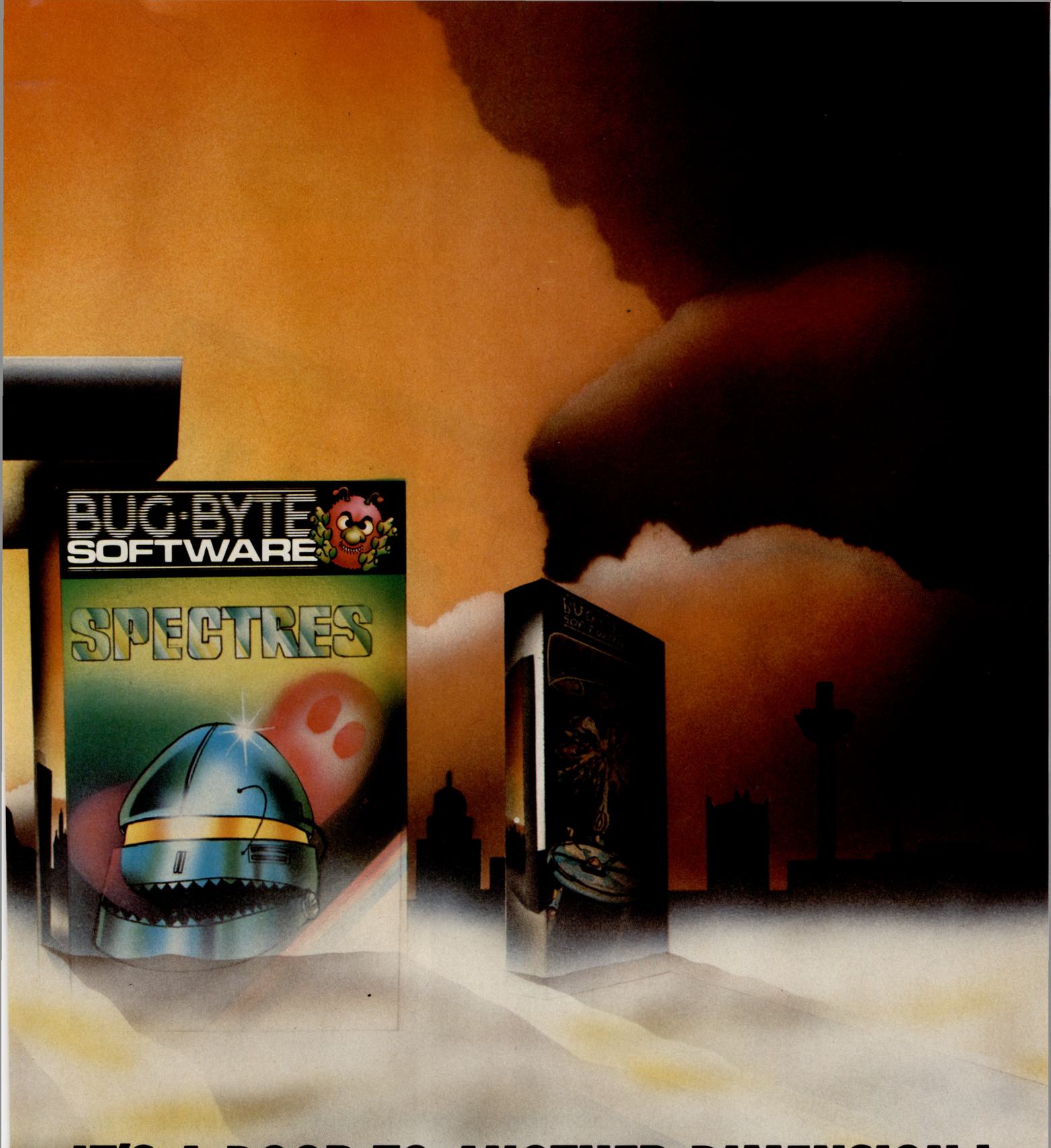
BUG-BYTE SOFTWARE, MORE THAN A GAME

All about me was darkness. Tens of thousands of screens stared blankly into space. Minds drifted aimlessly, dulled by lack of stimulation. The world was grey, drab, lacking . . .

Then suddenly it happened. First one, then another, then tens, hundreds, thousands of tired screens felt a surge of power and flickered back into life. They were much as I had seen on my own planet's microcomputers – the ZX 81, ZX Spectrum, Vic 20, BBC Micro and ORIC-1.

The minds paused to take stock. They clustered round the screens, their nimble fingers excitedly flicking the controls back and forth. At last they had found a challenge . . . action and adventure with cunning tests of dexterity and reaction. Everywhere, conversation was of Asteroids, Mazogs, Panic, Another Vic in the Wall.

Unable to resist, I too had a closer look. There before me was vivid colour, high resolution graphics. I could practically feel the spine-tingling



...IT'S A DOOR TO ANOTHER DIMENSION !

sound effects as whole battle fleets of Cosmiads swarmed out of nowhere and attacked. I should have known. As my fingers raced over the controls, and I prepared to stand and fight with only a single laser bolt for protection, I realised I was trapped!

Too late now, I remembered this was no ordinary software. I'd been warned, as I now warn anyone buying from Laskys, W.H. Smith, Currys Micro C, Spectrum and larger branches of Boots, and a nationwide network of dealers stocking Bug-Byte. Because Bug-Byte is more than a game, it's a door to another dimension. One that I had opened.

BUG-BYTE SOFTWARE

100 The Albany, Old Hall Street, Liverpool L3 3AB

Make Friday you



Friday, March 11th sees the launch of Britain's most exciting microcomputing publication. Big deal.

You've heard all that before, eh? Over the last year, everybody and the cat's mother have been launching microcomputer publications.

And most of them cost the better part of a quid.

And the really good ones are rarer than hen's teeth.

So here's the good news.

★ **Personal Computer News** is weekly.

Around a hundred pages printed on glossy paper, much of it in full colour.

★ **Personal Computer News** is only 35p.

★ **Personal Computer News** is edited by the largest editorial team working on any microcomputer publication in Britain. We have individual editors working on hardware, software, peripherals, features, listings and programs - fourteen of them in all.

A massive investment of talent and expertise with only one aim. To make **PCN** the finest microcomputing title in Europe.

★ Our deadlines on news and features are short.

That means we get to publish comprehensive hardware tests, software reviews, news and much else besides, weeks and weeks before monthly publications can hope to do so. (For example, this advertisement was prepared at the end of January and we'll be lucky to squeeze it in

r day of discovery.



the March issues of those monthlies brave enough to carry it. Get the point?)

Personal Computer News will carry scoop reviews and tests in virtually every issue.

Whatever your particular interest in the world of microcomputing, you'll find it first in **PCN**.

★ **Personal Computer News** comes from the publishers of Personal Computer World.

That means you can rest assured on the quality and independence of the editorial package. Certainly we need ads to be able to offer such a package for only 35p, but they won't be allowed to swamp the editorial content.

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NEW FROM ACT



The 10 Megabyte Winchester Sirius — — £3995·00

Once again, ACT introduces a new price/performance breakthrough in personal computing: An ACT Sirius 1 16-bit personal computer with 128 Kbytes of RAM **COMPLETE** with integral 10 Mbyte Winchester for just £3995.

And, it's available now. Ready to take on the large business applications that previously called for much more expensive minicomputer systems.

Both access speed and data integrity are enhanced compared with floppy-based systems. The user can divide the disk into multiple volumes each of which appears as a discrete entity. And more than one operating system can access the Winchester.

Like all the Sirius range it's backed by the strength and resources of ACT: The PULSAR range of true 16-bit application software for accounting, planning and word processing; ACT Training Centres in London and Birmingham open to all; nationwide field service; a full range of printers and consumables. And, the most complete and professional dealer network in personal computing.

The new Sirius Winchester is the latest addition to the 16-bit ACT Sirius 1 family. Prices start at just £2395 for a dual floppy drive system with 1.2 Mbytes and £2895 for the double-sided floppy drive version offering 2.4 Mbytes. All provide an Intel 8088 16-bit processor and 128 Kbytes of RAM.

NEW SIRIUS WINCHESTER: THE FACTS

Winchester Subsystem

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- 218 msec average access time
- Intelligent disk controller
- DMA interface to system memory
- Multiple operating systems
- User configurable

General Specifications

- 128 Kbytes RAM
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- 1.2 Mbyte double-sided floppy disk drive for back-up
- 800 x 400 pixel high resolution graphics
- Multiple operating systems
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- User port

For more information on the new Sirius Winchester clip the coupon and return to

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SC1

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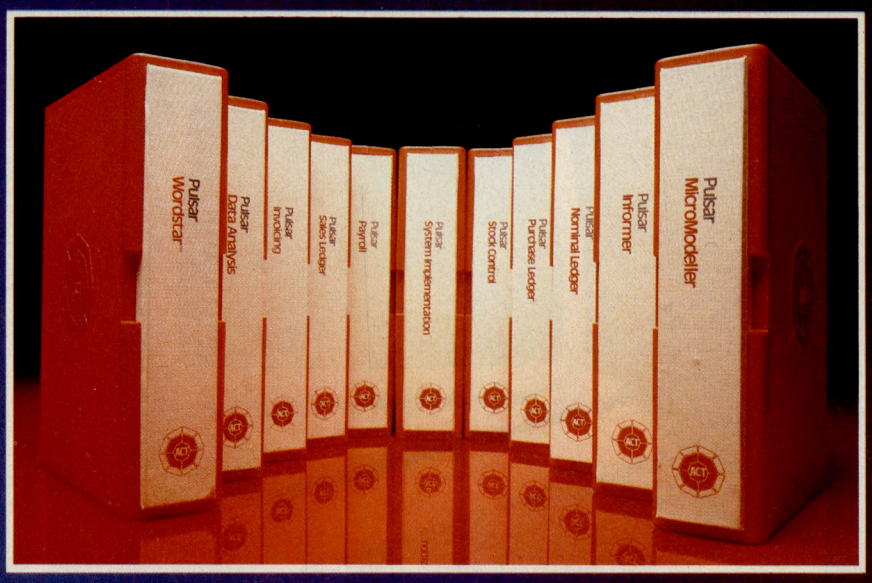
16 BIT BUSINESS SOFTWARE



PULSAR business software is the creation of ACT – the company behind the Sirius 1 and recognised leader in 16-bit personal computing.

The new PULSAR range, developed by ACT at a cost in excess of £1 million, takes full advantage of the power and expandability of 16-bit computers.

It is inherently faster and more powerful than traditional 8-bit software.

And it is a true 16-bit range, designed and developed by ACT's own software engineers.

PULSAR offers more of all the key requirements in business software:

MORE PORTABILITY

Written thoughout in machine-independent portable languages to protect your software investment.

LONGER PEDIGREE

ACT has more than 17 years experience in developing business software. Thousands of companies throughout the world use ACT packages.

GREATER INTEGRATION

All the PULSAR packages are designed to share information, avoiding duplication of files and eliminating re-entering of data.

MORE USER-FRIENDLY

ACT's unique UFO (user-friendly origination) routines allow even the inexperienced user to quickly and easily configure a PULSAR system to precise requirements.

BETTER TRAINING

Two training centres, in London and Birmingham are open to all PULSAR users.

MORE SUPPORT

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Only PULSAR is available through the unique network of PULSAR Software Centers. These are hand-picked computer dealers who handle a range of personal computers but who specialise purely in PULSAR to meet all business needs.

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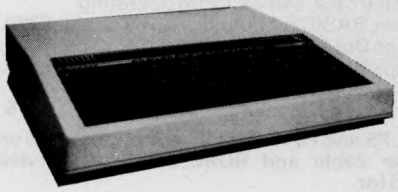

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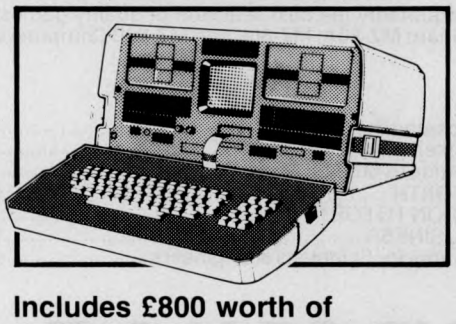

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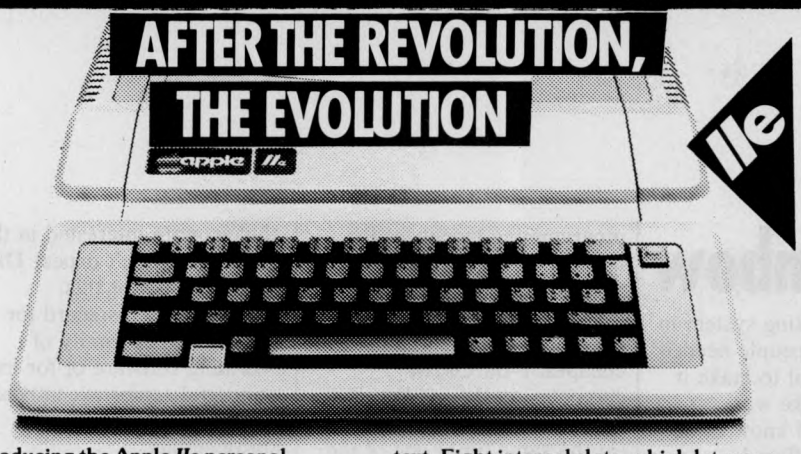

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Guy Kewney provides the latest micro news.

Mad about the Rainbow

Of all the things that I have ever heard about Digital Equipment Corporation (DEC) the one thing I can honestly say has never been said is that its digital equipment failed to work. It nearly always does.

Indeed, there have been times when people wanted DEC minis so badly that they were prepared to order machines 27 months in advance, just to be sure of getting deliveries.

And there have been items of equipment priced at two or three times what outside suppliers could manage, which customers felt morally obliged to buy direct from DEC even though DEC really didn't mind if you bought the comparable add-ons.

The only thing that DEC ever did, publicly, which was a complete fiasco was to launch a networking system in the days before people needed networks, and fail to make it work. The mistake was withdrawn, and I know of no customer that suffered.

In a week when IBM launched its 'market research exercise gone mad' and DEC launched the Rainbow, there is no obvious reason why the world went wild about the IBM machine.

But there are several reasons why the world should go mad about the Rainbow.

Since we first reported on the machine, things have changed. It has now acquired an impressive list of dealers, an impressive and comprehensive software catalogue (though I have my reservations about a catalogue entry which has identical entries describing both Fortran and Pascal as 'powerful programming languages for writing structured code'), and has acquired a splendid year's free on-site maintenance.



DEC's Rainbow

At £2,400-odd, it is not the cheapest 8-bit CP/M computer on the market. But when you consider that it is (at the same time) one of the cheapest 16-bit machines available, you will begin to understand just why, by comparison, the IBM bandwagon produces such a rotten tooth-grinding sound from behind my typewriter.

Nobody need run away with the idea that DEC has got it all right, and IBM has got it all wrong. Admittedly, DEC has announced a 12-month warranty, has established a phone-in centre for all hardware and software queries, with the phone number on the keyboard of every computer sold (compared with IBM's 6-month, 'bring it back to us yourself' policy).

But there do appear to be flaws to the Rainbow. Not everybody likes the pricing policy on additional memory — a policy easily summarised as 'stupid' — nor is everybody enchanted by the pretty but non-standard disks.

And I'm told that attaching an ordinary Oki or DRE or Epson printer isn't the sort of thing that DEC has planned for, and there will be problems.

There is even a small question mark over the very clever operating system, CP/M-86/80, which combines eight and 16-bit operation, but which is not a bog-standard CP/M-80. In my mind, it's a very small question mark, because DEC does tend to get these things substantially right.

To lovers of the old PDP-11 minicomputer on which DEC founded its fortune, there is another question mark.

The Professional range, originally announced at £2600, now costs around £1000 more than expected. To me, this is a small matter — I was always more interested in the Rainbow. I don't expect DEC to forgive me for this, however: any disregard for either its RSX family of operating software or for its wonderful senior executives has always struck them as blasphemous.

Despite the blasphemy, I have to admit that things look good. The company says it has had 400 enquiries from people hoping to be dealers. And it plans to have a dealer 'in every major city', according to small systems boss Lawrie Cattell, 'by the end of the year'.

By the end of the year, there will be people buying things like standard 9100 bus CP/M boxes, instead of Rainbows — but I can't think why. I suppose it will be all due to DEC's carelessness in failing to put the ninth, second and thirteenth letters of the alphabet on the box.

Soft options

Three big-name companies have launched computers that we have all been waiting for for at least nine months — DEC's Rainbow, IBM's PC, and Apple's Lisa.

The only software house to have announced working products for all three is British-based Cobol specialist Micro Focus.

In the case of the DEC launch, the Cobol language plus all the specialist add-ons is available not only for the Rainbow, but also for the Professional, and the DEC Mate II.

Behind them comes Peachtree again, with the claim that it is the first company in the UK to form an agreement with Digital Classified Software, and the launch of its full family of applications software for the whole DEC range. Peachtree's catalogue includes a whole batch of software written in Micro Focus Cobol.

Pascal specialist Systematics International has



Before you get all hot and bothered, I have to tell you that this isn't the long-awaited, marvellous Comodore 700 range. It's an ordinary PET, the 8032 (with a derisory 8 kbytes! — why do they do it?) in a new 'futuristic-style housing designed to conform to compulsory IEC specifications'.

Naturally, it costs a little more. So lots of people (the dealers tell me) who didn't want an ordinary PET, either 8032 or 8096, are queueing up to buy one.

It's called 'marketing'.

also linked publicity forces with DEC by announcing the availability of its accounting software — 'the first UK software house to sign an agreement for Pascal Basic Accounting software for the Professional'. Obviously I'd be more interested if it were on the Rainbow, especially since DEC says that Pascal is available for the Rainbow.

DEC has its head office in Reading at the Digital Park, PO Box 110 RG2 0TR — phone (0734) 868711 — where enquiries about dealers and software catalogues should be sent.

Protection racket

Software house TABS has decided to make money selling its software protection system to other programmers.

The idea of 'unstealable' software, like the idea of home burglar alarms, is one which has caused more nuisance that it has helped .TABS's system is less annoying than some, in that it isn't intended to prevent the software user from making a safety copy of his own disks.

It uses the 'dongle' idea, with a little computer (a Z80) in it. This fits onto the RS-232 output plughole, and pretends to be a printer cable, unless it spots a program that wasn't licensed to run on it.

And TABS promises that unless your program is one which knows about the device, it will never accidently send the signal which turns it on, and the cable will be just another printer cable, except that it will need its own power supply, and will take up space on the table.

We'll just have to wait and see what this does to sales of the appropriate products — or, more importantly, to the amount of money that is spent on them.

What happens (I want to know) to the poor blighter with an Apple II, plus CP/M card, who has a TABS-protected accounting program, something like CORP that uses a dongle on the games port, something else that has a competing printer cable dongle, and a special peripheral which uses the RS-232 plug for non-standard purposes — and who has a hardware breakdown.

Which of all these clever folks is going to admit that the fault is on his clever piece of hardware?

And how long will it take to fix? Details on (0264) 58933.

Xenix 16

There are supposedly some 3000 people using a computer called the Tandy Model 16, a machine which until last month has an almost completely unusable 16-bit Motorola 68000 chip in it. This month, they can buy an operating system, Xenix, from Microsoft, and start using it.

In fact they don't even have to buy it, because Tandy will give it to users. And not before time, one might say.

According to Microsoft founder Bill Gates, this doubles the number of Xenix-based systems. That has surprised several people, since the amount written on Xenix would tend to give the impression that it was a best-seller of far greater proportions.

What it doesn't explain is what possessed those 3000 people to buy a system costing as much as Tandy Model 16, just for the ordinary eight-bit Model II inside it.

Background transmission

Telex preparation and transmission which would normally have interrupted your microcomputer can now be done 'in the background' on stand-alone CP/M machines like the Superbrain and Televideo 802.

The software which does it is produced by Encotel, a Televideo distributor and big Superbrain dealer.

The micro can get on with — well, whatever it was doing, like the accounts or some text editing — while it operates the Telex. It dials the numbers, checks the answerback, and then finds the right file (even a Wordstar file) and translates the ASCII codes into the Telex Baudot codes. Then it transmits the letter.

Incoming telexes, says Encotel, can be stored automatically, and viewed later.

Encotel also includes a Telex interface unit (a Hasler design) in the price.

Details on 01-686 9687.

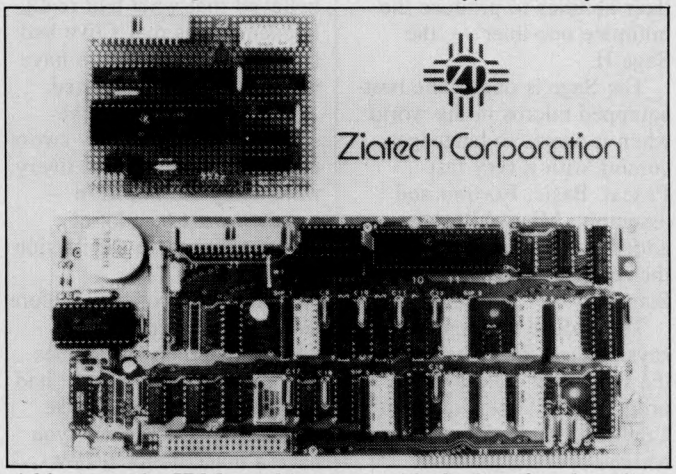
Transfer charges

A cable costing £25, and a program (called XMIT) costing £95, are all you need to 'transfer programs or data files between the Superbrain or any CP/M machine, and the 16-bit Sirius or IBM PC,' according to the producer of XMIT, Steer Davies & Gleave.

The company is based at 68 Upper Richmond Road, London SW15 2RP, and can be contacted by phone on 01-874 6583.

Outward Bound

Presumably if all managers had been Girl Guides or Boy Scouts (or whatever they are called today) when they were



Add-ons to the IBM machine start with the interface bus that is standard on Commodore PETs, Hewlett-Packard micros, and Osborne computers — the general purpose IEEE-488 bus.

This universal method of connecting computers to test and measurement instruments, also usable to connect more orthodox computer peripherals like disks, is available from Data Translation of Slough.

It is built by Ziatech in America, hence its product code ZT 1488. It includes a clock/calendar with its own battery, and can be programmed in Basic, says Data Translation.

Data Translation is on (06286) 3412.

little, they would be wonderfully confident, well developed with respect to communication and leadership, and (in a phrase) prime management material.

We have all heard of 'management training' courses which seek to remedy this gap,by taking overweight 30-year-old management accountants down to a gravel pit and making them row across with nothing more than a barbed wire paddle (I think).

One such course, organised by Michael Drayton, has had its hazards noticeably increased.

In addition to rock climbing, caving, canoeing, orienteering, archery, assault course, riding and shooting, there is the testing subject of Management Information Systems. With particular emphasis, they note, 'on microcomputers, distributed systems and communications'.

Anybody fancying a computer course coupled with leadership potential, 'set in ten acres of rocky mountainside and woodland in the Brecon Beacons National Park', should contact the company on 01-439 1379.

Sage or Scimitar?

Lovers of APL (A Programming Language) now have another 68000 based computer on which to exercise their abilities to produce the 'ultimate one-liner' — the Sage II.

The Sage is one of the best-equipped micros in the world when it comes to languages, coming with a very fast Pascal, Basic, Fortran and assembly. MicroAPL has added its pedigree, and calls the result a new computer, the Scimitar.

To produce the Scimitar, says MicroAPL, it has taken the version of APL.68000 produced by 'The Computer Company' and added to it the Mirage operating system (multi-user, multi-tasking) already offered on the Scorpion and Spectrum (*not* Sinclair's!) machines it sells.

On top of this, says the company, 'full compatibility is retained with the normal SAGE operating system. But we have implemented Mirage as the primary operating system.'

The Scimitar package costs £5445 including two 720 kbyte floppies, 400 kbytes of internal workspace — plus delivery, onsite maintenance and training. And the maintenance and training is available for a year, not six months (IBM please note).

Details on 01-834 2687.

How to succeed in business?

Competitors for the cheap Spectrum — competitors which we expected to appear in large numbers, the Camputers Lynx and the Oric — seem to be in short supply still. This is strange, because the makers of the Oric and the Lynx were determined not to make the mistake that Clive Sinclair made.

However, there appears to be a difference in their perception of what that mistake was — from what you and I might have imagined it was.

Clive, you will recall, made the mistake of announcing the Spectrum as 'available' before it was. The Advertising Standards Authority, noting a 'record number of complaints', smacked his wrist firmly with its usual feather.

But at Camputers and Oric, it would seem that they had a better understanding of what happened. As far as can be judged by their actions, they believed that what had really happened was that Clive had been unlucky enough to have his misjudgement reported.

So they did exactly the same thing, in that they swore powerful oaths about delivery which they did not keep — but then went to a lot of bother to preserve the illusion of delivery.

Exactly as promised, before Christmas, several trade journalists received samples for review. 'We're sorry,' had been the constant response before, 'but we can't let you have a machine for review until we're in full production. We aren't going to have pre-production faults written up by you irresponsible scribblers.'

Fair enough.

My first Lynx exhibited so many preproduction oddities that I suppose it wouldn't be fair to report them, because Camputers promptly took it back and produced another.

'The fact that it won't automatically switch your tape recorder on and off,' explained a harassed spokesman, 'is due to the fact that the wires to the switching transistor from your tape are back to front. You'll have to replace the transistor with a relay circuit.'

My experiences with the Oric were complicated by the fact that I didn't get one for review. This, Oric told me, was because they'd never heard of me. 'What magazine do you write for?'

However colleagues have steadily worked their way through up to four machines each before getting one that worked, in colour. Even now, in end January, I still don't know anybody with a sample which will load and save programs, but the first ones, just before Christmas ('Yes, the chips are absolutely fully tested,' they said the week before) wouldn't edit programs.

One colleague who rang to ask why was met with blank astonishment. The sample sent was only functional in the hardware sense, he was told. Software would be supplied when it was working — couldn't he admire the neat circuitry and leave it at that?

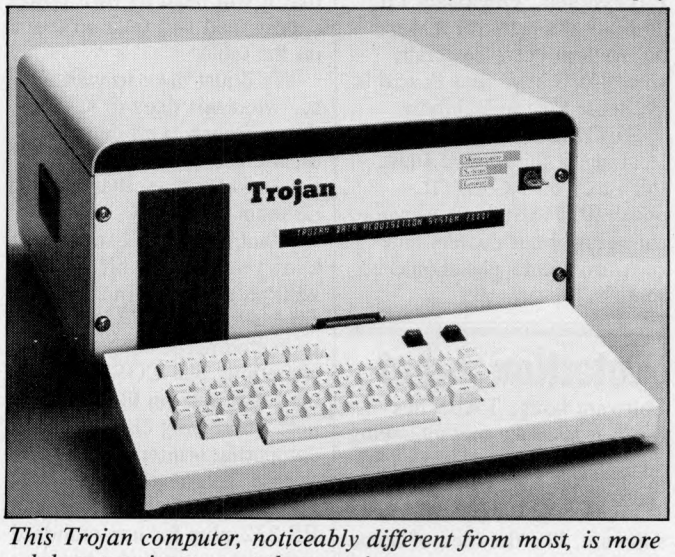
I mention all this just as some slight explanation of why, despite last month's rumour, you will notice that the Spectrum prices in the shops haven't come down, after all. Wouldn't be much point, really.

Banking on Apple

Banks use 8in disks to transfer money. They have a program called the Bankers Automated Clearing Services (BACS) utility, on which money transfer information is encoded in a standard way, and anybody who can produce credit transfer information in this way can use the system instead of writing cheques, filling in payment slips, and so on.

Apple users, normally, can't use the right 8in floppies. So Eicon has produced a £3000 system, including an Apple II, or else (for those who already have an Apple) a £1250 8in disk add-on for an Apple II, which can produce the right floppies.

And for an extra £150, they will sell you a program to swap money with your bank. And for another £600, you can buy a payroll program called Payman, which will pay



This Trojan computer, noticeably different from most, is more a laboratory instrument than a micro.

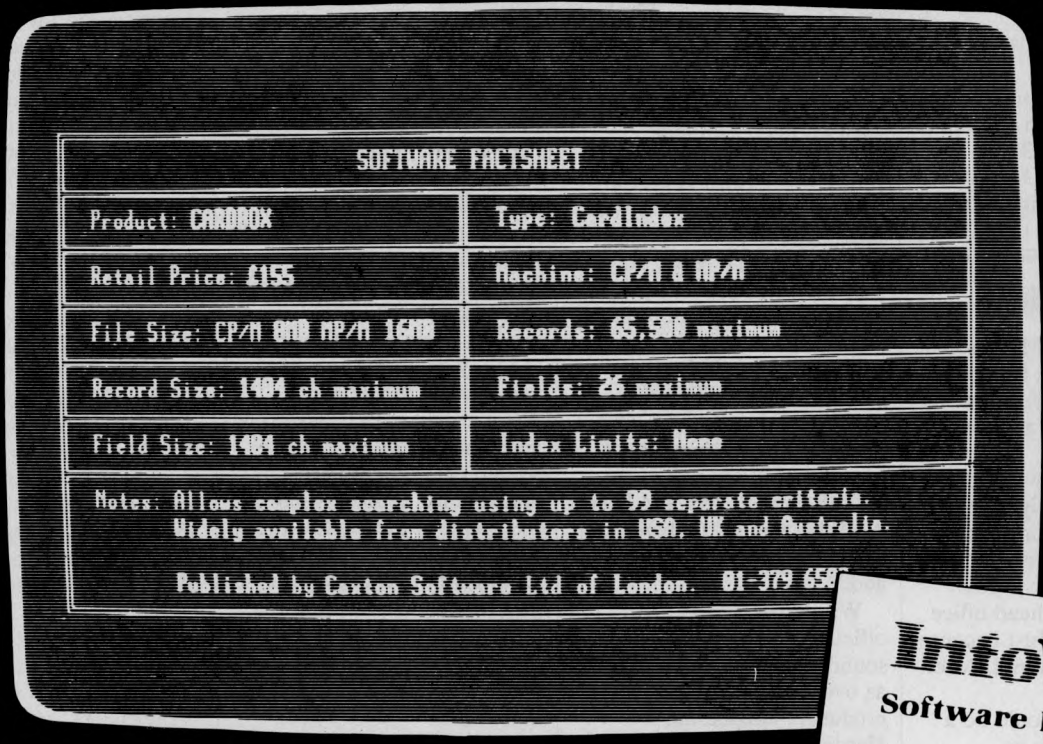
'It is designed specifically for the professional user of Microcomputers in measurement and control environments,' says Measurement Systems Ltd, the producer. 'And it offers, for the first time, a low-cost measurement system which provides a wide range of analogue and digital interfaces to a powerful microcomputer.'

The system can read inputs which are not merely digital signals (as from disks, modems and other computer peripherals) but finely graded voltage variations.

The instrument side of this can detect a force of a mere 0.75 microvolts, and since it uses a 16-bit resolution, the digital conversion is very accurate.

Details from the Newbury office on (0635) 45420.

Still Need Convincing?



The Critics Don't....

"Cardbox is your familiar, tried and trusted card index...with most of the features you have always wanted on your manual card index but couldn't have, because of the limitations of pieces of card."

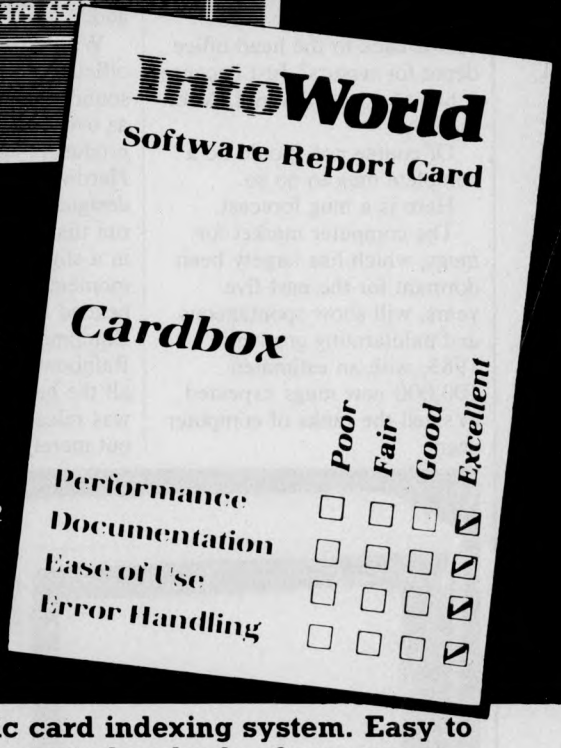
"Cardbox...succeeds extremely well. Its facilities for indexing and searching are good and very fast...the user image of the screen displays and the documentation are in the main excellent."

Personal Computer World, August 1982

"The interesting thing...is the display...Cardbox enables you to draw a form on the screen complete with headings."

"Cardbox is an excellent database manager...its versatility...and its ease of operation make it a useful program for home or business."

InfoWorld, September 13, 1982



Anyone can use Cardbox. It's a simple yet powerful electronic card indexing system. Easy to learn and easy to use, Cardbox is bringing real computer power to hundreds of new users.

Put yourself in a user's shoes:

- You wouldn't have to change your present working methods or think in computer terms. Cardbox talks to you in plain English.
- If you can do it with a card index you can do it better with Cardbox thanks to its sophisticated automatic cross-indexing.
- Up to 65,500 'cards' can be stored and they can be displayed, printed or passed to other programs in any number of alternative formats.
- Groups of 'cards' can be selected by any word in any field. Your choice can be refined by using up to 99 words in a single search.

Cardbox - the ideal card index system for CP/M users

CP/M, MP/M are trademarks of Digital Research Inc.

I am a ☐ **End User** ☐ **Dealer** ☐ **Distributor/OEM**

Please send further information. Business Card attached ☐

Please send_____copies @ £157 + VAT (includes P+P)

A cheque for_____is enclosed. Specify Disk Format_____

Name_____ Position_____

Company_____ Address_____

Telephone _____

Caxton

Caxton Software Ltd, 10-14 Bedford St, London WC2E 9HE. Tel: 01-379 6502. Telex: 27950. Ref: 398

employees and write the payslips onto the disk — for up to 8000 employees, they say.

The system can also be used simply to send information to computers that use the standard 8in drives — examples are IBM 3740, DEC RT11, UCSD Pascal, and CP/M operating systems.

Details on (0954) 81825.

Mug trapping . . .

Now that the IBM Personal Computer has been launched, let's ask a simple question.

'Would you buy a computer from a typewriter manufacturer, if it was almost 50 percent too costly for what it could do, if you only got a six months' guarantee on the thing, and then only if you sent it back to the head office depot for repairs? Just because it had the three letters IBM on the box?'

Of course not. You'd be a complete mug to do so.

Here is a mug forecast.

The computer market for mugs, which has largely been dormant for the past five years, will show spontaneous and exhilarating growth in 1983, with an estimated 100,000 new mugs expected to swell the ranks of computer users.

So powerful will this trend be that IBM alone is expected to sell up to an estimated 60,000 computers to mugs.

And by the end of the year, there will be so many mugs using computers that they will form an important and powerful software market, which will in turn attract a heavy investment by software producers.

I'm afraid the result may well be that, by 1984, you'll have to be a mug not to buy an IBM Personal Computer, because there will be more software for the thing than almost anything else around.

The irritating thing about this absurd event is that we will all have to grin and bear it all the way to the bank, because it will do us all some good.

Within seconds of the official launch a heavy thud sounded from the bandwagon as over a hundred software producers jumped on. Hardware producers who have designed machines that will run that same software landed in a slightly heavier heap a moment later. They were headed by a reluctant Digital Equipment, whose superb Rainbow would normally grab all the headlines in the week it was released, but here stands out merely as 'the only compatible machine that doesn't sell on its compatibility'.

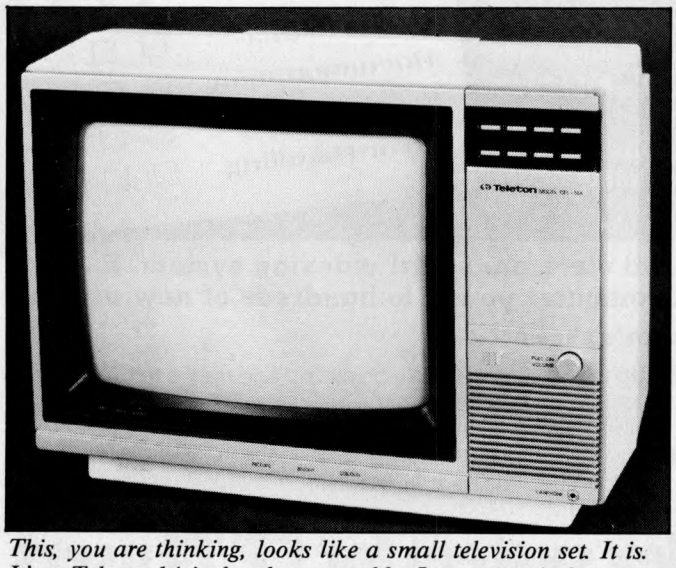
There follows a small roundup of announcements received on the subject, which you are welcome to browse through.

One thing, however, I must say first.

In my opinion, any reputable company which sells a reputable product can guarantee it for at least a year — especially when the product costs £3,000 or more.

If any small-time retailer can buy the things in America, add UK transformer and other electrical equipment, and still sell the machine for £2,400, what's the secret of the £3,000-plus price? And if a workaday retail chain like Laskys can give a two-year warranty on an Apple, what's wrong with the IBM Personal Computer?

The answer is probably 'nothing'. The six months' warranty, like the price and the keyboard, is just God's way of telling the user he's a mug.



This, you are thinking, looks like a small television set. It is. It's a Teleton 14-inch colour portable. It was sent in by Teleton, a subsidiary of The General Corporation, Japan, to illustrate the strange fact that, although computers are supplied with outputs to TV sets to save money, people are buying TV sets specially for their computers. And Teleton reckons its set is 'compatible with the Sinclair ZX81 and Spectrum'. Sadly, they add, although the company also makes computers, 'the range is currently unavailable in the UK.'

I saw them at Hanover, last year — small, portable, pretty and a bit pricey. Anyone interested could try talking to them in Sutton, on 01-643 9131.

. . . wins respect

The whole point of the IBM launch is that it 'makes personal computing respectable'.

If IBM does it, then it can't just be a hula-hoop fad — it must be a good idea. Cautious bank tellers on their way to assistant deputy under-managerial status will suddenly cease warning younger colleagues of the dangers of trusting this new-fangled 'technology'. Instead, they will start diligently reading magazines like this one, and offering their bosses (the deputy under managers) carefully thought-out advice on which system they should consider.

Only the managers are going to get IBM computers, however. Their deputies, assistants and the like, will go into the shop to buy an IBM, and come away with something rather cheaper.

Similarly, with software: people of every sort will push hard to get their software on the IBM PC, so that people who can only afford something better at half the price will still want to run their software.

Top of the tree, from day one, is Peachtree, which originally provided the first official IBM software in America. On the day IBM announced the machine, Peachtree announced the Nominal Ledger system for it.

The company also released its general accounting packages, and Office Productivity Tools.

Cobol supplier Micro Focus announced a 'fully integrated Cobol programming environment for the IBM PC' called Personal Cobol — sold under the IBM label for £250.

This is 'based on' Level II Cobol — but is slightly more than just a version of Level II loaded onto the IBM. It is 'specifically designed to take advantage of the special keyboard and screen features of the IBM Personal Computer'.

Pete and Pam Computers wasted no time in announcing the full screen of established 'independent' software for the PC.

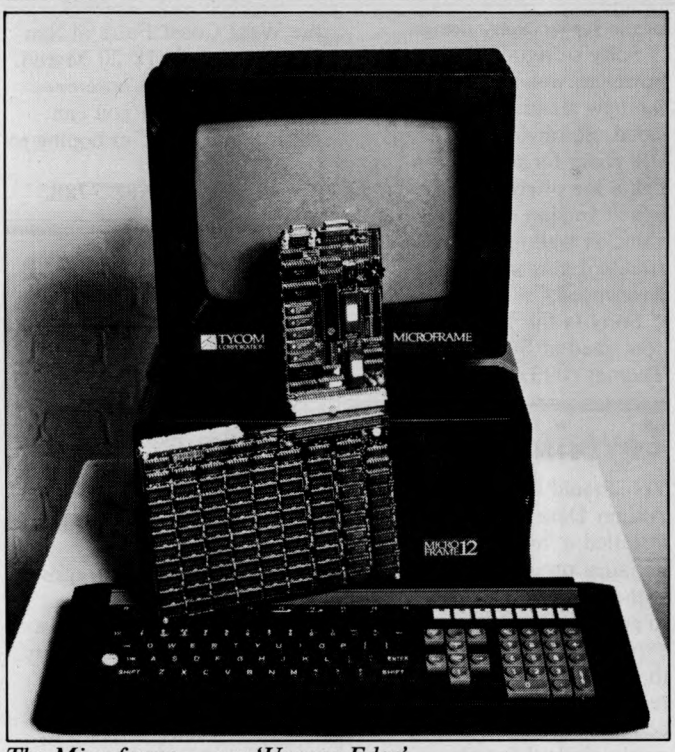
The list starts with DB Master, from Stoneware Inc, the range of 'Easy' text processing programs, including Easy Writer, Easy Filer, Easy Planner, and Easy Speller, from Information Unlimited Software. These all cost well over £100, with Easy Writer and Easy Filer costing over £200.

Even better, there is a nice cheap game — 'Pig Pen' — a maze game, described by Pete and Pam Fisher as 'boaring'. They summarise the action as' 'Basically, you are chased around a maze by wild pigs.'

I'd like to share the rotten puns about giving the game the chop, being amazing, getting trotters on, and so on, but I'm stymied for a good excuse.

Digital Research, however, has not just launched CP/M-86 for the PC. It has declared war. Gary Kildall will market an enhanced version of CP/M-86 himself, not just leaving it to IBM to sell the operating system as an option to its own Microsoft developed PC DOS.

And the price will be £42. That is a quarter of the IBM price, and there are several extra features — such as print spooler, graphics extensions, plus a library of device drivers 'for the most popular graphics printers, plotters and cards — including the HP7220 and



The Microframe — see 'Uneasy Edge'

7470 colour plotters, Epson MX80, Okidata Microline 92, printronix and three IDS printers, the Orchid and Plantronics PC cards, and' — it sounds almost too pedestrian to be true, but there it is — 'and the standard IBM PC monochrome display'.

Digital Research, by the way, now has a UK address at Oxford House, Oxford Street, Newbury RG13 1JB.

And the project which Digital Research is probably more proud of is the arrival of Doctor Logo.

Actually, it's Digital Research Logo, but it will always be DR Logo to me. It will be available in April, they say. See story on Logo below.

IBM itself is not to be left out of the software kitchen. It has promised to open a 'new international software development centre in Dublin, to develop applications software for administrative and control systems,' for export to IBM companies world-wide.

Annoying the pros

Logo is a programming language which people find easier to use than other languages which seem designed more for the convenience of the computer — say its fans.

Logo has now been adopted by CP/M company Digital Research, with a version being released for the IBM Personal Computer.

Commands in DR Logo include the ones supplied in Apple Logo, which makes one realise that Apple Logo has been more successful than outsiders expected. In addition, DR's version includes others 'which allow users to examine and cross-reference procedures created in the workspace.'

Logo is the language developed at MIT which uses Turtle graphics — the imaginary turtle walks around the screen obeying commands like 'Forward' and 'turn' and leaves a trail behind it. Then it can store the drawing, and reproduce it later.

What is really nice about Logo, however is its unrestricted approach to what professional programmers call 'type'. For example, if I use a formula referring to 'X' in Basic, then X must be a number, not a sentence. In Logo, I can add or divide sentences with the same formula.

'This makes Logo suitable for a wide variety of applications from simple symbolic mathematics to a natural language translation, artificial intelligence and knowledge-based systems, such as artificial tutors,' comments the company announcement.

This also annoys the pants off professional or academic programmers, who have spent so much of the lives making burnt offerings to inferior compilers that they regard 'strong typing' (which prevent this kind of trick) as a 'useful discipline'.

Uneasy Edge

The 'Future Proof' Tycom Microframe is not meant to be an IBM lookalike, but since one of its options includes an 8088 processor board and both MSDOS and CP/M-86 as operating systems, it will be obvious that dealers will assure customers that they don't need to worry about compatibility.

In fact it is a very ambitious system, and again (no surprise) appears to be clearly superior to the IBM. No-one should be astonished at the number of superior imitations — IBM didn't get where it is today by being a technology leader, and it isn't about to change the successful habits of a lifetime just to please journalists.

The Tycom machine, like Shelton's Sig-Net, and like the BBC-based Torch, is designed to be expandable, with plug-in or bolt-on big processors.

In the words of the well-prepared publicity literature, 'With the versatile base bus connect (VBC), the Microframe treats central processing units not as the heart of the computer, but as peripherals.'

The idea is that instead of having to convert a program from one processor to another you just plug in the right processor. The only snag is that you then have to plug in a compatible version of the operating software, which isn't always as straightforward as it might be.

Nobody is sticking their necks out and offering clear-cut opinions on the Tycom design. I'm certainly not going to, because of the number of things that would have to be tried out before we have any idea of how well the technology stands up — and at the time of writing, I hadn't even managed to press a single key on the machine.

The reason others may be a little reticent, is that there is significant edginess in the minds of many tradesman in this industry about Guestel, the dealer-based company on which Tycom is based.

This edginess is a sort of schizophrenia. Originally, Guestel set itself up as an Apple dealer, and made powerful enemies by undercutting its rivals. Angry cries for 'an orderly market' were heard, while Guestel, unperturbed, accumulated stock, capital and expertise.

Then, established, Guestel became respectable, and began putting its name to the amalgamated dealers' calls for an orderly market. Since the



Quick off the mark following the launch of the Apple IIE is British add-on manufacturer Digitek, which has announced a series of plug-in cards for the new machine. These include an 80-column card, the Screenmaster 80, and a printer driver, the Super Printmaster. More from Digitek on 0403 66550.

company now claims to be 'the country's largest Apple systems dealer', its desire for an orderly market is understandable enough.

The man in charge of Tycom worries the more established sages, too. Alan Timpany, who set up Guestel in 1979, is in his mid-twenties, and left Bath University a mere four years ago. No matter how clever he may be, older folks feel somehow that if it was so easy to start a company, they'd have done it themselves ten years ago.

Hence, I suppose, the appearance of the ordinary-sounding name of Sir Jack Stewart-Clark on the company letter-head, as the non-executive chairman.

Sir Jack has a background to go with the 'common or garden'-like ring of his name: Balliol College, Oxford, Harvard Business School, Coldstream Guards, managing director of Philips Electrical and of Pye, Member of European Parliament for East Sussex.

There is a lot more to selling computers than designing hardware. Tycom has spent a lot of time and trouble on its business image, and in making sure that not only is the technology pedigree there, but that the pedigree document is well framed and prominently displayed.

Brochures, publicity, management team image — all have been given serious attention. Selling to people who are spending £3000 for a system, all these things, as IBM well knows, as far more important than mere cleverness.

But if you aren't IBM , you have to be twice as careful about the cleverness, too. I look forward to the first user reports with more than usual interest, because this company is clearly aiming very high.

Small is beautiful

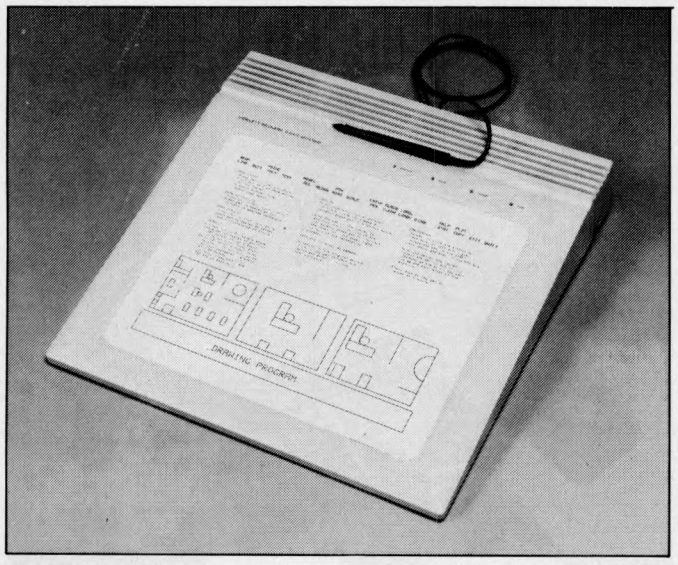
A war is on for leadership of the market for extra-small 'microfloppy' disks, and the first battle is the fight to establish standards.

Sony, one of the inventors of a 3½ inch disk, obviously thinks it has won this little point, because it has issued a statement that it and Shugart (amongst others) have 'agreed to support a mutually compatible 3.5inch floppy disk format'.

Other names attached to the announcement (13 of them) include BASF, Memorex, Verbatim and 3M, but it will be the Shugart name that Sony is proudest to be able to list. Shugart had originally pushed (and hasn't abandoned) a 3¼ inch standard, which had ordinary cardboard envelope protection, rather than the hard covering of the larger Sony design.

Sony's original design, however, was single-sided, and the new standard is double-sided. So obviously there is still room for negotiation (as fights are often called) over which version of the standard wins, as well as which standard gets more agreements announced.

Sony in the UK can be contacted at Sunbury-on-Thames (09327) 81211.



Rapid Recall is now selling this very smart graphics tablet for Hewlett Packard 80 series micros. The tablet — the 9111A — allows you to draw diagrams, maps, etc, and enter them simultaneously into the computer as a series of digitised X-Y coordinates. The computer can then display your masterpiece on the screen or reproduce it on the plotter and, of course, the 'picture' can be stored on disk for later use. Contact Rapid Recall on 0494 35634.

Covering up

You should be warned that Allrian Data Services has installed a 'modesty switch' in its latest program. The reason is that the user might not want to go through the tedium of explaining why his (or her, though that seems unlikely, really) screen doesn't have the company forecasts, but a partly-clothed female on it.

The package is strip poker, with the added 'incentive' of graphics on the Atari. The Atari graphics are all right, but I can't believe anybody is going to break into a sweat over Atari graphic nipples. . . anyway, details on (0753) 45201.

The promotional brochure, showing some nerd *actually stripping, himself* in front of a computer, is a collector's item of sheer chutzpah.

Audio Visual

They hope, the organisers of Audio Visual 83, to be able to put together an exhibition showing many of the suddenly exploding computer display abilities.

The exhibition is needed because different ways of showing data in pictorial, or graphics, form are becoming more confusing than the number of machines which can do it.

As Maclaren Exhibitions observe, graphics have always been a good way of getting information out of a list of figures. What has been difficult is the problem of getting the graphics out of the information.

The important addition to the art which micros have made possible is the spare processing power needed to actually convert the data into graphics.

Anyway, the exhibition is from 21-24 March, just after the West Coast Faire in San Francisco from 18-20 March. It's at Wembley Conference Centre. I suppose you can guess which one I'm hoping to get to. . .

Details on 01-688 7788.

IBM vs the Future

The other side of the IBM launch was the appearance of the competitors.

These are the machines which are built to the same specification, more or less. They can run the same software, but cost less, or offer some other advantage (like portability).

Easily the most impressive of these is the Future Computer, designed and just launched in the UK at a very much lower price than IBM can manage. A system which on paper at least offers a lot more than the IBM system, it costs just about exactly half the price.

The Future machine is a lot smaller than the IBM, roughly half the height. It has a much better display, which is easier to adjust.

Most important, the standard operating system offered is CP/M-86 — but not the ordinary one-job after-the-other version. Instead, Concurrent CP/M-86 will be standard — allowing the user to edit a letter, print a form, transmit an invoice down a phone line and look through a database at the same time.

The only thing that really puzzles me about the Future Computer is that it can be made to read standard IBM disks, but that the plan is to sell it with its drives, which don't.

Next in line, a very ordinary lookalike from Computer Ancillaries, which is nonetheless demonstrably more sophisticated than the IBM design.

Like the DEC Rainbow, the CAL-PC has two processors, one 8-bit Z80 (but a fast Z80-B, not the ordinary one) and one 16-bit 8088, as in the IBM machine.

The keyboard is exactly the same as the IBM one. Users tell me that they like it. I don't, because of several surprise keys, but that's the way IBM did it, and that's the way the imitators have to do it, so as not to confuse people reading the IBM manuals.



Another 16-bit micro has hit the streets — this time a British one! It's from Future Technology Systems and is being marketed by Office and Electronic Machines (OEM) as the Orion Total Business Management System.

It's 8086-based with 128k of RAM expandable to 896k, and runs 'enhanced versions of CP/M-86 and MS-DOS'. There's a good selection of software available, including the Peachtree range, and a useful collection of expansion options, including hard disks. Starting price is £2950, for which you get 128k, twin 512k disks and EOS-C, the 'enhanced CP/M-86' but no software — everything else costs extra. Contact OEM on 01-407 3191.

One unusual feature of the CAL machine is the decision to offer a full range of applications software based on the Business Operating System (BOS) from MPSL.

Its disks are bigger than the standard IBM ones, at 400 kbytes each, with the option of having twice that per drive, or hard disks instead CAL is in Egham, on Egham 36455.

Joke on Baker

Even the Government got its five cents' worth out of the IBM launch. Minister Kenneth Baker, in charge of Information Technology at the time (information technology is to computers what American bathrooms are to lavatories — a euphemism) said he welcomed the machine.

'I warmly welcome the decision by IBM to manufacture their personal computer for the whole of Europe at Greenock,' Baker said. 'It is further evidence of the company's commitment to this country,' he added.

This presumably refers to the fact that IBM is building our new driver/vehicle licensing computer (replacing the ICL machines known in the trade as the Swansea Joke Factory) and is building the thing in France.

Double Dealer

Dealers for the IBM Personal Computer were headed by the Comart-owned Byte Shop chain, fresh from an impassioned plea to the Government to ban all American imports.

Comart can plead that IBM intends to make the PC in Scotland — but the peripherals that the group will be distributing won't be made there. They are the Tecmar Inc range of PC-Mate disks, cartridges, memory, colour graphics displays, and industrial control modules. And one of the stores in the group, Xitan, is importing the same range of Easy software that Pete and Pam is selling.

Nice to see that Comart didn't expect the BMMG's lobby to work.

Another announced dealer is Computerland, the American-owned chain with its first store open in Southampton.

The full dealer list is available from IBM itself in Basingstoke.

16-bit tools

It you're a programmer struggling with CP/M-86, it will scarcely have escaped your notice that there just isn't the wide range of development aids available for this operating system as there is under CP/M-80. Now Island Software has produced a set of five development modules to come to your rescue.

There's a Base Module which includes utilities to convert 8080 and Z80 source code to 8086 source, transfer MS-DOS files to CP/M, turn CBasic programs into Microsoft Basic listings, edit disk sectors directly, reinstate erased files and lots more.

Then there's the Sourcerer module, a 'range of intelligent dissemblers' and TRX, a module allowing files to be transferred between machines using an RS232 link. Screenwright + Keybase is a module which allows you to develop screen formats and file handling facilities and automatically codes these in Basic; and the final module in the range is Screenplot, which allows you to use your machine's graphics capabilities.

If you buy all five modules at once, says the blurb, you save a third of the cost of buying them all separately. The snag is that the brochure doesn't say what they cost. Find out from the importer, Export Software International (you figure it out) in Edinburgh on 031-556 3266.

Free port for job generation

Doyen of the micro industry Clive Sinclair is championing the cause of free ports, claiming that they would stimulate employment.

In a letter to *The Times* earlier this month he suggested that a free port in, say, Dundee could generate 'hundreds, possibly over 1000, new jobs' to meet the needs of Sinclair Research alone.

This suggestion comes hot on the heels of industrial unrest over redundancies at the Timex plant in Dundee where Sinclair's manufacturing is done.

At one stage Sinclair was threatening to withdraw completely — a move that would lead to hardship in an area already severely hit by unemployment.

Free ports offer great attractions to exporting UK manufacturers. This stems from an anomaly over import duty. Under the weird and wonderful idiosyncrasies of British law it seems that if you want to import a component to build a machine in Britain you pay 17 percent import duty. But if you want to import a complete machine, the import duty is considerably smaller — a mere five percent.

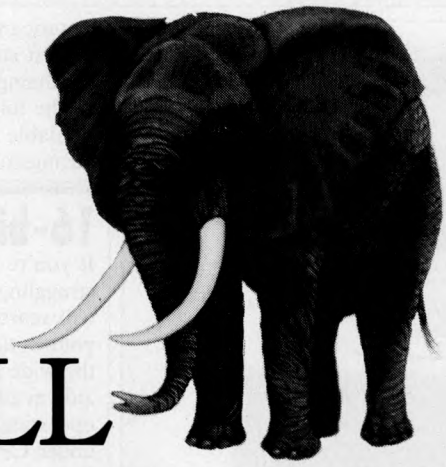
This is an active disincentive to British micro manufacturers, as was highlighted by their trade organisation in an impassioned letter to the Prime Minister last November.

Members of the group claimed that they would soon be forced into the position of shutting down their factories and setting up a business importing foreign micros from their own front rooms.

Although Sinclair sought to disassociate itself from the impassioned letter, and ultimately resigned its membership of the trade organisation, the issue of import duties remains a pressing one.

In Sinclair's words to *The Times*, 'My company sells small computers. The major import cost in these is semiconductors, which for the most part are imported from outside the Common Market at a duty rate of 17 percent, whereas only 5 percent must be paid on finished computers. This places the European-based manufacturer at a disadvatnage relative to a foreign producer.'

Another UK micro manufacturer, Torch Computers, was less sure of the benefits of rationalising import duties. 'Even if import duties did go down I'm not sure how much it would be passed on to the computer companies, which mostly get their components from importers who could just increase their profits,' said Torch's chairman Martin Vlieland-Boddy.



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MOUSE MAKES MICROS MANAGEABLE

Jane Bird reports on the latest way to interact with your computer.

In January, *PCW* was invited to two previews of new products based on the latest gimmick — the graphics mouse.

If you think this sounds like some freak creature escaped from a video game and running wild on the screen then you are some way off the truth. The graphics mouse does not run wild: it is under the strict control of the user. In fact, the mouse is the user-friendly creature that enables the user to feel in control of the total system.

Two new products incorporating Graphics Mouse Technology (GMT) are a dedicated micro from Apple, called Lisa (Locally Integrated Software Architecture) and a portable software system VisiOn (Operating Environment) from VisiCorp.

Broadly speaking, Lisa is polished and expensive while VisiOn is clever and cheap.

Now the whole point of the mouse is that he will be the friendly vehicle that smoothly ushers in the next generation of computer users. These are the executives who, as we are always being told, have a phobia about keyboards.

But how can a mouse replace a keyboard? Answer — it can't. A keyboard is still essential for the text input. But so long as a secretary is on hand for the text-inputting bit it really is amazing what you can do with a mouse.

You skate the mouse around on your desk and a pointer moves correspondingly on the screen. The Lisa screen displays a set of 'icons' or visual representations of system facilities. For example, a waste-paper basket, a clipboard for temporary information, and a filing cabinet. If you use the mouse to locate the pointer on the filing cabinet and then press the button on the top of the mouse this opens the cabinet and lets you get at what is inside. On screen you then see a set of visual representations of what is inside — clock, calculator, folders and empty folders, and tools to cut, copy and paste. You locate the pointer in turn on whichever facilities you wish to use and press the button on the mouse to open the window on the item you want. It all functions rather like a graphic representation of a menu-driven system.

Both Lisa and VisiOn allow you to view multiple windows at a time and to integrate information in them into a new window.

Lisa offers graphics, decision-making tools for spreadsheet and calculation applications, word processing, communications and file-management.

But the most spectacular facility on Lisa is the free format graphics. This allows you to draw smoothly in lines or circles, to stretch these drawings big or small — you can stretch them so big that only a tiny part of the whole is visible on screen — and you can shade them in a variety of different shading patterns.

Graphs and pie-charts can easily be generated from data. There are 720 by 364 pixels on a screen and the picture is clear and still. But it is unfortunate that Apple shows no interest in supplying a colour monitor on Lisa — especially considering the price which is £7000 for a system including printer.

Lisa has 1 Mbyte of random access memory (RAM) and two dual 860 kbyte disk drives. It contains three 8-bit processors and a Motorola 68000 processor. The operating system is completely new and incompatible with the Apple II or Apple III, so you cannot run your existing applications programs on it. But Micro Focus has already developed a standard Cobol compiler which Apple will be making available on the system. A Unix look-alike, UniPlus, has also been developed for Lisa. A Pascal development environment is being made available to software houses so that they can add their own applications software.

One nice feature of the system is that the software prevents you from removing disks until files are closed. Similarly, if you try to switch off in the middle of open files then the system closes them for you before closing down.

My gut reaction to Lisa is that this is a very expensive executive toy. It seems like a lot of money to spend to get an electronic version of your desk without even the facility to run VisiCalc.

Apple is optimistic. Let's face it, with the much-vaunted 300 man-years of development that's gone into the system it has to be. This compares with two man-years of development that had gone into the Apple II at its time of launch, and 25 man-years on the Apple III at its launch. But note that Lisa was only announced in January, and the time of arrival hangs uneasily around summer and autumn of this year.

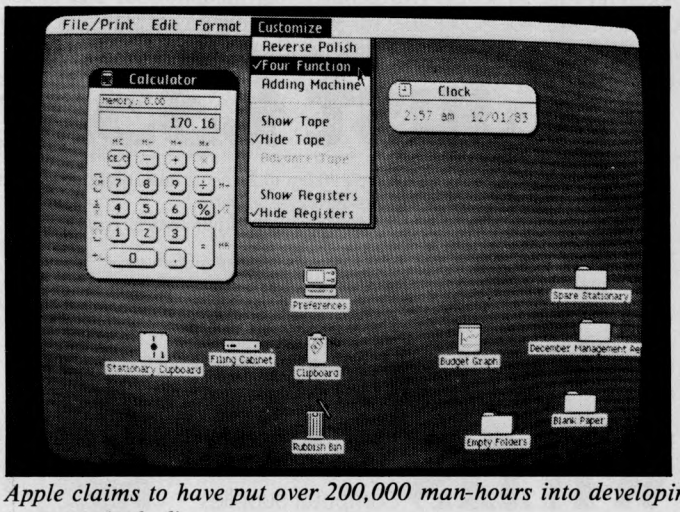
The price doesn't look quite so outrageous when you stand Lisa up against its closest contender, the Star from Rank Xerox. 'With the Star you are talking about a minimum of £15,000 for the system plus £50,000 for Ethernet which you need to use the Star,' said Apple's marketing director Keith Hall.

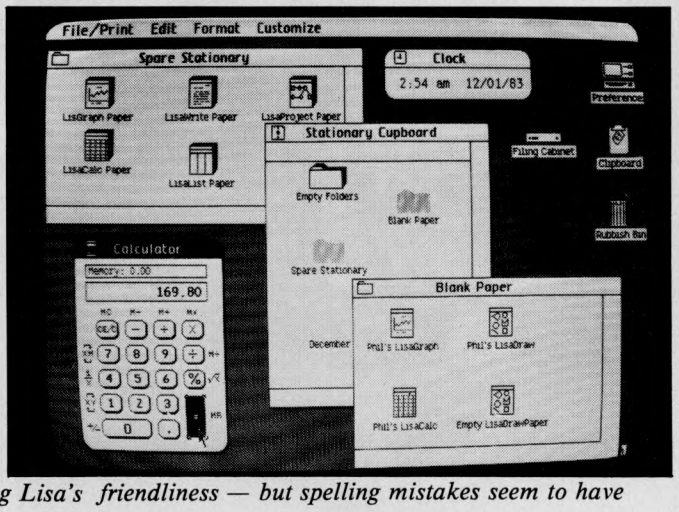
Both Apple and VisiCorp acknowledge their debt to the Star. 'We have borrowed very heavily from the Xerox Park work but they have built a dedicated machine which is very expensive, and for the average user we wanted only to provide the software for his existing micro,' said Gerald Diamond, vice president of VisiCorp.

Certainly, if price is critical then it's VisiOn that you want. And VisiOn will have the great advantage of combining with standard operating systems and existing applications software. Vendors will be supplied with interface specifications so that they can adapt their own hardware or software to run in conjunction with VisiOn.

VisiOn sits between the operating system and the various applications packages. VisiCorp will be making the technical specification of the operating system interface available to manufacturers who wish to implement VisiOn on their own machines. The minimum hardware configuration will be a 16-bit processor, hard disk, high-resolution graphics and 256 kbytes of RAM. VisiOn adopts the facilities of the operating system so that if multi-tasking can be handled by the operating system then you can use VisiOn in multi-tasking operations.

VisiCorp wouldn't be drawn on price but





Apple claims to have put over 200,000 man-hours into developing Lisa's friendliness — but spelling mistakes seem to have been overlooked!

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hinted at cheapness, noting that it wishes VisiOn to become a standard and adopted by as many people as possible.

The IBM Personal Computer and the Digital Equipment Professional are the only machines that VisiCorp has promised will have VisiOn so far — 'but the early indications are that VisiOn will be the next standard for personal computing,' according to Diamond.

VisiOn, too, is promised for the 'summer' and will come with packages for the standard applications of spreadsheet, database management, graphics and word processing.

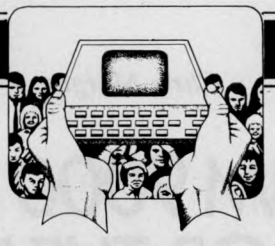
Both Apple and VisiCorp believe they have come up with products that will win over the next generation of computer users — the office professionals. This is a vast potential market with lots of money to spend. Apple admitted rather ruefully that it is investing large sums in general market preparation, the benefits of which might be reaped by other companies. 'There is lots of market education to be done,' said Hall.

Then it's over to you, mouse!

END

CTUK! NEWS

By David Tebbutt



In September 1980 the general public was pretty much in the dark as far as microcomputers were concerned. Certain union leaders were gaining a great deal of publicity by telling people that they would soon be replaced by silicon chips. They were also generating a great deal of fear of the so-called micro-revolution which was about to engulf us all. Government activity at this time was sporadic and it was clearly not going to get its act together for a while. Something definitely needed to be done to counteract the negative feelings surrounding microcomputers. There were a few magazines, (*PCW, Practical Computing* and *Computing Today* were the top sellers) but these tended to be bought by the already enlightened. What was needed was a direct approach to the public, to the sort of people who wouldn't be seen dead in a computer shop. It was then that we launched ComputerTown UK.

Loosely based on ComputerTown, USA! which I had discovered on a visit to California that March, ComputerTown was to be a non-profit-making, non-commercial attempt to introduce personal computers to the general public. Derrick Daines was the first brave soul to go to his local librarian and get permission to run ComputerTown sessions at Sutton-in-Ashfield public library. Days later, I plucked up courage to ask the Hillingdon Borough Librarian for similar facilities. So started ComputerTown UK. Since then, volunteers up and down the country have joined the ComputerTown movement and, by all accounts, are having a lot of fun as well as being darned useful to people who just don't know where to start.

Now there are around 40 ComputerTowns, and the number of people wanting to start them up is still growing. This has come as something of a surprise since we thought at the beginning that it would last a couple of years, by which time the newspapers, the television and the government would have made everyone aware of the potential of these little machines. In fact I think that all three have made a very good start but, to date anyway, they have still steered a little towards the 'gee whizz'. This situation is improving all the time but there is clearly a continuing need for a ComputerTown type of activity.

As time has gone by, ComputerTown has changed. Many of them have ended up with so many regular people that they have almost become clubs — which is a shame because they then tend to frighten off the very people they originally set out to attract. Others have entered a lovely symbiotic relationship with local clubs in which the ComputerTown feeds the interested members of the public into the club and the club sends volunteers to run ComputerTown. That, to my mind, is an almost perfect way of arranging things. The 'Towns in and around Croydon and those around Gateshead are excellent examples of this in action.

Another development was that of ComputerDays. A number of groups decided to have a big one-day event and, in each case, they were wildly successful. The nice thing about these for the volunteers is that they can invest time periodically, whereas a regular fortnightly session sometimes proves too much. Bill Gibbings must take all the credit for the idea — he ran the first ComputerDay in Retford. Frank Fadipe deserves a special mention too because he developed the ComputerDay idea into a ComputerWeek!

And so it goes on. It's impossible to single out all the people involved. They know who they are and they know that their efforts are mightily appreciated, especially by the thousands of members of the public who have passed through their hands.

By now you may be getting suspicious. Why's he going on about the past so much? The answer is that we feel the ComputerTown News page tends to get a bit repetitive and, dare I say it, boring — especially in winter when everyone seems to hibernate. So, we all got together and cooked up a new approach to reporting ComputerTown activities. First of all, this page is to be replaced by a sort of notice board containing announcements of things like people looking for volunteers to start a new 'Town, details of where to get CTUK information and notes of shows, events, good books, programs — anything in fact that you think would help other 'Town organisers. Big news, like new ComputerTowns starting up, will find its way into the News pages of the magazine and articles from ComputerTowns will be published as features providing they pass muster with the editorial department. For this to happen, you must keep us posted about your activities and discoveries, no matter how minor. If you feel you have information which can help others interested in ComputerTown then please write in with the details. I'm sorry we can't take phone calls. The truth is that we, too, carry out all CT activities in our own time. Articles for publication must be interesting, informative and maybe even inspirational. They will have to be reasonably well structured and written although the editors aren't averse to a bit of rehashing. Finally, the list of ComputerTown contacts will continue to be maintained in the Direct Access section of *PCW*.

This new approach is much more flexible and I'm sure that it will prove to be even more successful than what has gone before. We have secret plans to make sure that the ComputerTown notice board grabs your attention.

Of course, it's all very well to say all this, but it does depend on you to make it happen. If you've learnt something from running your ComputerTown, for goodness' sake share it with the rest of us. You can't say that in the hundreds of thousands of man-hours that have gone into CTs you haven't learnt something that's worth sharing with other readers. Come on, put pen to paper. If you just write the way you feel then you'll find the words will come easily. If you're uneasy about it, *PCW* won't mind giving your work a final polish. After all, it's what editors are paid for, isn't it?

The new approach starts next month. I figure that if you'd like your ComputerTown to be featured in any way, you've got about two days to get the copy to us. Go on, try. We look forward to hearing from you.

END

ComputerTown UK! is an ever-growing network of computer literacy centres where members of the public are given free access to microcomputers, courtesy of those willing to volunteer their time and equipment. ComputerTowns might be found anywhere — in a church hall, a library or perhaps a school after hours. The aim is to make computers enjoyable and non-threatening and, because ComputerTown is entirely non-commerical, overt axe-grinding of any sort is banned. Guidelines are available for those interested in setting up their own 'Towns: Write to CTUK!, *PCW*, 62 Oxford Street, London W1A 2HG. Remember to enclose an A4 SAE for your reply. Please don't telephone *PCW* for information as CTUK! is entirely a spare time activity.

IBM'S 'SECRET' MICRO

Chris Morgan of Byte *magazine reports on what could be the basis of IBM's next PC.*

IBM 9000 INSTRUMENTATION COMPUTER OR THE NEXT PERSONAL COMPUTER?

The best-kept secret of 1982 may have been that IBM makes a 68000 computer. If that surprises you, you're not alone. The unit, called the IBM 9000 Instrumentation Computer, is IBM's second major microcomputer product — the first, of course, is the IBM Personal Computer. The 9000 made its debut this past summer at the Comdex show in Las Vegas, though it was first announced last May by IBM's subsidiary, IBM Instrument Inc, in Danbury, Connecticut. The May announcement was so low-key that few people took notice.

The machine is marketed as a laboratory instrumentation computer, yet its design innovations and modularity make it a natural candidate for a business or general-purpose computer — with the appropriate engineering and cosmetic changes, of course. IBM has declined to comment on this possibility, however.

In this article I'll describe the features of the machine, which I saw during a recent visit to the IBM Danbury facility, and speculate about the importance of a 68000-based microcomputer from the world's largest computer company.

Why has IBM decided to offer a 68000 computer? To answer that question, we interviewed the machine's designers at IBM Instruments, a recently acquired, wholly-owned subsidiary of IBM. For years it has been active in the design of computer-oriented laboratory equipment. The division's status as a separate profit centre within IBM allows it to experiment more freely with unusual computer designs — in particular, development of a laboratory-oriented microcomputer.

The incentive to do this came after a major change in the instrumentation field. During the 1970s laboratory techniques such as nuclear magnetic resonance and gas chromatography became more popular — techniques that required much sophisticated mathematical calculation. These calculations demanded more in the way of mathematical analysis than 8-bit computers could deliver. For example, Fast Fourier Transform analysis (a common mathematical technique in the laboratory) consumes huge portions of memory. Thus laboratories had to stick to more expensive but powerful minicomputers. A real need arose for ways to improve the productivity and cost-effectiveness of data acquisition and processing in the laboratory.

So the IBM 9000 was born. It has the memory space (up to 5 Megabytes of RAM!) to handle sophisticated laboratory mathematics. It has modular hardware features needed in the lab, such as a high resolution colour printer to create graphs and charts, a swivelling CRT display, and a movable keyboard that can go where the experiment is. More importantly, it has the Motorola 68000, a powerful 16-bit processor. Long a favourite with many software designers, the 68000 was chosen by IBM despite the fact that the IBM Personal Computer uses the Intel 8088 processor (which is not a true 16-bit processor). The 68000 won out mainly because of its superior Benchmark performance. According to its designers, the 68000 gives the 9000 a better price/performance ratio and provides a standard method to control all IBM instruments. The 9000 has real time multitasking capability — important in data acquisition — and its five I/O interfaces allow it to be easily connected to a variety of laboratory instruments.

The real star of the 9000 is its remarkable state-of-the-art planar processor board. Seven layers deep, it is literally crammed with ICs and VLSIs to the saturation point. IBM says the board could not have been manufactured just over a year ago because of its high chip density. The board has more than 1600 test points. On this single board are the complete computer, five I/O ports, the disk controller, and slots for an auxiliary expansion card that will hold up to five Versabus cards. The advantage of single board construction is the freedom from printed-circuit board connection points — a major reason for computer failure. (Incidentally, IBM will swap processor boards with customers in an overnight service in case of hardware failure.) The 32-bit Versabus insures compatibility with future instruments. In addition, the Versabus stands an excellent chance of becoming a standard bus in the future.

One look at the 9000's processor board reveals its designers' egalitarian approach: it contains ICs from over a dozen US and Japanese comapnies — AMD, Signetics, Motorola, National, TI, Intel, Intersil, Hitachi, Western Digital, and others. Each chip was chosen for its spec alone. This would have been unheard of back in IBM's monolithic days, when practically every IC inside an IBM computer was custom-made by IBM.

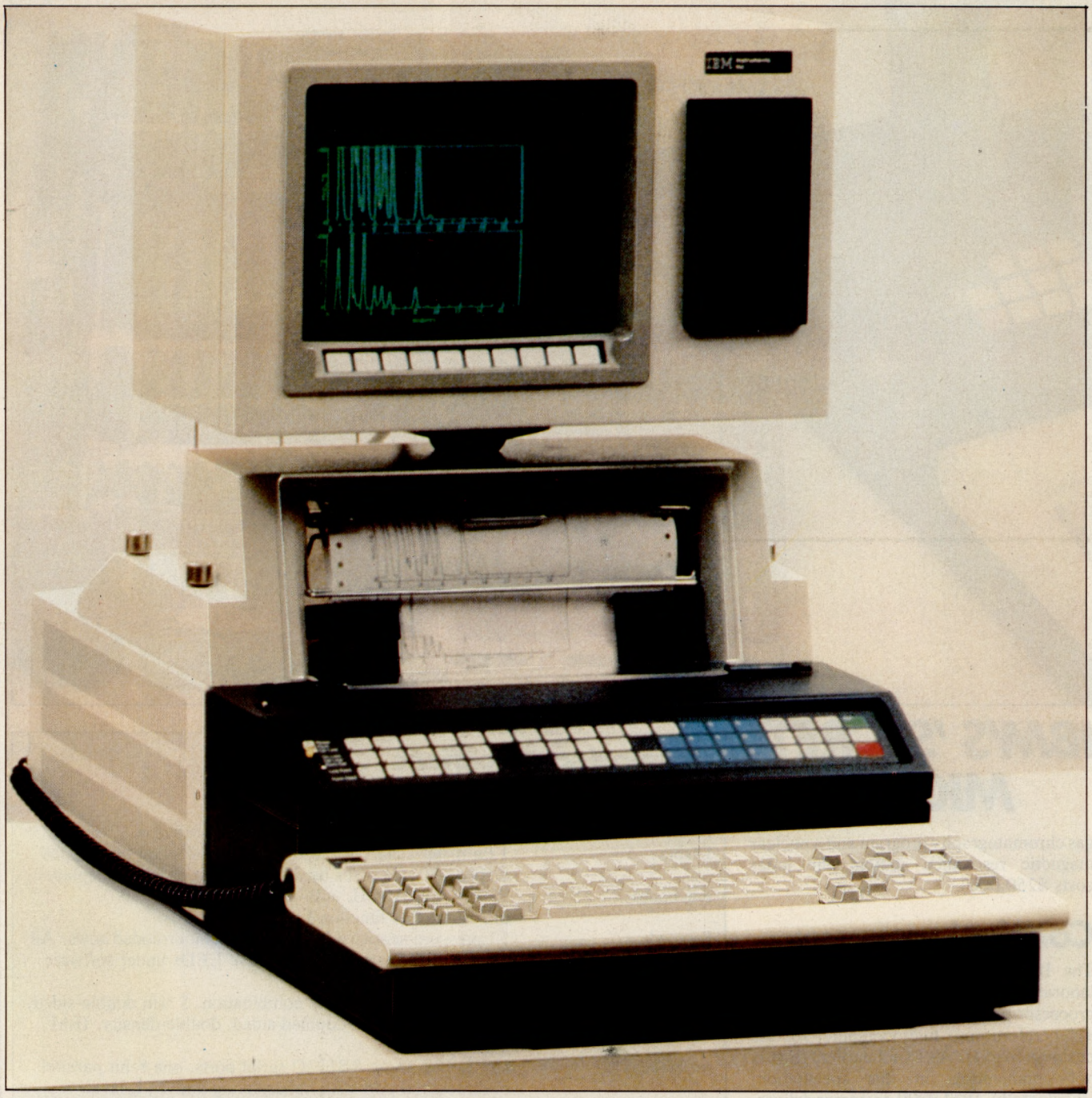
Hardware

The IBM 9000 is well suited to the laboratory: its modular construction revolves around a basic chassis containing a processor board, a 12in black and white VDU display, and a 57-key keypad, all selling for $5695. The 9000 has been engineered with the crowded laboratory bench in mind: the modules stack vertically to conserve space. When augmented by the printer/plotter, keyboard, and a host of other options, the 9000 becomes a powerful 16-bit computer system. The basic system module (processor board, VDU, keypad and chassis) measures 22.3in x 17.2in x 23.2in. It weighs in at 31.5lb (main chassis alone) or 78.8lb with VDU, printer and keyboard.

In addition to the RAM and ROM within the machine, there is a 64 kbyte (12 bit word) graphics memory to handle the screen display. The Motorola 6845 video control chip is used in the IBM 9000. Other features include a memory-protect scheme (useful in multitasking applications) and composite video.

The IBM 9000 automatically conducts a power-on diagnostic routine, and a second diagnostic routine can be initiated by the user.

The VDU display has excellent resolution (768 by 480 pixels) and one felicitous feature: a single handle control that lets you quickly shift the position of the display horizontally and vertically by merely pulling the handle toward you and repositioning the screen. Beneath the screen is a row of





The complete system (above) and its familiar-looking keyboard (below).

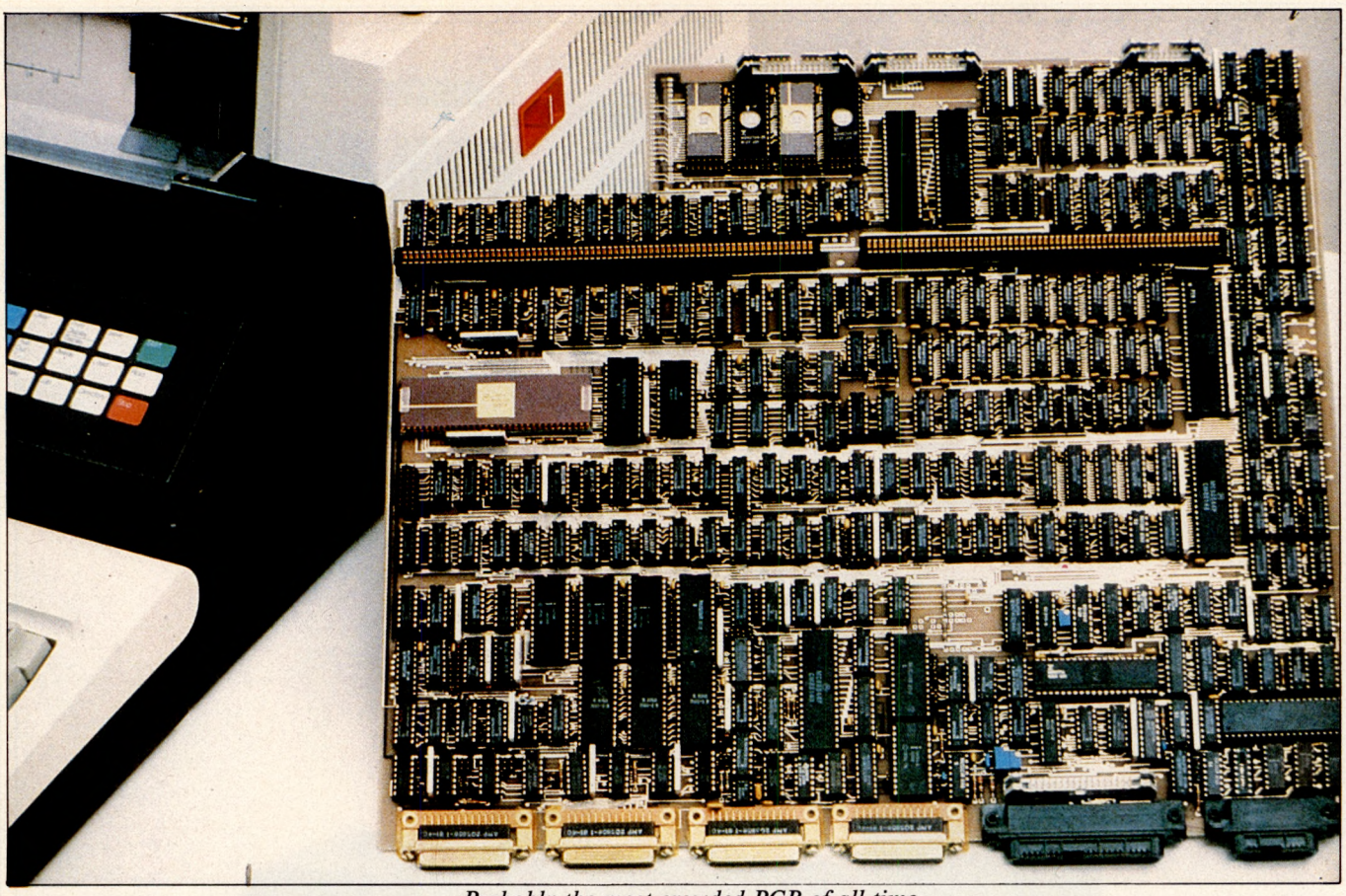
user-definable keys like those on Hewlett Packard machines. The printer/plotter is well suited to the 9000, with 220 by 336 dots per inch and excellent four-colour printing.

The 57-key user-definable keypad is perhaps the 9000's oddest feature. Yet having that many user-definable keys could be useful for some applications. One spectator at the Comdex show suggested using the keys to represent Wordstar commands. Though I'm no fan of this type of touch-sensitive key, I suppose it does the job.

Software

The 9000 operating system (custom designed by IBM) has multitasking capability and a sophisticated I/O manager that queues up all I/O requests. The software is menu-driven with keyword bypass for the expert user. The system features contiguous file allocation to minimise access time, and the various high-level languages (Basic, Pascal, and Fortran 77) all share a common graphics interface — a decided plus.

Laboratory-oriented software includes a



Probably the most crowded PCB of all time.

IBM'S 'SECRET' MICRO

gas chromatography program and a nuclear magnetic resonance station (the latter costs $250,000).

Conclusions

The IBM 9000 is ideally suited to the laboratory. But it strikes me that the 9000's processor board could become the heart of a general-purpose microcomputer for the business market. As I said earlier, IBM is not commenting on this speculation. (Incidentally, IBM 9000 customer deliveries should have begun by the time you read this.)

I think the 9000 is, in its quiet way, one of the most exciting announcements on today's microcomputer scene. I predict it will start showing up in all sorts of unexpected applications. In one gesture IBM has legitimised a microprocessor that deserves more attention: the Motorola 68000.

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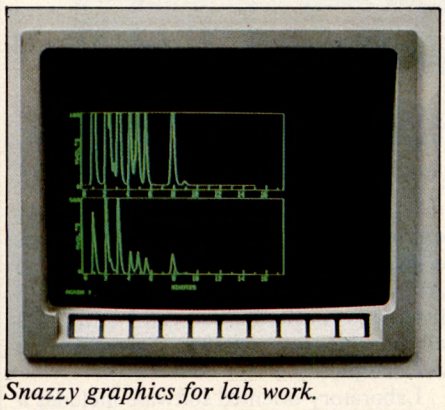
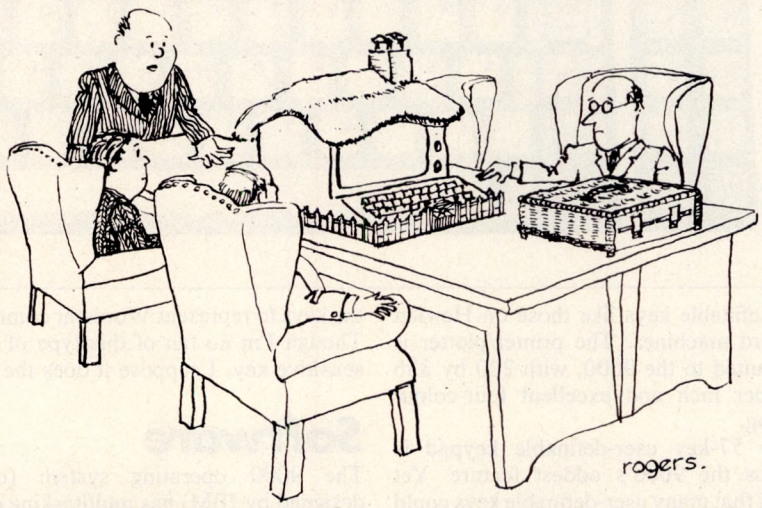


Snazzy graphics for lab work.

Technical specifications

Processor	Motorola 68000
ROM	128k
RAM	128k, expandable in 256k units to 5 Mbytes.
Display	12in raster-scan CRT with 768 by 480 pixel bit-mapped display; 80 character by 30 row green on black display.
Keyboard	83 key, full ASCII, auto-repeat on all keys. 10 programmable function keys.
Keypad	57 pressure-sensitive keys in three colour-coded rows. All keys user-definable, six keys have LEDs under software control.
Disk drives	Up to four drives in any combination. 5 ¼in double-sided, double density. 8in doubled-sided, double-density. IBM standard format.
Interfaces	IEEE-488, three RS232C serial ports, one 8-bit parallel bi-directional port with handshaking and TTL-level signals.
System software	IBM custom operating system.
Languages	Basic, Pascal, Fortran 77.



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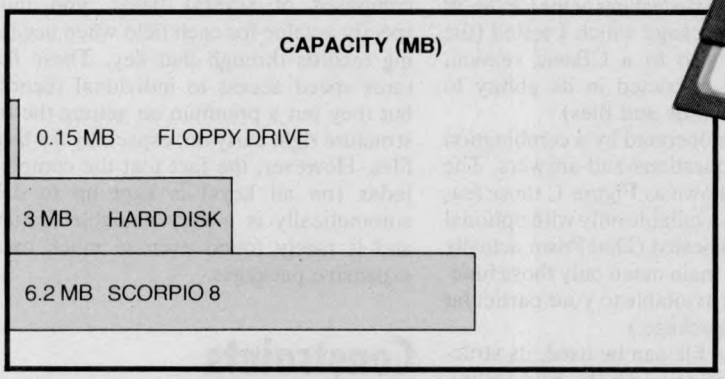

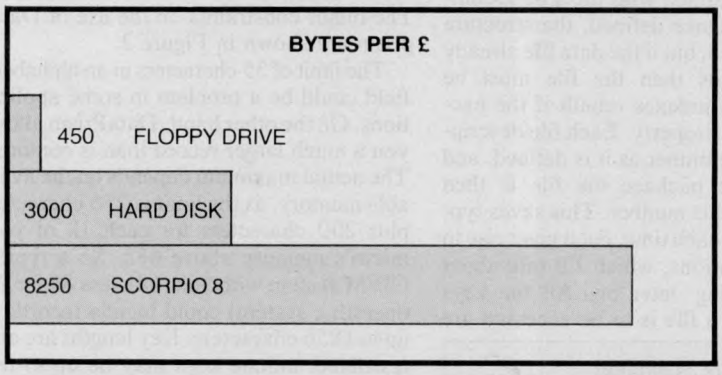

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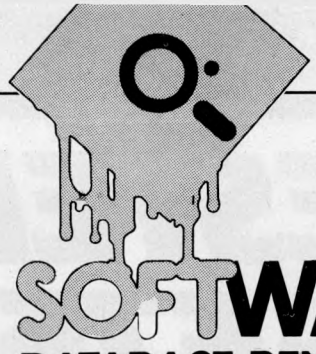


SOFTWARE
DATABASE BENCHTEST

DATAPRISM

Kathy Lang reports on a multi-version general purpose data management package.

This month we are back with general purpose data management packages, looking at DataPrism, which comes in three versions and runs under CP/M (the manual also mentions versions for CP/M-86 and Unix). The simple version has facilities for storing information in individual files, which can then be edited, displayed on the screen or printed. This version permits access to data only by key; keys are used both to find particular records and to determine the order in which records are to be displayed or printed. Screen and report formats are provided by DataPrism, but the user also has a limited facility for printing output in formats of his or her own design.

A more sophisticated reporting facility, allowing full screen formatting as well as formats for printed reports, is an optional extra, which can be further enhanced by a feature which allows you to select items for printing from more than one file.

Finally, for the experienced programmer, there is an option which gives access from users' programs to all the screen handling and file management features of DataPrism, and also allows the tailoring of menus and gives some protection against unauthorised access to files and functions.

In this review you can assume that the features being described are those of the basic package, except where I explicitly mention one of the more advanced (and more expensive) options. Throughout I shall also describe the features of the CP/M-80 version of the package which I tested (the manual refers also to a CBasic version, which is more restricted in its ability to handle large records and files).

DataPrism is operated by a combination of menus and questions-and-answers. The main menu is shown as Figure 1; those features which are available only with optional additions are indicated (DataPrism actually displays on the main menu only those functions which are available to your particular version of the package.)

Before a data file can be used, its structure must be defined with the File Definition function. Once defined, the structure may be modified, but if the data file already contains records then the file must be copied and the indexes rebuilt if the package is to work properly. Each file description is given a number as it is defined, and throughout the package the file is then referred to by this number. This saves typing in the name each time, but it gives rise to other complications, which I'll talk about under 'Reporting' later on. All the keys through which a file is to be accessed are defined at this initial stage; they can be changed or modified later, but only if the indexes are rebuilt before the file is used again. This can be a quite lengthy process for a large file, as the Benchmark results show. The data itself is stored in a standard ASCII file, which can be created or read by many packages such as Wordstar, and by most programming languages including MicroSoft Basic.

The key facilities are very powerful. You can define a key as unique or duplicate; for a unique key field, an operator will not be allowed to enter a value which already exists in the file for that field. Duplicate keys may be single fields, or composites of up to 10 fields or parts of fields. If a key is composed of several fields, you must specify a value for each field when accessing records through that key. These features speed access to individual records, but they put a premium on getting the file structure right early on, especially for large files. However, the fact that the complete index (on all keys) is kept up to date automatically is a very valuable feature, and is rarely found even in much more expensive packages.

MASTER MENU

Bonsai — DataPrism
06/30/82

Select function:

M	=	Maintain Files
B	=	Browse Files
L	=	List Files
F	=	Forms Print
R	=	Report Print
D	=	Set Today's Date
E	=	Set Environment
U	=	Utilities
D	=	Define Files
DM	=	Define Menus
DP	=	Define Passwords
CR	=	Compile Reports

Enter desired selection or 'END':

Fig 1 DataPrism main menu

Constraints

The major constraints on the use of Dataprism are shown in Figure 2.

The limit of 35 characters in an alphabetic field could be a problem in some applications. On the other hand, DataPrism allows you a much larger record than is common. The actual maximum depends on the available memory, as the limit is 256 characters plus 200 characters for each 1k of your micro's memory above 48k. So a typical CP/M system with 56k (64k less 8k for the operating system) could handle records of up to 1856 characters. Key lengths are also restricted: unique keys may be up to five characters, and each field forming part of a duplicate key may be 20 characters long. If longer fields are specified as keys, only the first part of the field is used.

Every field in the record must have two names: the first, limited to eight characters, is used when abbreviated names are needed, for instance in reports where space does not

Max file size	CP/M limit or disk size, whichever is smaller
Max size record	256-9999 characters, depending on memory size — see text
Max no fields	999
Max field size	35 characters, 14 digits
Field types	Character, numeric, date (month/day/year), monetary (dollar), yes/no, auto-index

Fig 2 Constraints

MAG/base FILE DEFINITION DETAIL PRINT

File Attributes: File Number 3 — Bench Test file for *PCW* Review

File Number	3
1. File ID	PCWBTDPM
2. File Description	Bench Test file for PCW Review
3. Disk Drive ID	B
4. File Storage Mode	E
5. Next Auto Index	2
6. Auto Index Increment	1
7. Number of Fields	21
8. Number of Keys	1
9. Record Length	154

Fig 3 File definition — attributes

Field Number	9
1. Field ID	SUPP2
2. Field Description	Supplier2
3. Field Type	N
4. Minimum Field Length	5
5. Maximum Field Length	5
6. Decimal Places	0
7. Minimum Vale	0
8. Maximum Value	0

Fig 4 File definition — example field.

permit the use of the extended description of the field, which may be up to 30 characters. It is useful to be able to specify a longer description, but I would have preferred this to be optional — often the short name is self-explanatory, and it is tedious to be obliged to type it twice.

File creation and deletion

Files are created by setting up a file definition, and then adding data to the file. Indexes specified in the file definition are set up and maintained automatically as part of the file maintenance process. File definition is a rather tedious process — all information is entered on a message line near the bottom of the screen in response to a question from DataPrism, and the file definition is assembled from the replies. One screen is devoted to a description of the file (as shown in Figure 3) and then one screen to each data item (a typical description is shown in Figure 4).

After each description has been entered, you have the option of changing any item before saving — but the method used is to specify the number of the item to be changed and then to enter the whole of the corrected value. No actual editing of the definition list is possible, either on the response line or — much better — *in situ* in the body of the screen; indeed DataPrism makes no use of the keyboard's cursor movement keys at all. During file creation this might not be a great hardship, as you will not want to create new file descriptions very often, but the same method is used during data entry, which could be exceedingly tedious.

If you already have information in a data file, DataPrism makes it easy but rather slow to bring this data into its filing system. DataPrism stores its data in ordinary ASCII sequential files, using separate files for file definition and for indexing. So you just have to make sure that your data is either in fixed field format or in the usual Basic variable format (fields comma delimited, strings enclosed in quotes), describe its structure to DataPrism, and build an index. I found this quite straightforward to do for my Benchtest file, but it was quite slow — see BM10 in Figure 7.

Once the file definition file has been created, it can be amended, but only within quite severe limits even if no data file has yet been linked with it. For instance, I was able to change the type of a field, but not its length without changing other fields in a complementary way, so that the record length remained the same. If you need to make more major changes, such as adding an extra field to each record, you must create a new file definition. Any fields which are to be taken from the old file must be defined in the order in which they appear in that file, with new field(s) at the end. (This involves typing in the file definition all over again — I couldn't find any way to copy a file definition before amending it.) You then replace the old data file with the new (DataPrism puts blanks in each new field), and rebuild the index. The time taken to do this for my Benchtest file is shown as BM1 in Figure 7.

Screen display

When displaying data in order to amend it, you must access the record you want to change by a specific key. Matching occurs if DataPrism finds a record with the key field equal to or greater than the value specified. Once the record has been displayed, you can then browse through the file in the order given by that key. For instance, if you are looking for a customer called Smith, but don't know his initials, you can request a match on surname Smith (assuming surname is a key field). If the first Smith is not the right one, you can scroll through looking at each Smith in turn to find the right one.

Once the record is found, it is displayed in a standard format, with 16 fields on each screen; each line consists of the field description followed by the value in the current record, and each line is numbered in sequence starting from 1. To amend a data item, you specify the number of the line on which the field is listed, and give the value which is to replace the current field value. No editing is allowed. The way the screen looks during this process is shown in Figure 5.

When you are adding a record, once you've begun to enter fields you must enter a complete, valid record — you can't change your mind after the first field is entered. All field values must be entered from the keyboard: there is no facility to calculate the value of a field and embed that calculation in the file description, nor to 'echo' a previous field value or record.

If you want to display a record, but don't want to change it, you can get more sophisticated data displays by using the optional Report Writer. This allows you to specify the positions in which fields are to be displayed, by setting up a report format file which is then applied to the data file and the results shown on the screen or printed, as you wish. It is used in exactly the same way whether screen or printed output is required, so I shall describe it in more detail in the next section.

Printed reports

The simple version of DataPrism has two functions which give printed reports. The List function gives the ability to print one or more fields from each record, and to total those which are numeric. All formatting is carried out by DataPrism, with assumptions about standard page size, etc. Records may be selected by specifying a range within which one or more key field variables are to lie. You may also specify

FILE MAINTENANCE
CHANGE

Bonsai — DataPrism
06/30/82

Display/key description/ /key value/:

1.	/field description/	/field value/
2.	/field description/	/field value/
3.	/field description/	/field value/
4.	/field description/	/field value/
5.	/field description/	/field value/
6.	/field description/	/field value/
7.	/field description/	/field value/
8.	/field description/	/field value/
9.	/field description/	/field value/
10.	/field description/	/field value/
11.	/field description/	/field value/
12.	/field description/	/field value/
13.	/field description/	/field value/
14.	/field description/	/field value/
15.	/field description/	/field value/
16.	/field description/	/field value/

Enter change number, N=Next,
RETURN=Page or 'End':

Fig 5 Record Change screen format

```
MAG/base REPORT COMPILER — PCWBT92 Test 50 version (PCWBT92T)
1: DF:4/1
2: DP:P20
3: CD:C01+F008! COMMENT
4: CD:C02+F010! COMMENT
5: CD:C03+F012! COMMENT
6: PG:Price1 Total:@C01 Price2 Total:@C02 Price3 Total:@C03
>> NUMBER OF ERRORS: 0
```

Fig 6 Report format for BM9

BM1	Time to add 1 new field to each of 1000 records	3 mins + BM6
BM2	Time to add 50 records interactively	scrolling time
BM3	Time to add 50 records 'in a batch'	1 min + BM6
BM4	Time to access 50 records from 1000 sequentially on 25-character field	18 mins
BM5	Time to access 50 records from 1000 by index on 25-character field	3 secs + scroll
BM6	Time to index 1000 records on 25-character field	1 hr 40 mins
BM7	Time to sort 1000 records on 5-character field	22 mins
BM8	Time to calculate on 1 field per record and store result in record	na
BM9	Time to total 3 fields over 1000 records	20 mins
BM10	Time to import a file of 1000 records	as BM6

Note: na=not available except in Advanced Programming Aids module

Fig 7 DataPrism Benchmark timings

that only certain fields are to be listed — but to select these, you are given the name of each field in the file in turn, and asked if this field is to be listed. . . The Forms function gives more flexibility about layout, in that it permits the user to design a format within which fields are to be printed. This can be used for standard letters, labels and so on, rather in the manner of packages such as Wordstar's Mail/Merge option. However, the format for printing cannot be set up within DataPrism, as it has no editing facilities. You have to set up the format file with an editor such as CP/M Ed (ugh!) or a word processor such as Wordstar, which rather diminishes the point of the exercise, as Wordstar Mail/Merge can read DataPrism Normal-Format files.

The method of creating a format file with an editor and processing it in DataPrism is also used by the Report Writer optional package, but here there is a further complication in that the report definition must be 'compiled' before it is run. Any errors found during this compilation are flagged for you to correct; but of course to do this you must leave DataPrism, edit the report format file, return to DataPrism and recompile. I expect my resistance to this approach was heightened by finding a couple of apparent bugs in the report format compiler, but I felt it would have been tedious in any case.

The report format takes the form of a list of command lines, each prefaced by a two character command which shows what kind of line this is to be. The command lines may be instructions (such as 'Define Page Size') or layout models showing where field values or results of calculations are to be printed. Such command lines or statements may not exceed 135 characters. Nor may they span more than one text line, so you would need to use an editor capable of constructing lines of the maximum width you wanted to use.

Facilities include the ability to select particular records with the full range of comparison operators (such as 'less than') and of Boolean operators (such as OR and NOT), with comparison among constants, field values from the current or previous record, and calculation results. You can also perform calculations using memory variables; these calculations may be carried out on every record, when particular field values change, and when all records have been processed. Calculations may use all the usual arithmetic operators and *real brackets*. You can have these reports displayed on the screen or printed, and leave the decision about which mode you require until run time.

I found the syntax of the Report Writer rather tedious, but quite easy to learn; an example is shown in Figure 6, showing the instructions used to carry out BM9. The first line defines the file to be processed, by number in Dataprism's internal directory. (Unfortunately, when you delete a file the numbers of all the later files are changed so that the numbering remains continuous — so any report formats referring to these files would have to be changed too to reflect the new sequence.) All fields within records in the file are referred to by number (eg, F008). I couldn't get calculation lines to compile if they ended with a field specification — hence the rather unhelpful comments on each calculation line, which I put in simply to get the statements compiled. . .

The @ sign indicates that the calculation variables are to be printed in exactly the position shown on the printed line. Another special character used to 'picture' the display of numeric variables is the £ sign. In theory, this character only has special meaning inside the 'picture' brackets, but I couldn't get the Report Writer to interpret it properly outside those brackets either — it just refused to print it or the remainder of the line on which it occurred. This is of course likely to be a little unfortunate in commercial environments in the UK. DataPrism does provide the ability to print a dollar symbol and to have it 'float' in front of a printed sum of money — what a pity the designers couldn't have implemented a currency symbol in that way, which could be defined by the user as $, £, F(ranc) or whatever.

Selection

In the simple version of DataPrism, you can select for screen display only by specifying a value to be matched with the current key (the key may of course be a composite of several fields, and in that case you are asked for a match for each). A match is signalled if a value equal to or greater than the comparison value is found, and you may then browse through the file from this point on. The time shown to choose records based on key value is shown in BM5, while BM6 shows the time which would have been needed to create the necessary index, had the fields not been specified as key fields in the original file specification. When listing or form printing, you may specify a range between which the key value(s) must lie. In the Report Writer, the facilities are much more extensive, giving full comparison on any field in the record using the usual range of comparison and Boolean operators, provided only that a selection can be fitted into 132 characters. BM4 shows the time taken to select 50 records which match two criteria on non-key fields.

Sorting

Records automatically appear to be sorted in the order of whatever key is currently in use. You can sort on non-key fields as part of the Report Writer, specifying up to ten fields for the sort. BM5 shows the time taken to sort 1000 records on one field.

Calculations

With the simple package, the only calculation possible is totalling when printing reports. With the Report Writer, you can do any calculations you like on any field, using all arithmetic operators and brackets, and then display or print the results. The time shown for the Report Writer to calculate the total values of three fields is given in BM9. Only one of the totals was correct, but from the symptoms I couldn't see how the Report Writer could have made the errors, nor could I see how my data or instructions could have been responsible.

Without using the advanced programming features you can't store the results of calculations in records in a file, which is why BM8 wasn't done.

Security

Within the basic package, there are no security provisions. The advanced version, the one with programming aids, provides the ability to confine an operator to par-

ticular files and specified functions, and permits the use of passwords to identify operators when initiating a run of the package.

Tailoring

To use DataPrism, you must tailor it to match your terminal features. This seemed a pretty straightforward process, although like most packages you only find out if you have carried it out correctly when you actually try to run DataPrism. This tailoring does not include telling DataPrism about the cursor arrow keys, and these are therefore not available in any of the three versions of DataPrism.

As to tailoring while the package is in use, the most advanced version of DataPrism allows the programmer to access DataPrism files in the same way as DataPrism itself, to design menus of his or her own choosing, and to use all the screen control features to give terminal independence. Included with the advanced module is the MAGSAM/E file management system, which can be used either with DataPrism files or with files created by user programs. Finally, the format of the DataPrism data files means that they can be accessed from most programming languages quite independently of DataPrism if needed. However, since the main focus of these articles is upon the needs of the serious user who is nevertheless not likely to be an experienced programmer, I did not feel it appropriate to cover this area in more detail.

Within DataPrism, you can process up to five files together with the advanced version of the Report Writer. (This option comes with the Report Writer at the same price, but needs a substantial amount of memory to run it, so not all systems would be able to support it.) This gives the facility for reporting on several files linked together, for instance on family/child data files or on stock/supplier files. Beyond that, you would need to use the Advanced Programming Aids module to carry out more advanced linkages, such as updating several files in the asame operation. Relations with other packages and files are covered by DataPrism's ability to read and write standard ASCII sequential files in either fixed or comma-delimited format.

Stability/reliability

If there should be problems with data corruption (perhaps with a user switching off without properly leaving DataPrism), there are two functions to enable the user to rebuild the data file. I didn't have any problems with data during my use of the package. However, I did manage to get thrown out of DataPrism on two occasions with different errors, getting error messages of the kind 'Func=RG Error=E0F Data File ID=PCWBTDPM'. I also found the three apparent bugs in the Report Writer which I have already mentioned.

User image

The user image of the software — that is, how the package appears in use — is very mixed. DataPrism is menu-driven, with clear well-designed menus and mnemonic single-letter codes for menu options. Its approach to file and key selection is sensible. But getting into a function is much better catered for than getting out of one; I never found it possible to by-pass unwanted questions, and often found I needed to type the word 'end' three times to get back to the main menu. This lack of imagination is found, too, in data entry, where one must enter values for each item even if they are mostly zero for a particular record, and in file definition, where I couldn't find a way to copy a file definition if I wanted to create a file similar to one I already had. The problem reaches the really irksome level when referring to files by number — this saves time at the keyboard, but could waste much more if you forgot to change the file number in a report after you had deleted a file and hence had the reference numbers to other files change.

Again, the general screen layout is good, particularly in being consistent about its placing of file names, instructions, current data, message lines and so on. But DataPrism is highly unimaginative in its handling of screen input. In particular, it is very irksome to be obliged to type the numbers of variables one wants to change, followed by the new values, rather than just whizzing the cursor down the screen, pausing only to change fields on the way. Presumably the reason is that there must be terminals somewhere (though I have never come across any) which allow cursor coordinate positioning, clear and home screen and so on, but don't have cursor arrow keys on the keyboard — but even then one could permit the user to specify the use of control keys along the Wordstar lines as a substitute if necessary. This is particularly serious in DataPrism, since there is no forms design facility for screen data entry — so you cannot provide a neater user image for yourself or your employees, except by programming it using the advanced module.

This 'curate's egg' syndrome is reflected too in the documentation. The manual is very full — to the point of being so verbose that it is hard to find your way around or to get a picture of the overall model of the package. The only reference I could find to DataPrism's quite considerable ability to display formatted reports on the screen comes in one line in the middle of the Report Writer description, where the screen is mentioned as one option among four for display of the report. On the other hand, there are a large number of helpful examples, which makes a welcome change. On the minus side again, it does add insult to injury to find an index listed in a table of contents (of the Report Writer manual) and no index in the manual (or in the main manual for that matter).

Costs

The basic version of DataPrism costs £175. With the Report Writer the package costs £325, and with the Advanced Programming Aids module £525. As to the more hidden costs, the most noticeable was the amount of disk space needed. The package itself is quite large — it seems you would have difficulty accommodating the basic package plus the Report Writer in less than 370k. Indexing space could also be a problem — my data file used 152k of disk for a file where each record has 154 characters, while its index file, for keys totalling 25 characters, used 52k. As to performance, you should find some indications from the Benchtests which are shown in Figure 7. As usual, these were carried out on our Sirius using the (6MHz) Z-80 card and running under CP/M-80.

The package originates in America, and is distributed in this country under licence by Bonsai Ltd, telephone 01-580 0902. I would like to thank Bonsai and Michael Kraftman in particular for help with this review.

Conclusions

If your requirement is for a simple file handling package for under £200, with good facilities for listing files in key order as well as retrieving them by key, then DataPrism should do a straightforward job for you, albeit without any screen formatting of your own, but with quite flexible forms output to the printer. You should compare it with packages like Cardbox and Pearl to see whether it gives the particular mix of features you need. The DataPrism Report Writer gives access to much more sophisticated report functions for display on both screen and printer, but this addition brings the price of DataPrism up close to that of some very strong competitors such as dBaseII, Condor, DMS and the cheaper version of FMS-80. I hope I've given you some idea of DataPrism's strengths and weaknesses; I suggest you compare those with my comments on these other comparable packages. END

Missing data

In the excitement of putting together the results of testing nine packages for the December summary of data management systems, I made some omissions, for which my apologies. (The original articles included the information — it was just the summary that left them out). You should note that:

Condor can display selected records interactively (with DISPLAY) — you don't have to create a subfile first. You may also enter (with ENTER) and edit (with UPDATE) records interactively. The emphasis in the manual is on a 'transaction processing' approach, but the commands are there for you to choose the interactive method if you wish.

Personal Pearl stores its information in variable length records of variable format, allows you to design report formats on the screen ('paint-a-screen') and keeps all its indexes up to date automatically. Maximum field size is the maximum width of a screen line, up to 132 characters (not 80, as Figure 1 suggested). Importing of 'foreign' files should be available by the time you read this, and I hope to Benchmark Pearl in the next couple of months.

THE DESK TOP GENIUS.

Now from Sharp, the Sharp MZ 80A. A personal computer that is ready to run the moment you own it. Because the CRT display, the typewriter-style keyboard and the cassette-based data storage are all integrated into one complete system that leads the operator, either amateur or professional, into an incredible new computer world.

For this computer has the power to do virtually anything within the range of Personal Computers. In it, Sharp has combined all its fine electronic technology in the field of information engineering to create



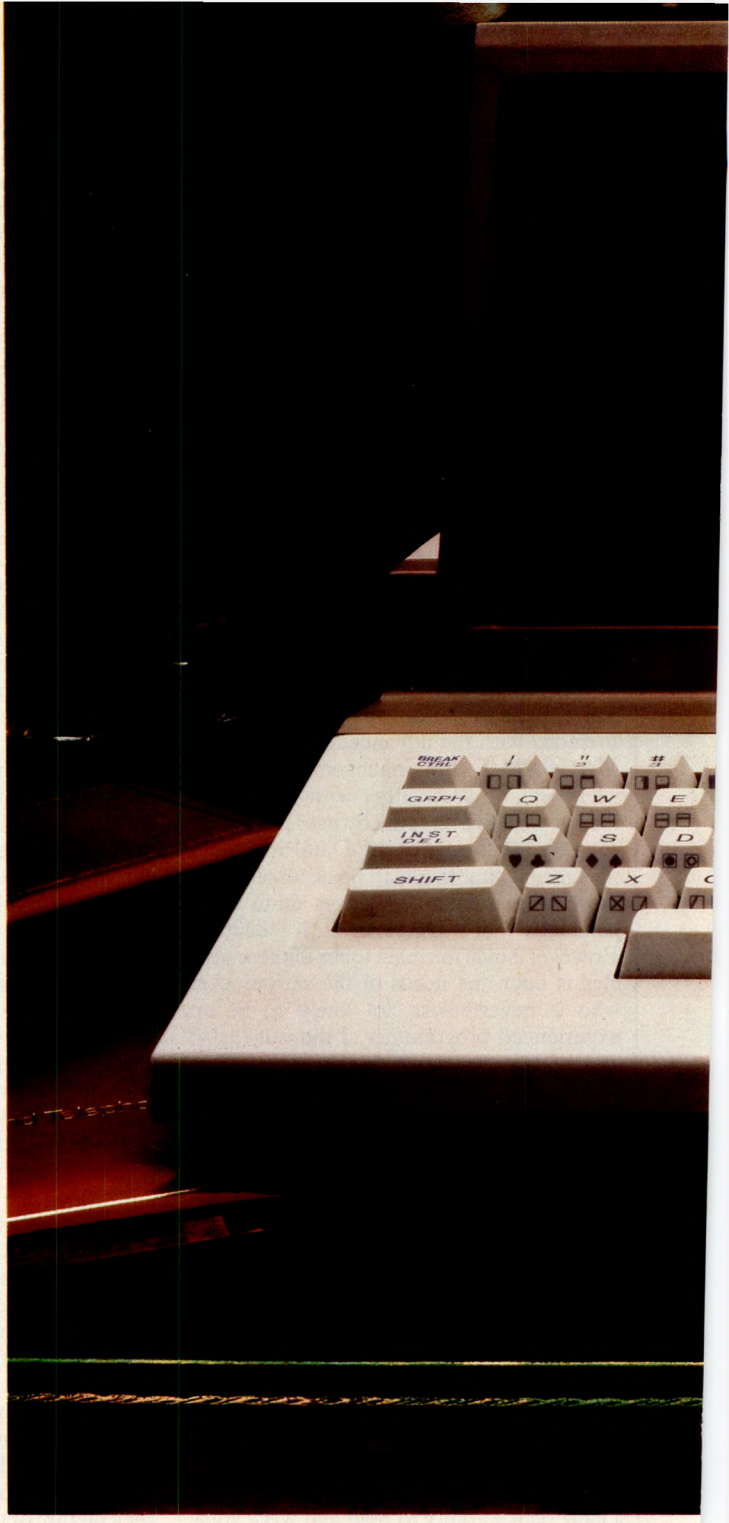
MZ 80FB
Twin Mini Floppy Disc Unit.

MZ 80P6
Character Graphic Printer.
Also available MZ 80P4 and MZ 80P5

a marvel of precision. Plus, when you purchase you get a valuable software package absolutely free.

The superb Sharp MZ 80A. Among its competitors, it is rated as a genius. To you, it will become a desk-top companion you will treasure, an invaluable part of your daily life.

Bringing to your school, office or home, the high-speed skills and advanced technology of the world of Sharp. Where great ideas come to life.



Specifications MZ 80A

CPU	Z 80
Memory	4K-byte ROM; 48K-byte RAM; + 2K-byte Video RAM.
Display	9 inch (23 cm); 40 characters x 25 lines. Green screen.
Cassette	Manual control; standard audio cassette tape. Data transfer (Sharp PWM system) 1,200 bits/sec.
Keyboard	ASC11 keyboard; upper-/lower-case alphabet; graphic symbols; numeric keypad.
Other features	Built-in clock and music function. Auto repeat on all keys. 2-page video RAM (allows the screen t be scrolled up and down). *CP/M available.
Options available	Tape based Pascal Interpreter. Tape based Machine Language package. Sharp FDOS including BASIC compiler. Tape based Z-80 Assembler package.



Printer specifications	Optional Printers MZ 80P4	MZ 80P5	MZ 80P6
Printing method	Serial impact dot matrix		
Feed method	Variable sprocket; Friction	Variable sprocket	Variable sprocket; Friction
Kinds of characters	230		
Character make-up	9(W) x 8(H) dot matrix (normal-size characters)		
Number of digits	136/68 per line 160/80 per line	80/40 per line 136/68 per line	
Printing speed	150 cps (normal-size characters)	80 cps (normal-size characters)	
Head sweep direction	Bi-directional		
Other functions	• Software-controlled full graphic function • Programmable number of lines per page • Battery-operated memory of HOME position (MZ 80P4 only)		

Design and specifications subject to change without notice.

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Memory capacity 280K bytes per diskette.

To: Sharp Electronics (UK) Ltd, Computer Division, Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE. Tel: 061-205 2333.
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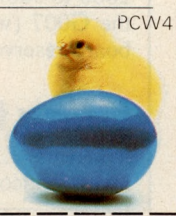

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CHECKOUT

G007 GRAPHICS MODULE

Maggie Burton takes a close look at the Notting Dale Information Technology Centre's G007 graphics board for the ZX81.

The pictures on this page were all produced using a ZX81 upgraded with a simple, inexpensive add-on. In that light they're quite striking, especially when the resolution is considered. It's 256 x 192 pixels, which compares favourably to the Spectrum's maximum of 256 x 176 when programmed in Basic.

This add-on is the G007 Module from Notting Dale ITeC — the first product they've put on the market. It was designed by a student, Gary Keall, while he was on holiday, using equipment at Notting Dale, and was originally a hobby project. Keall wanted to increase the graphic capability of his ZX81 and eventually he handed production rights over to Notting Dale.

Originally it was felt that the board should be uncased. The version I have used is one of these earlier ones and it connects horizontally to the back of the ZX81, lying flat behind it. Production models are enclosed in a smart black box which snaps into the '81 in the same way, standing vertically.

The uncased board is rather unstable to use. As it doesn't lie absolutely flat but tilts downwards a little it is very prone to jolts and nudges which have the undesirable effect of crashing the computer. The cased version stands more firmly, although in some circumstances — for instance, when a ZX Printer is being used — it could need propping in place in some way or another. An idea of its shape can be gained from a look at its dimensions. It's rectangular in shape, being 16.6cm from left to right, 6cm high and 2.7cm from front to back (4cm if the edge connector is included).

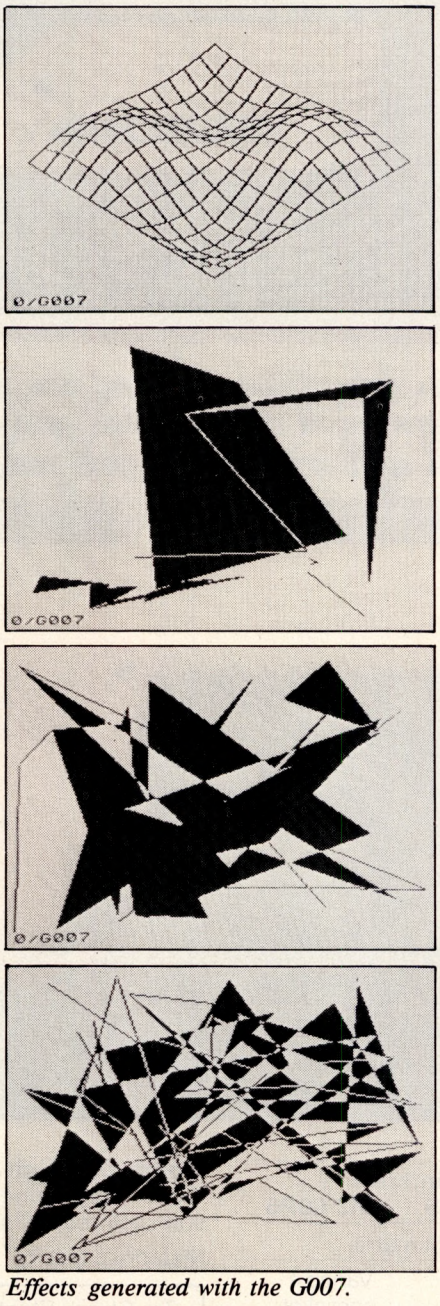
There are some conditions for using the board which should be borne in mind, especially if your ZX81 is in any way modified.

The module will only work if the ZX81's 1k of internal memory is in place and extra RAM of at least 8k is connected. The ideal RAM pack to use is naturally the Sinclair one, but Notting Dale has tested several other makes and found these all work, including some 64k ones. If in any doubt, of course, it would be advisable to consult them. Other hardware add-ons apart from the ZX Printer are not guaranteed to be compatible so again it would be wise to check. The ZX Printer connects between the board and the RAM pack.

Hardware modules and machine code programs which use the area of memory 2000 to 3000 hex should not be used with the G007 (wouldn't work, in fact) as the board reserves this area for its own use.

Using the board

When the ZX81 is first switched on, the inverse video 'K' cursor appears as normal.



Effects generated with the G007.

The first unusual thing to get used to is the fact that the ZX81 effectively now has two screens: the low-res one which is exactly the same as the basic ZX81 and the high-res one on which all G007 specific commands are executed. You can change between the two at will. The ZX81 defaults to the low-res screen initially and all program entry and editing is done using this display. Typing SLOW or FAST, followed by a number in the range of one to six, will change the display over to high-res, and typing SLOW will take you back to low-res. Changing from one mode to the other has no effect on the contents of either display.

This is a bit strange at first, but the more confusing (initially) aspect of the module lies in its modifications to Sinclair Basic (Figure 1). Rather than adding new keywords, it has added parameters to the existing graphic-related ones and this is probably because of the ZX81's single-key keyword entry. An example of this is the use of SLOW as outlined above. A better one is the G007's use of PLOT. The ZX81 uses the format PLOT x,y – x and y being the coordinates of the pixel to be shaded. For G007 purposes the formal PLOT n,x,y is used; with n specifying one of 115 separate plotting functions available — hardly a capability to be sneezed at.

Although this is confusing at first, your only real problem lies in remembering which value of n specifies which function — or looking them up all the time as I did. They are summarised at the end of the manual.

As mentioned before, the 'old' ZX81 capabilities have all been retained. The first command specific to the G007 in a program sets the display to high-res mode. UNPLOT on the high-res screen has been replaced by PLOT 0,x,y. When a program is listed (which can only happen in low-res mode) the message 'G007' is displayed rather than the usual '0/0'.

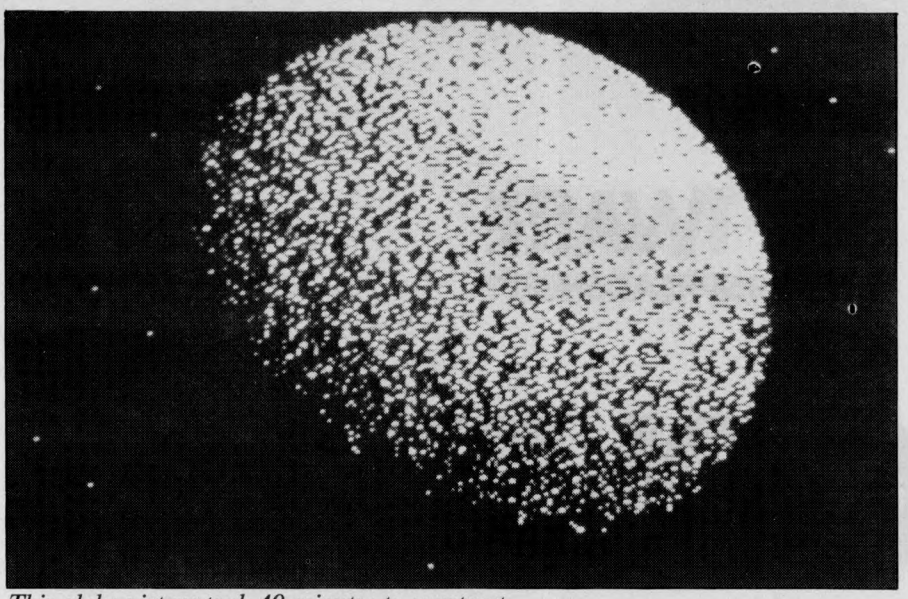
Some slight disadvantages are encountered in the use of the high-res screen. The first of these is the rather common one of being able to see only one command line at the bottom of the screen, as per RML 480Z, among others. It can become rather tedious changing mode every time you want to make a modification to a program, but this is cosmetic more than anything else. The second of these is the fact that re-running a high-res program does not automatically clear the screen. Unless a CLS command is inserted, re-running a drawing program will simply overwrite what was there before, making a really messy screen. Lastly, the display sometimes tends to waver to the right at the top. Remedying this is simple enough. In high-res mode you just type POKE 8833,0. POKEing 8833 with any value other than 0 or 237 crashes the computer.

Programming

The G007 manual contains several demonstration programs which quickly illustrate the capabilities of the module.

A quick look at the summary of commands will show that the PLOT command is the one around which most of the G007's functions are centred. For the sake of clarity I'll go through the PLOT functions one by one and outline what they do.

Points can be plotted in any position on the screen either relative to the graphic origin (the bottom left point) or to absolute coordinates. These can be in black, white or inverse video. PLOT 12,x,y is the equi-



This globe picture took 40 minutes to construct.

valent of a MOVE command.

Lines are drawn from the last point plotted (or the original if no points have yet been plotted) to the point specified. Again these can be to either absolute or relative coordinates, in black, white or inverse or with the last point missing. A useful provision is that of three line types apart from solid ones. These could not only lend variety and texture to a picture, but are also useful in drawing graphs. The three types are coarse, fine or chain-dotted and all are obtained by adding 32, 64 or 69 respectively to the basic line drawing values for n.

It is also possible to fill and texture triangles in a similar way to that in which lines are drawn. Vertices are the last two points plotted (or the two ends of the last line) and the current one. Texturing is not possible on an inverted screen. The default texture (given by putting n in the range 73-80) is a chequered pattern which is quite effective. This can be changed by inserting POKE statements into a program to change the values of the two bytes determining texture. Left or right diagonal shading, cross-hatching or fine dots can be obtained in this manner, although the relevant bytes must not be changed directly from low-res mode.

User defined characters

Defining your own characters with the G007 is, unfortunately, not the easiest of tasks. It is made possible by the fact that the module enables direct conversion between normal and inverse video — therefore the ZX81's inverse video character set is no longer needed. Custom-made characters can be designed on an 8x8 grid, translated from binary numbers into decimal ones, POKEd into memory and then stored in a REM statement at the beginning of a program. The inverse character set vector is moved (again using POKE) to the address containing the first part of the user-defined character. The addresses containing all subsequent parts of the character must be consecutive. Characters are printed using CHR$.

It's plain that this is not the easiest way to define characters. But it's effective and is protected from NEW as the area of memory between 8448 and 8703 decimal is reserved for storing the necessary data. It is possible to redefine the whole of the ZX81 character set in this way, but extra memory must be reserved to do this.

User-defined characters are complemented by the facility to mix predefined characters and graphics on the high-res screen. This is a flexible capability, especially when compared to the normal ZX81 facilities. Six printing modes are provided, specified by the value of n following a SLOW or FAST command. These modes are quite versatile and you can switch from one to another within a program using SLOW and FAST.

Text is treated as having a foreground and a background. The foreground can be in black, white or inverted and the background can be inverted. This means you can contrive things so that characters are invisibly printed on the screen.

Documentation

An attractively bound manual is provided with the G007. While it is easy to follow and quite friendly, it isn't ideal reading for the beginner. All you need to know about the module is within it, with plenty of details in appendices at the back on the ins and outs of the memory, calling routines and system variables. It is, though, a manual which needs a fair amount of knowledge of normal Basic before it can be fully understood. This, however, is mostly due to the method of operating the board.

It begins with a list of operating conditions, and an introduction to the G007's capabilities. It then goes step by step through each command used and finishes with a summary and technical details. In spite of the fact that it is in no way aimed at a naive user, it is quite adequate.

Conclusion

There are other graphics boards for the ZX81. Digital Integration makes one which costs £38.95, and provides lower case as well. The G007, however, has the edge in the price department, costing just £32 + £4.80 VAT. It's only available by mail order and 75p postage has to be paid.

It has to be said that operating it is not as simple as it might be. It provides very fast and crisp plotting and outputs well to the ZX Printer, but using it to the full really does take some careful thought and possibly background reading. This means it would be a useful educational tool once a beginner has got past the very first stages, and the possible results make the challenge of a bit of mental activity very worthwhile, as the display photos show.

Notting Dale guarantees the board for 12 months and will repair it (if repair is possible) after that time. A demonstration tape is supplied with it containing some games, more of which will be available in the near future. I'm told that they are 'open to suggestions', according to production manager William Haynes, on the subject of software written for the G007 and would consider using any good ideas which come from customers.

All things considered, the G007 module is a worthwhile buy for any serious-minded ZX81 owner. It's especially good value from the point of view of someone who can't afford a more powerful computer because it makes high resolution computing possible for under £110 (at an educated guess, based on the cheapest available RAM pack prices).

Command	New Format	New Functions
SLOW	SLOW n (n=1 to 6)	Sets display &
FAST	FAST n	PRINT modes
CLS	CLS n (n=1 to 3)	Clears high/low res screen, inverts display.
COPY	COPY n (n=0 or 1)	copies high/low res display to ZX Printer.
PLOT	PLOT n (n=−1 to 130)	Plots points, draws lines, moves graphic origin, unplots, fills & textures triangles, specifies line types.
PRINT	Syntax as before. One of six print modes set by value of n in SLOW/FAST commands.	Prints as normal, prints with black/white/inverted foreground or inverted background depending on mode.

Fig 1



SOFTWARE

WHICH SPREADSHEET?

PROPHET II

Mike Liardet reviews an all-in-one spreadsheet system which combines hardware and software in a budget-price package.

My first encounter with the Prophet II system was a rather energetic one: carrying it down three flights of stairs from the *PCW* offices, into the car, then back up three flights of stairs into my flat. 'So what?', I hear you say, 'Liardet must be pretty feeble if he can't manage to carry a software package a few yards.' Ah! but this package includes the hardware, doesn't it? And it's a particularly 'hard' piece of 'hardware', too!

Basically Prophet II comes as a complete dedicated spreadsheet system — hardware, software, everything you need (bar a printer) at a very modest price of just £795+VAT. The actual physical components of the system are a modified Acorn Atom computer, a Ferguson 12in black and white television and a Pearlcorder microcassette recorder — all fairly lightweight items. However, in an intriguing attempt to marry Victorian engineering with the marvels of today's silicon revolution, Busicomputers — the supplier of the system — has housed all these components in what can best be described as a robust metal case. The case comes complete with carrying handle, but no rubber feet — so if you buy one, don't be like me and plonk it straight down on a polished table. Any other complaints? Well, yes there are, actually: there's no on/off switch — you have to use the plug, and the case obstructs the aerial socket of the TV, making it difficult to use as a conventional TV, should you wish to do so. At least the microcassette is detachable and can be used independently if so desired, and the computer can be used as a straightforward Acorn Atom in addition to its spreadsheet function by simply flicking a switch.

Getting started

Anyway, having got the system home, where do you start? Well, quite simply, plug in the single mains plug, switch on the TV (the Prophet II one, that is), twiddle the tuning dial and with minimal fuss you are faced with the spreadsheet display. Refer to the manual and off you go!

To anyone who has seen a number of spreadsheet systems, the initial display has a fairly reassuringly familiar look about it: The bottom 13 lines of the screen (out of 16) are dedicated to the spreadsheet window. The top left hand corner of the spreadsheet is currently 'in-window', with the cursor (displayed using inverse video) at the very top left hand cell. Also in inverse video, down the left hand side are listed the row coordinates (numbers), and along the top are the column coordinates (letters). The top three lines of the screen are also in inverse video, but are reserved for special messages, and so on.

Moving the cursor around the spreadsheet is very simple. The Atom has four keys (up, down, left and right) at the side of the keyboard and simply pushing these moves the cursor in the obvious directions. Moving the cursor off the right or bottom edge of the screen causes a rapid screen redraw — the window position is being adjusted to follow the new cursor position. The cursor actually remains physically where it was before, but the coordinates have changed. Moving off the bottom of the screen causes row 1 to disappear, and be replaced by row 13 at the bottom — row 2 being the new top row on the display. A similar thing happens to the column coordinates when the cursor moves off the right hand side of the screen. Holding the arrow keys down causes very rapid cursor movement, with lightning-fast screen redraws. Unfortunately, this redrawing is accompanied by a somewhat disturbing 'tracer-storm' on the display. As soon as you let go of the key the display returns to normal.

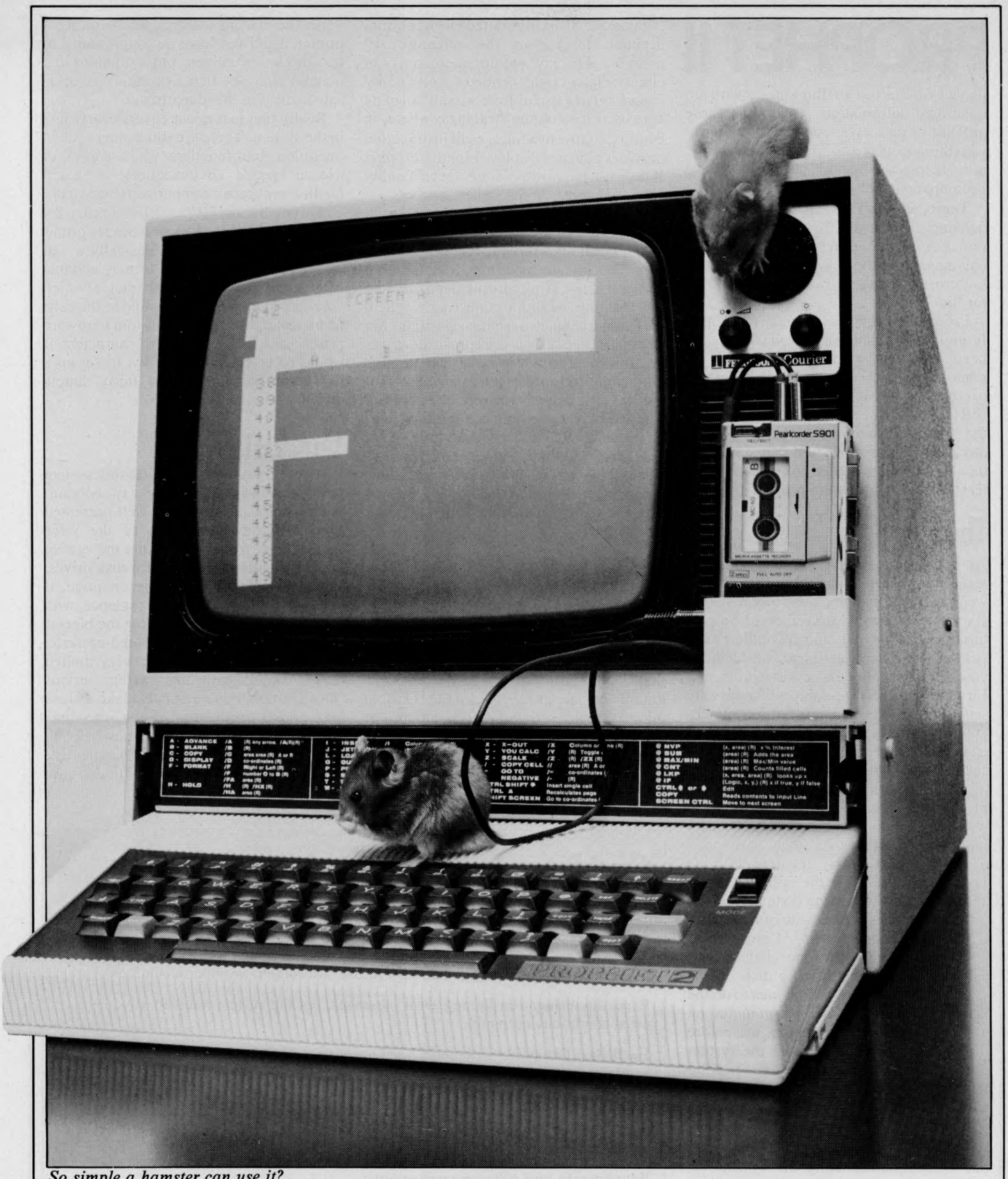
By continually moving the cursor away from the top left hand corner, the overall boundaries of the spreadsheet can be established: 255 rows by 63 columns (columns after the 26th are identified as AA..AZ,BA..BK). Attempts to move any further than this are flagged with beeps from the Acorn speaker. The system provides a direct cursor 'jump' facility: a few keystrokes and we have leapt back to the top left hand corner. Actually there is also a rapid cursor move facility: holding 'shift' and an arrow key simultaneously, the cursor leap-frogs ten cells at a time, which is quite useful for middle distance 'jumps'.

Entering numbers and text in the spreadsheet is very straightforward: simply move the cursor where you want, and type away, terminating with 'return' to 'fix' it there. (Terminating with an arrow key results in the cell being left blank and the text being moved with the cursor to an adjacent cell.) If you enter a decimal number it is a little bit disconcerting: at switch-on the display format for numbers is integer-only and consequently your decimal number is displayed rounded to the nearest integer. After some scouring of the manual, it transpires that all is in order — if you change the display format (fairly easy to do) you will see your number correctly displayed. Regardless of display, the system has correctly 'remembered' your original entry.

Doing calculations

Setting up a calculation is almost as easy as entering numbers and text: Prophet II uses the fairly standard notation already familiar to anyone who has ever written a program, and picked up easily by anyone versed in most basic mathematics. Cells are identified by their coordinates, '*' is used to signify 'multiply' and '/' for 'divide' — thus expressions can be built up like '(A1*B3+(C4−A1))'. So to get Prophet II calculating simply move the cursor to the required cell, type in the expression and see the instant results of the calculation. Jump back to any of the referenced cells, change a value, and see the new recalculated value instantly displayed. Change one of the referenced cells from numeric to text data, and we can quickly verify that Prophet II does not go haywire (good!).

Prophet II comes with an extensive range of other functions, apart from the elementary arithmetic: square roots, logs, trig, degrees to radians, a random number generator — in fact just about everything



So simple a hamster can use it?

you could possibly want in this respect. Special functions, not normally encountered outside the world of spreadsheets like 'SUM', 'MAX', 'COUNT', 'net present value' and others have all been implemented to operate on a rectangular block of cells as well as being capable of dealing with a simple row or column. There is also a function called 'TOP' which returns the amount of memory still available. Unfortunately, the display itself does not provide this information automatically, so if you are reaching the point where memory is getting scarce you must keep referring to this function. (Incidentally the system does not 'crash' if you attempt to exceed its memory capacity — it merely displays 'E' (for 'exceeded'?) and refuses to allow you to do anything that would consume any more memory.)

Special facilities

Much to my relief, the system comes well equipped with a formula replication facility — the Benchmark tests involve filling the system up to saturation point, easily done with replication, but a major cause of 'reviewer's digit' if you have to do it manually! Incidentally, most of the extra facilities, such as replication, format changes, and others yet to be mentioned, are invoked by hitting the '/' key, followed by a sequence of mnemonics — eg, '/FA A1L9' means 'Format Area from A1 to L9'. Although the facilities are all well described in the manual, and there is also a reference card stuck on the case, it was sometimes difficult to remember or find the correct sequence. Unfortunately the system provided very little prompting, most of the time keystrokes being passively dis-

played at the top of the screen with no additional information. Obviously these difficulties pass once complete familiarity with the system has been gained, but a little more help at the learning stage would have been appreciated!

There are also adequate facilities for deleting and inserting rows and columns, or rather crossing out and inserting lines and columns (since the delete mnemonic is 'X' for 'cross out' and the row mnemonic is 'L' for 'line').

Prophet II provides a facility for editing formulae or whatever may have already been entered into a cell. It was only when I reached this point in the manual, where an exercise is set to change 'PROFIT' to 'PROPHET' by editing, that I appreciated the product name is in fact a pun — obviously based on the old joke about the monk who was expelled from the monastery for fiddling with the profit!

The cassette

At this point, I must say that although somewhat disappointed by the overall weight of the system, once permanently stationed on a table it seemed to be performing fairly well: documentation well written, consistent and clear, all facilities you can reasonably expect, low price, etc. First surprise: a 60-minute microcassette set me back £2.50. As it is not recommended to store more than one spreadsheet on each side of a cassette, this works out several times more expensive than floppy disk storage (where a £3 disk can usually manage 10-20 spreadsheets or more). Still we can buy a fair number of cassettes with money saved on the overall purchase price of the system! Anyway, having set up the Benchmark test, I got the system to do a 'save' to cassette. Having done this sort of thing many times before, with other floppy-based spreadsheet systems, I am used to just a few seconds pause for even the largest spreadsheet to get written to disk. In the event, Prophet II took 32 minutes to do the 'save', spending the last two minutes on 'borrowed time' and finishing just before the tape ran out! I gather that the system uses the standard Acorn Atom cassette tape protocol and appears to be able to save about a thousand characters of data a minute. Tape read and write speed being the same, the 'load' time is identical. Anyone contemplating using the system for medium to large spreadsheets (and applications can grow big very easily) had better be prepared to do loads and saves during his lunch-hour.

Display and formatting

Having dealt with the only major problem so far, I moved on to check out the layout and formatting facilities: These proved to be very flexible. Columns can have individually differing widths ranging from zero (yes zero! — useful for 'hiding' intermediate work-columns, etc) right up to 29, which fills the entire screen width. Numbers can be formatted using normal decimal, integer or the scientific 'E' notation. Display within a column can either be left or right justified — this facility is particularly useful for correctly aligning text used for column headings, where, in contrast to row headings, right justification provides a neater display. Finally, Prophet II does not provide the 'split-screen' facility seen on some spreadsheet systems — perhaps the Acorn Atom 16x32 character screen is too small to make this of any real value, but it does provide a useful alternative. The system maintains four different cursor positions (initially all identical), and it is possible to flip around each of them very rapidly. Once the cursor positions are at different points on the spreadsheet it is possible to effect a very rapid scan through four completely different (and quite probably very distant) parts of the tableau. These different positions are labelled, a little misleadingly, as 'Screen A', 'Screen B', etc. I prefer to think of them as 'positions', since they are in fact all on the same spreadsheet — my initial impression was that the system maintained four different spreadsheets.

Other facilities

Two other useful facilities: cell protection and titling. Cell protection prevents inadvertent modifications to a cell and the titling facility enables what would typically be the first column and top row to be kept continually on-screen, even when the cursor is miles away from the top left hand corner. As this is where you normally place your row and column headings, this provides a great deal of help finding your way round the spreadsheet ('Is is row 78 or 79 that has the sales figures?').

As the system was supplied without a printer, I did not have the opportunity to test printout facilities, but examining the manual suggests that everything is quite satisfactory in this department.

Really that just about covers everything in the system. There are some other special operations and functions which can be of use in special circumstances: a search facility, arithmetic comparison ('less than', etc), a conditional (IF(x,y,z) results in y if x is true, but z if it is false), and a fairly primitive facility for graphics. Basically a cell can be given the 'graphics' format, and this causes it to display a text character (which character depends on the value in the cell) instead of its value. As the Atom hardware provides a set of graphics characters it would be possible, eventually, to set up a bar graph, or some other fairly simple display.

Conclusion

It should be remembered that this system provides a fairly inexpensive way of obtaining a sound and reasonably well-presented spreadsheet system. Most of the price savings arise from the fact that the system functions without the need for disk drives. Whilst this saves something on price, it does penalise the user in convenience, with up to half hour waits for saving the biggest spreadsheets onto the audio-cassette. Spreadsheet purchasers on a very limited budget should give this system serious consideration, but should also take a close look at the competition — eg, the disk-based Osborne 1, or the new Epson HX-20, to name but two inexpensive systems with spreadsheet facilities, both recently reviewed by *PCW*.

Checklist

Documentation: One manual of 67 pages, no index, no contents page, sparsely illustrated. Written as a tutorial with embedded reference material. Easy reference card affixed to case. Documentation generally clear, consistent and well-written.

User-friendliness: System was easy to use. More help-prompts would be of value.

Error-handling: Hardly any error messages, but the system handled all keyboard error conditions correctly.

Facilities: Extensive arithmetic, very primitive graphics, can handle spreadsheet overlays. Turnkey system. Can insert, delete and replicate rows and columns. Very flexible display facilities — no split screens but useful alternative. Can protect cells and do titling, edit formulae, switch between automatic and manual recalculations. Provides 'long jump' facility, and deals satisfactorily with 'out of memory'. Searching and logic also provided.

Benchmarks and other measurements:
Measurements: Up to 255 rows and 63 columns. Columns can be up to 29 characters wide. Screen dimensions are 16 rows x 32 columns. Numeric precision is 9 digits.
Benchmark 1: (a) 87 rows; (b) 34 seconds; (c) 34 seconds; (d) 6 columns/second, 6 rows/second (21 columns/second, 64 rows/second using 10 cell at a time 'leap-frog' moves).
Benchmarks 3: 123 rows.

For an explanation of Benchmark timings see 'Which Spreadsheet' — *PCW* February 1983.

Supplier and price:
£795+VAT — includes all hardware (except printer), software, manuals.
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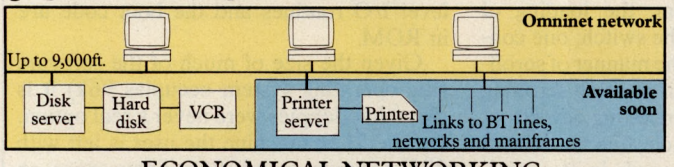

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BENCHTEST

CORVUS CONCEPT

Dick Pountain tests another entrant in the 68000 supermicro stakes.

The introduction to the Corvus Concept User Guide begins 'Congratulations, with the Corvus Concept you have entered the next generation of computing'. It seems like only yesterday that I entered the third generation of computing with the ACT Sirius, which makes it clear that microcomputers reproduce on a timescale closer to that of the rabbit than to homo sapiens.

Inspection of Corvus's claim, though, reveals that it has much merit. The presence of the MC 68000 processor alone is not quite enough to constitute a new generation, shared though it be by the Fortune 32:16, Sage II and a host of other new machines, but the claim is strengthened by the overall design of the Concept. It is basically designed from scratch as a powerful network work-station which can if desired be used as a stand-alone computer. It makes use of high resolution graphics and a fullA4 display only previously found on expensive dedicated word processors. It is entirely winchester-based, floppy disks being used solely for distributing software. The system software and programming facilities are entirely based around Pascal, with Fortran as a second option for the scientists and engineers; for use as a management tool it comes ready equipped with a spreadsheet and word processor which are integrated into the system firmware. All of this certainly adds up to something which feels like a next generation compared to the CP/M-based standard which still prevails among business machines. The refinement does not come for nothing, though; the Concept is more than twice the price of a top end CP/M computer.

Hardware

The Concept was Benchtested as a stand-alone computer system using a 10Mb winchester disk for storage and a single 8in floppy for loading extra software to the winnie. The system consists of five units; a processor housing on top of which sits the monitor, a separate keyboard on a coiled lead, and the floppy and winchester housings. The units are boxed in well-finished glass-reinforced plastic cases in Apple grey/beige.

The processor housing is a flat box whose sole visible feature is a cooling grill through which the very quiet fan draws its air. At the rear of this box is a panel which mounts two RS-232 sockets and the connectors for keyboard, monitor and Omninet, the Corvus network. A large section of this panel is removable by loosening two screws; it slides out like a drawer, revealing the main board to which it is attached. This board, a multi-layer PCB, contains the 68000 and all the support chips as well as four Apple-style expansion slots. These are more than just Apple-style, they are Apple-compatible: the controller boards for the Corvus winchester and the floppy plug in here, their ribbon cables leaving through a vertical slot — again Apple-style. The winchester controller will reputedly plug straight into an Apple and work (I didn't have a chance to try it). The compatibility is limited since the 68000 will not run 6502 code.

Memory is contained on a second board, piggy-backed on 2in stilts, and consisted of 512k of static RAM on the review machine (256k is standard). This is organised as four banks of 64k devices, each bank being further split into upper and lower bytes for the 68000's benefit when performing 16-bit accesses. 55k of the memory is used to bit-map the video monitor with Direct Memory Addressing to allow writing to the screen at 32 Megabits/sec.

The huge monitor sits on top of the processor housing and tilts and swivels in the modern fashion to any convenient position. The real novelty though is that the monitor can be lifted off its pedestal and turned on its side so giving the option of a 'portrait' (full A4-sized display) or a 'landscape' (extra-wide display for spreadsheet work). The monitor is locked or released from the pedestal by a sliding catch under the front edge; having changed its orientation a switch on the rear panel is flipped to change the orientation of the display to match. This operation has to be done with power off and the monitor unplugged so it is not advisable in the middle of an editing session.

The two different display modes require different display drivers, the loading of which is controlled by the switch; one consequence of this is that the manner of scrolling varies. In the portrait position scrolling involves a rather disconcerting rewrite of the whole page at each line so that I generally preferred to work in the landscape position where the scrolling is more normal. The monitor displays 560x720 dots in black and white; the picture being sharp and steady apart from a very slow ripple which is not obtrusive. The display can be reversed to a white background by toggling one of the function keys, and is divided into windows which are controlled by the system software — of which more later. One surprising omission is that the screen is of bare glass with no anti-reflection coating; handy for combing your hair but annoying in a machine of this price.

The keyboard unit is small by comparison with the surfboards we have seen from IBM and DEC; it has 91 keys and features a numeric keypad which also contains the cursor keys and is separated from the main keyboard by a narrow fixed bar. The feel of the keys is excellent and they make a most satisfying click. All keys auto-repeat and there is a FAST key which steps up the repeat rate to rat-up-a-drainpipe proportions. All input is via a sizeable type-ahead buffer so that you can type a whole string of commands without having to wait for, say, a series of disk accesses to finish between commands. A proper caps lock is fitted along with the usual ESC and CTRL, though the latter is placed at the bottom right. Two special shift keys sit on either side of the space bar; COMMAND shifts to a new set of function key labels while ALT gives an extra set of characters from the keyboard, including in the standard set Greek and European accented characters. Concept character sets are software loaded and user-definable, as will be seen under 'Software' below. Along the top is a row of ten function keys which are extensively used by the operating system and are the main means of entering commands. In all, this is a high class keyboard which is a pleasure to type on.

Software

When you have said 'software' you have said almost everything about the Concept; remarkably little is contained in ROM. As it is intended to be used exclusively with a winchester, all its device drivers, character sets, and most of the operating system reside on disk and are loaded as needed. Only the self-test routines, some machine level I/O routines and the boot code are in ROM.

Given the size of much of the software (the operating system occupies 96k) it is clear that floppies were never a real option. On the 512k machine the user is left with 275k of program and 121k of data space, on the 256k you get 83k of program and 57k of data.

The single-user Concept uses an operating system which is called Merlin but which the manuals consistently refer to as CCOS. This is a volume oriented system which bears strong influences from Unix but lacks the latter's multi-tasking abilities (that is, the ability to run two or more programs simultaneously).

When powering up the Concept, following a self-test report, a menu invites you to choose the source for booting, the options being Debugger, Floppy disk, Local and



Photography by Ian Dobbie Graphics by Andy Martin


CORVUS SYSTEMS

Omninet. In our case Local is chosen for the local hard disk drive. The Debugger (not fitted to the test machine) resides in PROM for use in development systems. Once booted, the Corvus logo is displayed and then you are asked for your user name and password; while this is hardly necessary on a single-user machine it has immense psychological value. You really feel as if you're playing with the grown-ups. CCOS then looks for a file called CC.SETUP which contains a command sequence to execute. On the review machine this mounts a selection of volumes, but it could be made to go on to run a program for turnkey applications.

A volume, in Unix-speak, is any physical device which is on-line, like a printer, a floppy drive or the console or keyboard. Volumes used for storage are called blocked volumes, because they are written to and read in blocks, whilst the others are serial volumes. A floppy drive is treated as a single volume whereas the winchester is divided up into several volumes, of sizes chosen by the user. One of these is selected to be the current volume, which is rather like having a particular floppy loaded in a drive. The current volume can only be selected from those which are mounted (ie, recognised by the system).

Once into the operating system proper, one is confronted with a screen divided into three windows: a large box where the business is actually done, under which is a narrow box, the command window, where all system prompts and user replies are typed, and below that ten labels which show the current function assigned to each function key. As on the Hewlett Packard HP125, these labels are arranged in hierarchical fashion so that pressing one often leads to a new level of labels. In addition, each single label can carry four different functions by virtue of the two shift keys, SHIFT and COMMAND — pressing either or both of which presents a new set of labels.

The actual operating system shell, which is very Unix-like, need not be seen since all necessary commands are available through the function key program, which is called the 'Dispatcher'. If it is required or desired (say by an experienced Unix user) to enter the actual shell this can be done by pressing the Execfile key without any argument; this takes you out of the Dispatcher level and puts the '%' prompt up in the scrolling window ready for typed commands. Execfile is a utility like CP/M's SUBMIT (but more general) which normally takes as argument a file of operating system commands which are then executed in order.

The first level of Dispatcher labels contains the names of various application tasks which are available — *viz* CP/M (the Corvus CP/M Emulator), Logicalc (the spreadsheet), EdWord (the word processor), plus the commands to list the directory of the current volume, change the current volume, clear the current window, change the current window and Help. Help gives access to an on-line manual; press it followed by the key for the function you wish to enquire about and an explanation is loaded from disk and displayed.

The second level is reached by pressing COMMAND and contains the various manager programs; FileMgr, WndowMgr, SystmMgr and MountMgr. FileMgr leads to a new level where all the utilities for copying, listing, deleting, renaming and concatenating files are found; additional facilities are Makefile which can construct a directory header and Crunch which is necessary to gather up free disk space into a contiguous block when files have been deleted.

Directories in CCOS are not nested beyond one level (one per volume), unlike Unix. A directory listing shows file names, date last updated, size in blocks, number of bytes in the last block, starting block address on the disk and type (there are only two types, text and data, ie, binary) — which is quite a screenful for a humble CP/M user. Free spaces are shown in a volume directory listing as files with the name <. . .> and Crunching the volume will place all the space as the last entry.

Output redirection a la Unix is allowed with ListVol and ListFile; to send the listing of a volume called Myprogs to the printer you would type '/Myprogs > /Printer', where the slash denotes a volume name and > means 'send output to . . .'. To access a file on a volume which is not current you type a 'pathname' such as '/Myprogs/Myfile'.

WndowMgr leads to a level where alternative character sets can be loaded from disk either to the keyboard or the display or both. Also, windows can be created, deleted and selected in the main part of the screen (the command and label windows are fixed); up to 17 windows can be made but, since CCOS is only single-tasking, one of them must be selected as the active one where display occurs while the others are frozen.

SysMgr gives access to utilities for setting the time and date on the real-time clock calendar (which has built-in battery backup), for setting printer parameters and assigning device drivers; it also contains the program EdChrSet which lets you create new character sets. This program works rather like EDOT (or Cedit or whatever they call it now) on the Sirius, being a screen-oriented editor whereby you draw the characters on a supplied grid using the cursor and filling in squares on a much enlarged scale. It is more flexible than the Sirius version, though, in that the size of character you can produce is not limited to the standard 8x10 grid but can have any height and width in the range 1 to 16 dots.

Finally, MountMgr contains the utilities needed to mount and unmount volumes. This has only scratched the surface of the Concept operating system but there is so much to describe that it could take up the whole Benchtest. In particular, I haven't mentioned printer spooling and despooling. At first I was rather intimidated by the beast, not having had any Unix experience, but once the system of Dispatcher labels had sunk in I began to find it easier and easier and soon started to regret the absence of many of its better features in CP/M. In particular, the error reporting is clear and intelligible and invariably fail-safe — eg, 'Vol. not on-line'. The only real gripe I have is that there are some inconsistencies in the ways of quitting functions: sometimes you hit Exit, sometimes Q for Quit, Cancel or Cncld, sometimes ESC and Return, sometimes Return on its own, and very occasionally you have to reboot. This is about par for the course on most micros but the rest of the Corvus ergonomics are so good that it stands out as a source of irritation here.

Talking of CP/M, the Concept has an Emulator program in which the 68000 pretends, through software, to run 8080 instructions. Separate volumes have to be set up in CP/M format; pressing the CP/M key then brings up the dreaded A> and away you go. It runs very slowly but I managed to install and run a database program called Rescue successfully from the floppy drive. It flatly refused to run Z80 Forth, though, presumably because some Z80-only instructions are used.

EdWord is Corvus's text-editor/word processor program and its fame has already spread in advance of the machine that supports it. It is entered from the top Dispatcher level by pressing its own key. The program then prompts for the name of the workspace you wish to use. A workspace is not merely a text file; rather it is a structured collection of text files which is saved as a total environment each time you exit from EdWord. This means literally that when you reopen a workspace weeks later, the cursor will still be at the place in the text where you left off (it also means that you never have to worry about saving your text as you do in Wordstar). If the workspace you name does not exist, EdWord asks you for the size you require and creates it on the current volume if there is room (the size cannot be altered once set). The workspace I am typing this in occupies 700 blocks — ie, 350k — which should be enough!

Each workspace is structured into named workpads which are the actual text areas; some of these, like the ones for printer output and the Undo and Redo functions, are created by the system and others by the user. The workspace is organised by hierarchical directories (more like Unix than CCOS itself is). You can create new directories at will and new workpads within them. Workpads can be written to disk as CCOS files, which is the format required when using EdWord as a Pascal or Fortran editor; it is unnecessary when word processing as they are saved in the workspace anyway. Equally, a CCOS text file can be

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read into a workpad — the system does this initially with a pad called 'HELLO' which is an interactive EdWord tutorial. Later on you will delete this facility to save time. A nice touch is the provision of two graphic 'thermometer' style indicators on the screen which show you where you are in the current workpad and how much of the workspace has been used up.

The actual editing functions are a joy to use, controlled as they are from the function keys with no control codes to remember. Basic editing is done with the cursor and the Insert and Delete line and character keys while a key called Zip allows fast movement about the workpad with GOTO a given line number or the beginning or end of file or backward and forward a page. Adjust automatically formats paragraphs, preserving any indents (great for Pascal source code). Automatic wordwrap is featured but, unlike Wordstar, EdWord does not justify text on the screen; justification occurs on the printed output using dot commands. Search and replace can remember four 'patterns' to search for, either literal or token search, and also remembers the last pattern you searched for and offers it as the default. Cut and Paste commands for moving blocks of text work through a system workpad called Copy which holds the text to be moved; this allows copying or moving to other workpads and editing of the copy text in its buffer. The maximum width available is 150 columns; this requires sideways scrolling even with the landscape screen.

It is when using EdWord that the combination of winchester, fast processor and fast screen is most noticeable; everything happens almost instantly compared to a floppy system running Wordstar, and what small delays there are are absorbed by the type-ahead feature.

The feature which has excited most comment, though, is Undo/Redo, which allows you to undo all the changes you have made to a text, generation by generation, restore them to the original form, and also to redo them again (this is done by saving the edits in special system workpads). Undo means that when a horrible mistake is made all can be made well at a keystroke.

Full background printing is supported, as the formatted text lives in a separate workpad called PRINT; you can carry on working in another pad while it happens. Printing can be arranged so that the formatted version of your text can be inspected in the PRINT pad before committing it to paper, and printing starts automatically when you leave the pad; the formatted file can be edited for last-minute changes.

In short, this is the best editor I have ever used and I grind my teeth audibly at the thought that I have to give it back! My only disappointment, perhaps rather a churlish one, is that given the amount of memory and the ability for soft character sets, surely it should have been possible to display bold and italic on the screen, rather than relying like everyone else on embedded escape codes.

Logicalc is a competent but unexceptional spreadsheet program, which, by dint of the half a meg of memory, can hold a huge worksheet. A pity that Corvus couldn't have signed up Multiplan whose powerful multi-file capabilities would have suited CCOS a treat.

And so on to programming. Although a Fortran compiler is included, the Concept is every inch a Pascal machine in that Merlin (or CCOS) is written entirely in Pascal except for a few lines of assembler for raw I/O routines. The entire programming environment is the work of Silicon Valley Software Inc and consists of the Pascal and Fortran compilers, a 68000 Assembler, a Linker and a Librarian which can handle relocatable modules produced by any of the language processors. A system library contains Pascal and Fortran routines to control all the hardware including the high res graphics, turtle graphics, the sound generator for music, and the function key system. The graphics primitives include plotting a point, drawing a line, filling a block, moving a block and writing a string of bytes. No raster operations as such are included but the design of the machine would lend itself to writing some. The graphics are easily incorporated into a Pascal program by declaring 'USES CCgrfIO'.

The Pascal compiler (SVS Pascal) broadly follows the ISO standard with some extensions drawn from UCSD Pascal. Its file structure is UCSD-compatible. It generates 68000 native code and as you will see from the Benchmarks it is a bit quick (roughly the same times as the PDP 11/34), especially when compared to p-code systems.

It shares with UCSD the restriction to eight significant characters in identifier names and the implementation of Library Units and the USES declaration and Interface and Implementation sections. It adds an 'Otherwise' clause to Case statements, hexadecimal constants, and the passing of procedures and functions as parameters but lacks the reserved word 'segment' (the effect of segmentation can be had through a compiler option $S). Interesting additions are the predeclared variables ARGV and ARGC which contain the values and number of arguments passed from the command line to a running program and @ which when placed in front of a user declared variable, function or procedure returns its address.

The compiler prints the numbered source line when a compilation error is encountered but does not invoke the editor as does UCSD. Nevertheless EdWord's capacity for remembering where you were, plus its single keystroke entry, makes for debugging which is just as fast, and there is no doubt that though the UCSD editor is good, EdWord is better. The Linker is very easy to use as it is menu-driven; all Pascal programs require a run time library PASLIB to be the last item linked, regardless of any Library Units that might be in use. PASLIB contains all of the maths, including transcendental functions, whereas these are in a Library unit in UCSD.

Having no expertise whatsoever in either Fortran or 68000 Assembler I cannot comment any further on these except to point out that the Fortran compiler is too big to run on the 256k model without fiddling with stack pointers and one who should know says that it generates code which runs slower than the Pascal.

Expansion

The system tested had the full complement of RAM — ie, 512k. The winchester could have been replaced with a 20Mb model and up to four drives (including any floppies) could be daisy-chained onto it. But the most obvious expansion is to add the Omninet network and more Corvus Concepts to share the expensive bits, like the winchesters and daisywheel printers, between them. Each machine remains a single-user, single-tasking machine but the spool/despool facility of Merlin allows the printer to be shared while individuals maintain their own volumes on the disk. Obvious applications for this kind of network are for word processing and spreadsheet planning in a large office or for programmers in a software house. It is not very suitable for shared database work or systems where security is involved because of the relatively free access of all users to the data, and the degradation of disk access times that would be involved if the users were constantly on the net. Since Omninet uses a simple twisted pair cable and requires no interface hardware but that which is built in it should prove much cheaper to install than more sophisticated network systems such as Ethernet.

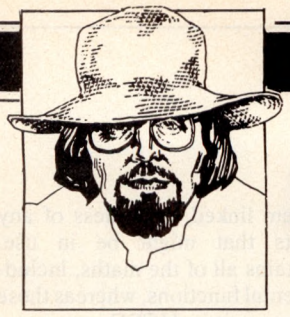
For multi-user, multi-tasking under Unix, Corvus is working on a new (incompatible) model of Concept which will also

GOTO page 224

Pascal Benchmarks

magnifier	0.15
forloop	1.33
whileloop	1.51
repeatloop	1.23
literalassign	1.73
memoryaccess	1.81
realarithmetic	19.75
realalgebra	17.88
vector	11.47
equalif	2.46
unequalif	2.44
noparameters	0.95
value	1.30
reference	1.38
maths	11.93

For a full explanation and listing of the Benchmark programs see PCW *May 1982.*



BANKS' STATEMENT

BELLS, WHISTLES & GIZMOS

Martin warns: don't build your hopes on manufacturers' castles in the air.

By the time you read this, the new year will have already taken shape and be well on its way. At the time of writing, however, it is still a fond gleam in a politician's eye. This is a time when it is worth considering what the next 12 months will bring, and whether you will benefit from it anyway.

Such thoughts may seem strange when the world and its uncle suddenly wants to buy a home computer for itself and its children. Both the users, and the industry, should benefit greatly from such an arrangement. Unfortunately, it is exactly this demand from users and potential users that can create problems — problems that can cause those users disquiet, distress and aggravation.

Not least of such problems is the one outlined by my colleague, *PCW*'s newshound Guy Kewney, in the January issue of this august magazine. He pointed out the number of products — both complete machines and add-on bits and pieces — that should have been available by Christmas time. Unfortunately, they were not available.

Now this is a fairly common occurrence in the computer business, where pre-announcement of hardware and software has been used for years as a legitimate, if unfair, marketing tool. With mainframe computers especially, where the purchase price is large and the purchaser's lead time on the decision-making process long, there is an arguable justification for a major manufacturer to pre-announce a new product, even though it may not be available for 18 months. Okay, so it's unfair not to tell people it won't be available, but with large purchases, the time scales involved make such tactics tolerable at least.

But now, as Guy pointed out, many of the manufacturers in the personal computer business are doing the same thing. They are not, however, doing it for the same reasons, at least not always, for with the mainframe manufacturers the ploy is consciously used to prevent a potential customer from placing an order with a rival.

In the personal computer business it would appear to be, as much as anything, an over-enthusiastic desire on the part of some companies to be seen in the marketplace with the latest gizmo. It is, to me at least, one of the saddest aspects of the personal computer business that it seems so intent of fostering the 'techno-freak' aspects of users. It is therefore imperative, in the manufacturers' eyes, to appear to the users as *the* company with all the latest bells and whistles. (In this context, one important bell and/or whistle is cost — or the lack of it.) Sadly, some companies could even be accused of announcing a new product before they have actually really cracked the problems of making its predecessor.

At the low end of the market, where machines cost between £50 and £150, this techno-freak marketing approach is quite noticeable. Virtually every issue of this, and other magazines, contains at least one advert for an entirely new product, the latest gizmo that technology can bring. It usually comes from a company that no one has heard of that is wishing to join a market that is already crowded with other similar companies that are under-financed and waiting to become cannon-fodder for the Japanese.

All these companies now face major problems. The size and growth-rate of the market for small home computers has taken many by surprise, including the manufacturers themselves. This would seem at first sight to indicate that there should be plenty of room for allcomers in the marketplace. Unfortunately, things don't normally work out that way. In a market that is large, rapidly growing, and oriented towards high-volume merchandising techniques, the fact that a new manufacturer on the scene has the best product is actully irrelevant. What counts is being able to manufacture it in high volume, coupled with the finance, ability and skill to support the distribution network.

Such requirements demand, in the end, the capabilities of a big company, and the majority of the minnows just do not match up, no matter how good their products may be. In the high-volume home computers marketplace, there is room for only a handful of successful manufacturers, yet the UK has thrown up more contenders than that itself.

By this time next year it would seem highly unlikely that many, if any, will have advanced much further then they are at present. Some inevitably, will have regressed significantly.

Such problems do prompt the general question of when is it a good time to purchase a system: should a user jump in now or wait for something better? In the home computer area, perhaps more so than anywhere else, the answer is to buy what is available on the shelf. There will always be something better coming along, and even if you wait for that to actually appear, something better will by then be coming.

The same is true for the bigger personal computer systems, those that find their way into the professions and small businesses. The main 'something better' in this area is, of course, tangible, for it is the IBM Personal Computer, due to finally and formally appear in this country about now (that's now as you read this, not now as I write it).

For better or worse, IBM's machine has already become the up-market hardware equivalent of CP/M, the *de facto* standard against which all others are compared and evaluated. IBM has a habit of assuming that level of significance in the computer industry.

The official marketing of the Personal Computer will at last regularise a hotch-potch situation in the sale of the machine in the UK, it having been available from an ever-growing number of suppliers — both respectable and dubious. Many of the 'back-doors' through which the machine has crept into this country will probably become superfluous, and may well consequently wither away. For the IBM PC, it must be assumed that the formalisation of its UK marketing will be one of the better events of the coming year, certainly from the user's point of view. It goes without saying that there is a certain assumption that IBM, as a company mainly experienced in marketing other types of system, will actually manage the event correctly.

The same remarks, if to a lesser degree, can be made about the appearance of the DEC family of machines, though these have so far failed to promulgate quite the excitement of the IBM system, through not generating a 'black market'.

Both of these machines have been launched long enough to become known to the users. More interesting in terms of speculation are the products from those two stalwarts of the personal computer industry, Commodore and Apple.

The former, even just a year ago, looked remarkably moribund. The PET was long in the tooth and the VIC not yet too significant. Announcements were rumoured to be around the corner, but had not yet arrived and all that was available was gossip. Now the company's dealers should be starting to sell the subjects of that gossip: the 500 and 700 series machines.

It is early days yet (though much later than expected — another example of pre-announcement of new products) but the company may well have come up with a couple of interesting systems. The interest comes from the fact that they combine the best bits of the PET, which in this case



Illustration by Ingram Pinn

means much of the software and data files already established by users, with greater processing power, and the opportunity to add-on second processors that allow the machines to emulate such as the IBM PC.

If it works well, this could prove to be a good trick, and one that the users could find very helpful. Many will find it has been worth waiting for.

The same may be true in a year's time of that other company, Apple. Apple II, till now arguably the most successful single system produced, is as long in the tooth as ever the PET was. Apple III, through its early problems and the subsequent appearance of rival and superior 16-bit machines, has never managed to take the world by storm.

Now, however, there is Lisa, a system about which there is (at the time of writing) only conjecture. The main platform of that conjecture, however, is that it will incorporate an operating system that will at last give true meaning to that oft-maligned term 'user-friendly'. It will allow users to perform tasks in the way they think of them, rather than demanding the opposite of the user.

As with so many manufacturers, not least of which has been Apple itself, the announcement of the machine may not mean too much to the user for a while. Machines do have a habit of not appearing on time. That is usually a good reason for the user to purchase what is actually available — it does at least exist. Both the Commodore and Apple machines show however that with technology there *is* also always something better coming over the horizon.

END

BENCHTEST

THE LYNX

We've been expecting this machine for a while. But is it as slick a cat as it's cracked up to be? Maggie Burton finds out.

Everybody must have seen the adverts by now. 'How to increase the size of your memory.' 'Expandable to 192k.' The Lynx, expected in November, is now just about to go on sale. And having been proclaimed in advance for several months, is it what it claims to be?

Camputers was formed in winter 1981 under the name Camtronic Circuits. Brought together by the Lynx, the company comprises nine members and its sister company, GW Design, about 16. The Lynx itself is subcontracted and the original machines were designed and put together by Camputers and GW.

The machine offers both colour and high resolution graphics. It also offers a 'grow with the user' type of quality that many machines cannot boast. It is theoretically possible to set it up as a small-scale business micro.

Hardware

To look at, the Lynx is very pleasing. It's cased in arty dove-grey injection-moulded ABS and is that rather familiar home micro 'wedge shape' seen from the side. It's about the same size as the VIC-20 but a bit more angular, like an Acorn Atom. The dimensions are 34.5cm wide, 21.5cm from front to back and 6.5cm at the highest point.

The casing is substantially built although there are one or two areas where it 'gives', most notably on either side of the space bar and above the ports at the back. These areas could have done with a little more reinforcement but it could take quite some bashing nevertheless.

A metal-cased PSU plugs in through a DIN socket at the back on the left. The PSU itself is roughly as heavy as the Lynx, weighing just over three pounds on my bathroom scales (the Lynx weighs just under four pounds). The lead between it and the computer is a little short, but the lead from PSU to mains is much longer. The PSU becomes almost painfully hot to the touch after being switched on for more than an hour or so, and at one stage I even warmed my feet on it while computing! The rivets holding it together at the bottom really do get too hot to touch. This could easily have been rectified by cutting ventilation slots in the PSU case and electrically insulating the whole thing from within.

Amusingly, the Lynx comes complete with an optional set of stick-on rubber feet for the PSU (I think they'd possibly melt if you stuck them on to the rivets). Otherwise, they stick like limpets; I stuck some onto a Sirius and I think they're there to stay.

The I/O connectors are nice and solid although you can see into the machine above them. From left to right (with the front of the machine facing you) there's power, expansion bus, cassette, RS232, light pen and composite video, RGB and, on the far right, the TV socket.

The keyboard comes in the same grey colour with white lettering on all character keys and red on the control ones. There is a total of 57 keys, 12 being devoted to control. These are: ESC, Control, up and down arrows, Shift Lock and Shift on the left; Break, Delete, left and right arrows, Shift and Return on the left.

Escape is used to exit a program in the middle of execution. The Break key is used (to quote the manual) 'within certain specialised programs' but it does not go into any further explanation. Apparently this key will be used in future applications. There is no reset key, which proved to be a nuisance — to get out of an infinite loop or to recover from a total crash, you have to unplug the PSU.

I noticed with some amusement that the Return key is labelled 'Control' even though there's a Control key, too. This is almost certainly a mistake as other Lynxes I've seen don't have this peculiarity. The big disadvantage with the Return key is that it's parked right next to the Shift key. If you're typing away enthusiastically it's very easy and extremely exasperating to hit Return instead of Shift — which, of course, means you have to retype the whole line. This would have been better placed where the Delete and arrow keys are and would thus prevent a lot of lost time.

Typing on the Lynx keyboard is quite a pleasant exercise. It has a crisp feel to it and responds well. It's endowed with auto-repeat, although this is a little slower than is necessary, and is fully debounced.

Inside

The machine reviewed here is the standard 48k machine; 92k, 128k and 192k versions are available and smaller machines can be fully upgraded internally. An upgrade to either 128 or 192k will increase the screen resolution from 248 x 256 to 248 x 512 and give an 80-column display as well but you'd have to buy a monitor for this.

In spite of the fact that I'm hardly either a stickler for tidiness or a hardware designer, I did feel that the design of the PCB was a little inelegant. This is probably made worse by the fact that the Lynx uses no ULAs and therefore has to employ a larger number of smaller chips to do the job. RAM is not grouped in any apparent logical order on the board — 16k of it is in front of the keyboard plug, 16k is haphazardly arranged on the right of the Basic interpreter chips and 16k comes on a cute little plug-in board which goes just in front of the TV socket.

The 4MHz Z80 sits between the keyboard plug and the Basic interpreter. The Basic interpreter comes on two EPROMS (socketed, of course) which will probably turn into ROMs before too long. A third socket is provided, presumably for the insertion of dedicated ROMs/EPROMs.

To the far left at the back of the Lynx sits a fairly large speaker (through which the Lynx beeps disconsolately when switched on), cushioned by a circular piece of plastic foam.

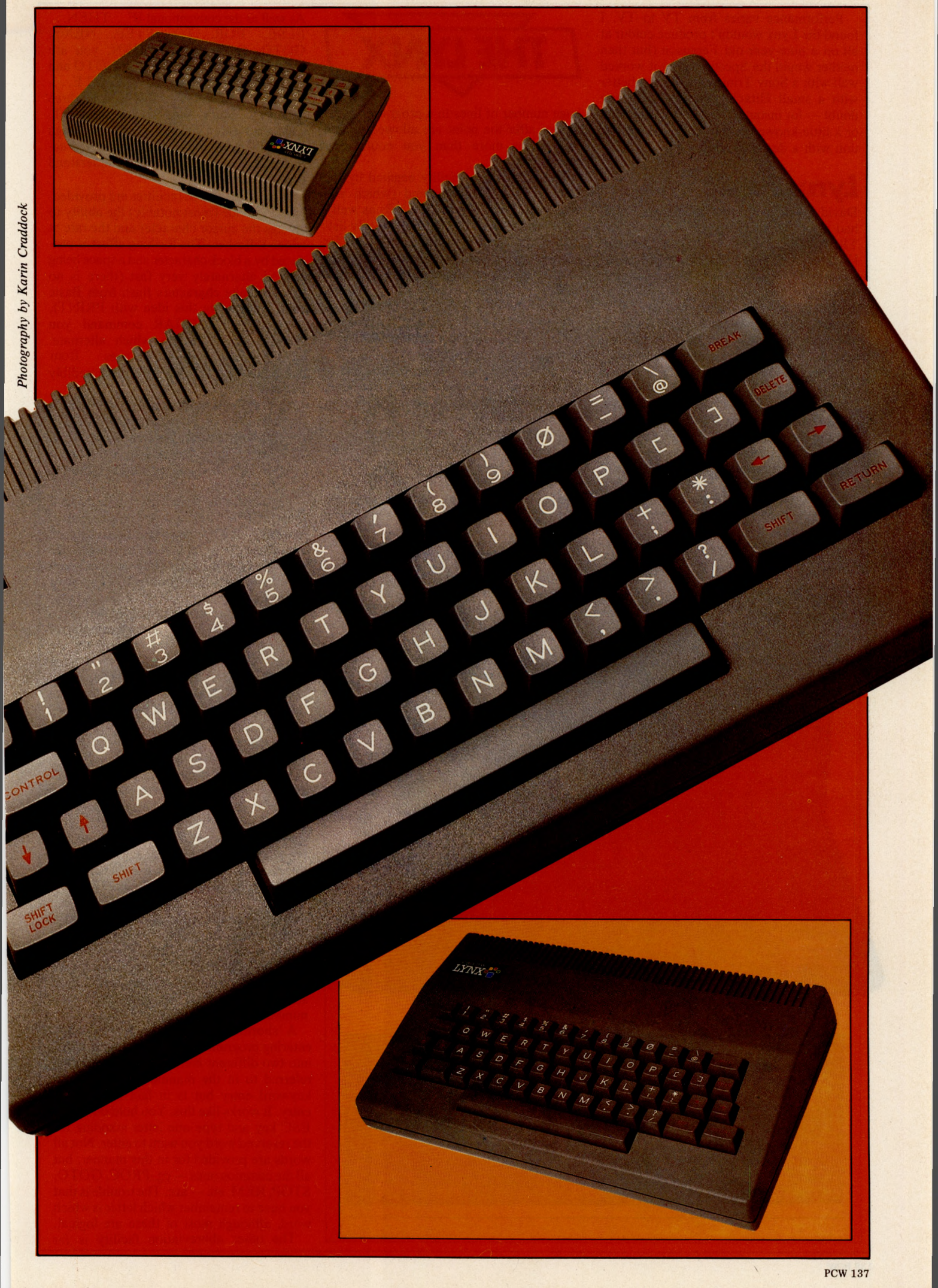
RAM expansions almost certainly plug in where the aforementioned memory board does, but there is a plug just in front of the parallel expansion bus which is probably also designed for extras. In fact, as there's a good bit of fresh air above that plug, you could conceivably fit in a substantial cartridge or circuit board — an indication of room being made for the future.

All in all, it's a solidly put together but really somewhat dated piece of computer engineering. All soldering is precise, components are firmly fitted and wires properly trimmed. Compared to, say, the Spectrum, it's a rather clumsy outfit when you consider the fact that the two machines have similar capabilities, but size and appearance really aren't everything.

Display

When you first switch on, the Lynx prints its logo at the top left of the screen (complete with the little pawprint) in white on a black screen. Underneath this it puts the prompt 'Ready!' and a 'greater than' sign followed by a flashing block cursor.

The display is quick to appear and very crisp. Initial tuning in is very simple and, once set, it rarely drifts off frequency. The only problem here is that the display is rather too sensitive to the position of the TV leads. Jerking this or loosening it slightly (as on occasions when the TV gets knocked) can cause the screen to waver. The colours are very vivid and crisp and, once you have the machine tuned right, they never drift. Full upper and lower case lettering is provided directly from the keyboard.



Photography by Karin Craddock

Performance varies from TV to TV. I found the Lynx wouldn't produce colour at all on a nine-year-old Ferguson (but then neither would the Spectrum) but it worked well with a Sony Trinitron and even better with a small Hitachi portable. If in any doubt — for instance, if your TV is ancient or a little-known model — some consultation with a dealer would be wise.

Lynx Basic

David Jansons, who designed Lynx Basic, had a lot of experience of Microsoft and TRS-80 Basic. 'I don't like them', he said. His aim in putting together a highly non-standard Basic was to make it 'as structured as possible'. Considering he put the original interpreter together in a little over four months, it's quite an achievement, though it has been regularly amended since the machine was announced in September.

It includes some very odd qualities indeed, the reasoning behind which seems a little strange. First and foremost, it won't allow multi-statement lines. Now, quite a few older machines are the same, and Jansons explained he did this to improve readability of listings. But the alternative in the area of code-cramming is to use line numbers with a *decimal point!* This means you can have a huge number of lines in a program — four figures after the point are allowed — and this is far more than you could ever need.

Not only is this facility negated by the Lynx's RENUM command (which will deal with GOTOs and GOSUBs as well), but it also makes for hideously untidy listings as the Lynx does not justify lines for you. Imagine beginning a program with lines 100-150 in increments of 10 and then adding 120.1234, 120.1235, 130.12, 130.13, 130.44, 140.5 and 141.444 (which you'd have to be mad to do). Write it down — unjustified — if you want to see the effect it would have on readability.

Furthermore, had you been enough of a lunatic to number your lines in increments of one (or even 0.0001) and you wanted to add more lines, all you'd need to do would be to type RENUM 1,100 (ie, from line 1 at an increment of 100) to rectify the situation.

The next oddity in Lynx Basic lies in the number of loops and conditionals provided. As well as the conventional IF...THEN...ELSE, FOR...TO...STEP...NEXT, GOTO, GOSUB...RETURN, you are armed with labels (for use with GOTO and GOSUB), procedures, WHILE...WEND, REPEAT...UNTIL and three logical operators — AND, OR and NOT. This is actually a good idea: you can plough through your algorithms, relentlessly structuring as you go and then understand them afterwards.

A lot of really odd facilities are provided. These include (most notably) the ability to change the cursor character and the rate at which it flashes. The flashing effect is produced by a block character and a space being printed alternately very fast (there is no way to make characters flash from Basic apart from using this idea with PRINT), so using the CCHAR command you specify two characters which alternate. CFR (cursor flash) ranges from incredibly slow (CFR65535) to incredibly fast (CFR1).

Debugging is made easier not only by a flow trace, but also by a command, SPEED, which sets the rate of program execution. This simply increases the delay between program lines and you can then see exactly what's going on.

This leads us logically on to editing. I found this fairly easy, but with one or two inevitable disadvantages (the perfect screen editor has yet to be invented). Control 'E' gives you the response 'line number?' and expects either a line number, label name or procedure. Inputting one of these and pressing Return gives you the specified piece of code with the cursor at the beginning of it. You then move the cursor to the place where the correction is needed and delete/insert as necessary. The up and down arrows can move you either to the beginning or to the end of the line. Control 'Q' will allow you to edit a line, entry of which has just given an error message without specifying its number.

It would have been a little more logical to add the ability to move up and down, using the arrow keys, line by line, although the Control 'E' idea can save time in long programs. What really is a bit of a nuisance is the use of 'DEL'. You can't just type in a line number, hit Return and see it magically disappear as you can with most micros, although you can overwrite lines. You can delete blocks of lines using the format DEL first line number, second line number. The only real advantage with this method is that you have less chance of erasing lines by just typing in the numbers, although you could still overwrite lines by using the wrong numbers for new ones.

A 'shorthand' facility can be used when entering programs. It is effectively divided into two different methods. One method is referred to in the manual as 'single-key' keyword entry but is in fact double key entry. It works like this: You hold down the ESC key and type one letter standing for the reserved word you want to enter. Not all words are provided for in this manner, but all the common ones — eg, PROC, GOTO, STOP, REM, etc — are. The trouble is that you have to remember which letter is which word, although most of these are logical.

The other abbreviation facility is far



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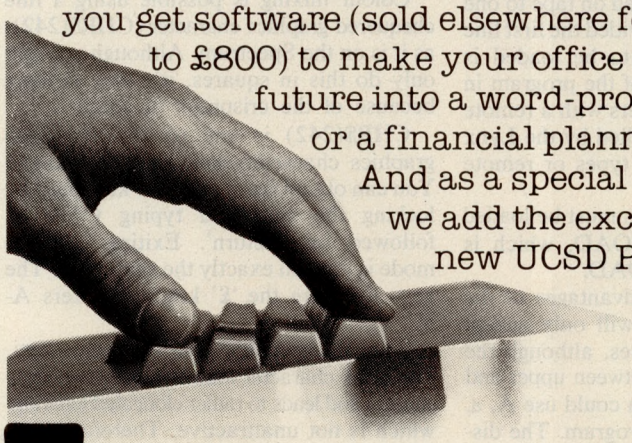

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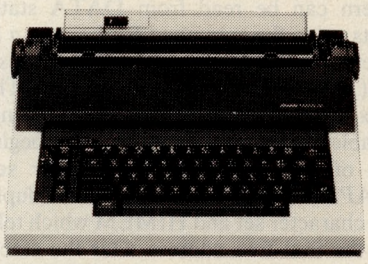

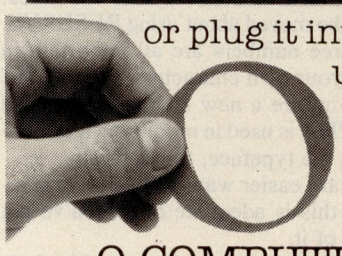

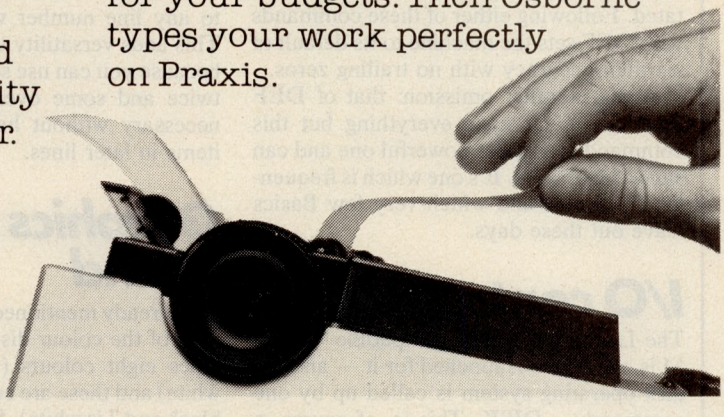

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more reasonable. You simply type in enough letters of a reserved word (the first two are usually enough) to make it distinguishable from any other command and follow them with a full stop. Once you get used to this it is very useful. In addition, you can use '?' instead of the word PRINT.

String handling is very odd. For a start there is the glaring omission of STR$ which converts a numeric variable into a string. In spite of this, VAL is included, which does the opposite. All the old faithfuls — LEN, ASC, LEFT$, RIGHT$, MID$ and CHR$ — are there with the addition of UPC$, an oddity which will convert all letters in a string to upper case.

String arrays were, incredibly, nearly left out altogether originally. Camputers plans to introduce a string/data file handling package on either EPROM or ROM cartridge in the near future. The situation now is this: you can type DIM A$(6) which allows you to input a string of up to six characters — rather pointless in the face of such commands as INPUT A$. DIM A$(6)(12) dimensions a 12 element array, each array consisting of up to six characters. The largest eight-character/element array that the 48k Lynx will accept is 1000 elements. Only single dimensional string arrays are allowed.

While still on the subject of arrays, two-dimensional numeric arrays can be wangled with DIM A(R*C). Selection of a particular element — say 3,4 — is done using the format A(3*C+4). A bit weird really, all things considered.

A positive arsenal of numeric functions is provided. Among the more bizarre of these are INF, which returns the largest number the Lynx can process, 9.9999999E +63, and FRAC which is the direct opposite of INT. Arcsines, cosines and tangents are available (as well as SIN, COS and TAN). Two functions I've never encountered before on a standard machine are DIV — integer division (dividing without leaving a remainder) and MOD, its opposite, which gives just a remainder. Logarithms and Antilogarithms (and natural logs, too) can be used. Another Lynx oddity is the command pair ROUND and TRAIL. ROUND OFF will switch off the computer's automatic rounding facility. Internally, the Lynx works on an accuracy of eight digits and round this off to six when final values are printed on the screen. Therefore you have the choice between six and eight digit accuracy. TRAIL ON allows you to put trailing zeros on to bring accuracy up to whatever ROUND has dictated. Following either of these commands with OFF sets the machine to its default of six-digit accuracy with no trailing zeros.

Again, another omission: that of DEF FN. You can't have everything but this command is a rather powerful one and can save a lot of work. It's one which is frequently invaluable and which very few Basics leave out these days.

I/O control

The Lynx is fully disk-compatible — CP/M is about to be launched for it — and the disk operating system is called up by one command — DISK. This is, of course, a stupid thing to type in if you have no disks as it crashes the system.

Three printer commands can be used — the obvious LLIST and LPRINT; and the addition is that of LINK, which displays simultaneously on printer and screen. This is handy, can be impressive in graphics programs, and is unusual on home computers. I must point out here that I was unable to run a printer from the Lynx and can only judge these commands from the manual.

Cassette handling is good. For a start the baud rate is user-specifiable in increments of 300 from 600 to 2100 baud. This is done simply by typing TAPE followed by a number from zero to five (zero being 600 baud, the default). The manual states, however, that to use the higher baud rates you have to have a 'good quality cassette player and tapes'.

LOAD, SAVE and VERIFY are, of course, provided, with the interesting and useful addition of APPEND. This allows you to add a program stored on tape to one already in memory — provided the first line number of the program to be loaded is higher than the last one of the program in memory. Cassette recorders with a remote control facility are controlled by the Lynx — although only certain types or remote control will work.

Machine code programs must be loaded using the command MLOAD, which is otherwise exactly like LOAD.

One of the major disadvantages of the Lynx is the fact that it will only accept single-letter variable names, although the interpreter distinguishes between upper and lower case. Therefore you could use A, a, A$ and a$ in the same program. The disadvantage here does not lie in numbers as much as in distinguishing one variable from another. Very few Basic programs will need more than 52 numeric and 52 string variables. The problem really lies in being unable to read a program and understand variable names logically, so a stringent record would have to be kept of which variable stores what. Two-letter names would have been more logical, and long variable names better still.

SWAP is a really useful command which allows you to simply swap the values of two variables.

The RESTORE command can be reset to any line number which contains data. This adds versatility to DATA statements because you can use some data once, some twice and some over and over again as necessary without having to repeat data items in later lines.

Graphics and sound

I've already mentioned the surprising crispness of the colour display. The Lynx provides eight colours (including black and white) and these are coded from 0 to 7 (0 is black and 7 is white). Interestingly, you can use the colour's name as well as its number — eg, PAPER BLACK or INK GREEN which I found myself using far more than the numbers. This also improves program readability.

PROTECT is a command which can generate some interesting visual effects. The Lynx sends colour signals as a mixture of three primary colours: red, blue and green. If you type in PROTECT RED, anything in red already on the screen will be left there and cannot be cleared or overprinted. But any new characters or lines with an element of red in their colour will have the red removed. You can also protect subcolours like magenta or cyan — which means you can only print on the screen in one colour. PROTECT 0 (black) returns you to a three-colour mix again. Protecting white will stop anything from being written to (or erased from) the screen.

This is lots of fun and it can even be unnerving if you forget that anything already on the screen in the protected colour cannot be moved. It actually looks as if the computer's crashed (hard crash I mean) if you've just listed a program and then run it with a PROTECT statement before a CLS statement.

Colour mixing is possible using a fine chequered graphics character (CHR$(242)) as it is on the Spectrum. Although you can only do this in squares, it's very striking because of the crispness of colour.

CHR$(242) is one of 26 predefined graphics characters listed in the manual. You can obtain these from the keyboard by locking the shift and typing CTRL 1 followed by 'Return'. Exiting graphics mode is done in exactly the same way. The keys used are the '£' key and letters A-Y.

You can also define your own characters. The Lynx character matrix is 6x10 which is unusual and leads to rather elongated lettering, which is not unattractive. Therefore each character takes up 10 bytes of memory and this has to be reserved before you start inputting the data. I'll deal with that in more detail later, along with machine code.

Once you've reserved your memory, the binary digits to make up the character's bit pattern can be read from DATA statements using the command BIN — not *a la* Spectrum but to the format POKE address, BIN(A) after the data has been read. The Lynx has two pointers and one read-only variable in memory, ALPHA — the beginning of the conventional character set, GRAPHIC — the beginning of the duplicate character set and HIMEM which tells you the first free address after the stack. This can be moved about using RESERVE. These three numbers are all important in defining your own characters. GRAPHIC points to where a new character is stored and ALPHA is used in modifying letters — changing the typeface, for example.

There are easier ways to design characters, but this is adequate once you've got the hang of it.

The Lynx's screen resolution is 256x248. This allows for some impressive drawing effects. DOT, DRAW, MOVE and PLOT are the relevant commands: DOT does the obvious thing — puts a dot on the screen at the specified coordinates; DRAW puts a

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line on the screen from the last point plotted (or the last position of the graphic cursor) to the point specified; MOVE simply moves the invisible graphic cursor to where you tell it to go. PLOT struck me as being rather unnecessary because it has five modes combining all the other graphics commands along with a relative move and draw, ie, the coordinates represent the amount by which the cursor moves, not the position at which it ends up.

Line drawing is crisp, clear and fast. Lines can be put on the screen at quite steep diagonals without an ugly 'stepping' effect becoming too apparent. My big reservation about Lynx graphics is that there is no easy way to fill a shape. The only way I could find to do this was by plotting individual dots, which is slow and inaccurate. It may not have been possible, but a PAINT or FILL command would have made a good replacement for the rather obsolete PLOT (or PLOT alone could have been used and all the other words scrapped, perhaps). Pixels are individually colour-definable and, when the DOT command is used, they prove to be very fine although they are clear in any colour.

An interesting idea is the use of PRINT @ and WINDOW. PRINT @ uses columns two pixels wide (as does WINDOW) and rows to the highest resolution of 248 to put letters exactly where you want them on the screen. This is far more versatile than using character squares. You can therefore mix text and graphics tidily if you want to. WINDOW specifies the size of the text area. You specify the first column and the last column + 1 and the first row and the last row + 1 to change the part of the screen on which you want to print. Some fascinating effects can be achieved here by using WINDOW in conjunction with PROTECT. Again, there is one reservation in my attitude to this command: some kind of quick normalising command would have been handy to reset the window to its default. As it stands, you have to remember the coordinates of the normal text window and use those numbers to put things back to normal.

Another Lynx oddity is VDU. This uses CHR$ (ASCII) codes 0 to 31 to perform cursor movements and other graphics commands as well as to perform the power-up beeping noise. You can use PRINT CHR$ to do the same thing, so I found VDU rather unnecessary, although it is quicker to enter than PRINT CHR$. Three of the facilities here are really striking. The first of these is VDU 21 — overwrite. This is like the Spectrum's OVER command and is turned off by inputting VDU 20. Secondly, there's

Benchmark timings

BM1	1.7
BM2	4.3
BM3	12.4
BM4	8.9
BM5	10.4
BM6	16.3
BM7	29.9
BM8	86.6
Average	34.1

For a full explanation of Benchmark timings, see PCW, Nov 82.

THE LYNX

VDU 24 — double-height characters (turned off by VDU 25). These are really fun to use and striking effects can be obtained by mixing single and double height text. Lastly, and more subtly, you can employ superscript and subscript on text. This simply means moving the cursor up or down three pixel lines, giving a peculiar overlapping effect. This command has to be repeated for each line of super/subscripted text. The other VDU codes do things like carriage return, colour changes, line feeds and backspace.

Sound is based on a digital/analogue conversion principle and is used with two commands, BEEP and SOUND. BEEP is followed by three figures broken up by commas; these stand for wavelength, number of cycles and volume. Volume is specifiable from 0 to 63 and wavelength and number of cycles from 0 to 65535. High wavelengths are high-pitched sounds (for those of you who didn't do physics at school), so to make a high note of the same duration as a low one, the result of multiplying the number of cycles by wavelength must be the same. The large number of parameters available makes for an impressive range of sounds.

SOUND is a machine code based command. You can POKE several consecutive addresses with appropriate values, type in SOUND followed by the first of these addresses and the computer will read them, converting the values within to sounds as it goes, stopping when it reaches a value of 0. This could conceivably be used to synthesise speech.

Machine code is well provided for, with DPOKE and DPEEK complimenting POKE and PEEK by enabling you to read or write to two consecutive addresses with one word. Using both you specify the first address. DPOKE loads the least significant byte into the address and the most significant byte into the address+1.

PRINT# is a decimal-hex converter. It works to four digits and the largest decimal number which can be converted is 9,999,999. Only the integer part of the number is used. Hex can be input directly by prefixing the Hex number with '&'.

Binary And, Or and Exclusive Or are provided and a command, CODE, allows you to incorporate machine code into Basic programs by prefixing each line with CODE. INP and OUT read or send data from/to specified Z80 ports.

A machine code monitor is accessible from Basic by typing MON (and exited by typing 'J'). This includes a breakpoint facility as a debugging aid.

The Benchmark timings tell a lot, in this case, about the machine. The first two are fairly fast but BMs 7 and 8 are really slow. BM8 involves finding functions and the Lynx obviously does this rather too slowly. It's turned out slower overall than many other Z80 machines and is certainly in the lower end of the overall timings range.

To conclude on the subject of Lynx Basic, I've really got no choice but to express stern reservations. Some of the effects which can be obtained with ease are really striking, but the overall structure is not in keeping with the reasoning behind it. At first sight it looks fantastic from a programming point of view, but using it for a while reveals serious disadvantages.

To a naive user, in any case, the importance rests far more on things like the efficiency of the screen editor than the intricate sophistication of the Basic. I'll make a huge criticism here while I'm at it: the screen does not scroll. It goes up to the top line and overwrites what was there before. This makes for either a hideously untidy screen or for the hassle of using CLS every time you want to list a program. And if your program is more than one screenful you've got real readability problems.

Lynx Basic has several omissions which appear to have been replaced by unnecessary trimmings. It repeats itself — as in the use of VDU and CHR$ — thereby leaving out more important things. The lack of a reset key makes it possible to get into a terminal crash very easily — for instance, if you get stuck in an input loop you can't use ESCape to get out of it (it has no effect, more to the point) and you have therefore to switch the machine off. A little thought here would have made all the difference.

Documentation

A paperback user manual comes with the machine, written in the familiar home micro 'step-by-step' style. It's illustrated with bizarre pictures of little robots wearing Elizabethan-style breeches which drew chuckles of not-too-complimentary amusement from me as I read it.

I'm not too happy about it, either. It starts on a good note, takes you through the fine basics in a readable manner and is written in a friendly style. It has some attractive demonstration programs in it but it does not go into enough depth.

Some explanations are sadly lacking — for instance that of user-defined characters — and others still have mistakes in them. I understand, however, that the manual will be amended.

Furthermore, no useful memory addresses are provided — for instance, video RAM start and end addresses — which would make the enthusiast's endless pursuit of machine gymnastics a great deal easier. As with many machines a manual twice as long would have been a great deal more helpful and the addition of more involved technical information a blessing. But other machines are guilty of the same fault and I must confess to being rather a documentation fundamentalist, especially where micros for beginners are concerned. Ideally you shouldn't, in these cases, have to buy other books to explain the bits your computer leaves out. With the Lynx (among others), you do.

Software

There's not a lot to be said about this outside of speculation. Camputers tells me the machine is aimed at the 'Sinclair graduate'.

GOTO page 158

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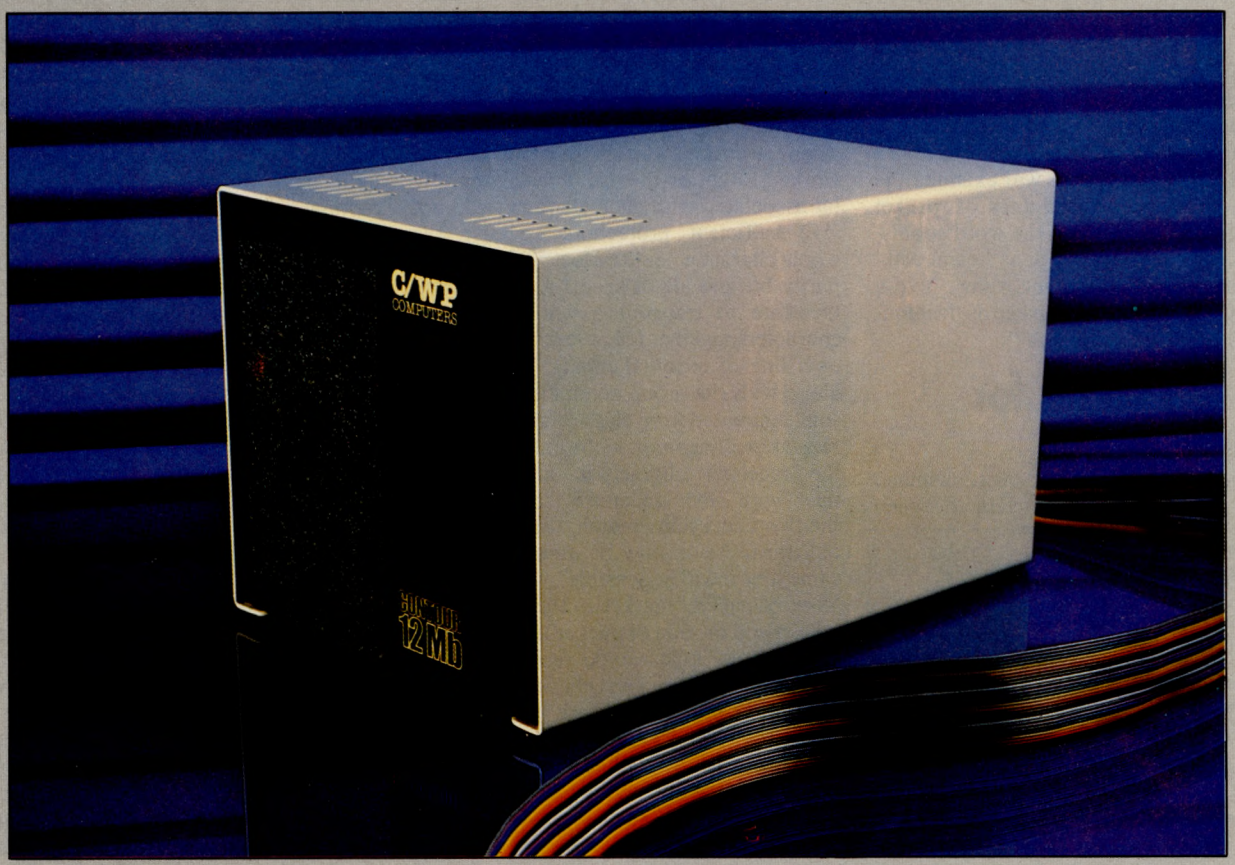

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SEND IT IN PACKETS

Terry Lang continues his series on networking with a look at packet switching.

This is the second in a short series of articles which aim to describe simply some of the problems and the solutions of networking. The previous article discussd the need for networking, and the criteria by which a network might be described as 'good'. It concluded by considering one of the simplest of networks, a 'star' of lines all connected to just one central switch or node, which was operated as a multiplexor to switch signals between pairs of those lines. The present article will examine the more sophisticated techniques of 'packet switching'. (Here we use the word sophisticated in its popular sense as 'technically advanced', though for some it may hold a touch of its more original usage as 'fashionable air of worldly wisdom'!)

Use of packets for error detection

Our simple star network just switched signals and hence characters between communications lines, and did nothing about checking the accuracy with which transmitted characters were finally delivered to a receiver. Suppose now that we have the basic case of one computer communicating with another, and that because of the long distance involved and/or because of the 'noisy' electrical environment it is important to check, and if necessary to correct, the corruption of data during transmission. In the general networking situation the use of a single parity bit associated with each character will not give sufficient protection, because the whole character could be lost without trace, parity bit and all. It seems a natural step therefore to transmit a whole group of characters together (eg, a record from a file or a line of terminal input), and to send along with the group some kind of checksum, computed from all the characters. The receiver will recompute the checksum from the received characters, and compare this with the received checksum; if the two checksums match, then uncorrupted transmission may be assumed. At the same time it will be sensible to add a special 'start of packet' marker to the front of the packet and an 'end of packet' marker to the end, to make it clear to the receiver exactly when and where the check should be applied, as shown in Figure 1.

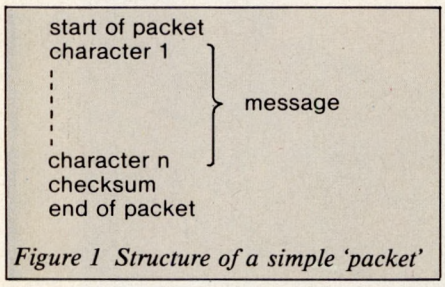

Figure 1 Structure of a simple 'packet'

At this stage we should note that if the packets are too short then the overheads of the 'envelope' surrounding the packet will be high in proportion to the characters in the message itself, whilst if the packet is too long then any noise in the system may prevent it ever being received without corruption. For obvious reasons, the upper limit of the number of message characters is generally set to a power of two, usually within the range 64 to 512. Typically two bytes are used for the checksum, which will not be just a simple arithmetic sum but some more complex algebraic function chosen for its ability to detect most of the data corruptions typical on communications lines. (As a matter of fact, we can never choose a checksum which guarantees to detect every conceivable corruption; the best we can do is to confirm that if the checksum received matches the message, then any corruption is extremely unlikely to have taken place. Even if as an extreme we sent the full message itself five times, and the destination received identical messages five times, the receiver could still not be a full 100 percent certain that the message contents were not identically corrupted on all five occasions.)

To return to our simple case of two communicating computers, when the receiver recognises an incoming packet it will compare the transmitted checksum with the checksum re-computed from the received message. If the checksums match, it will return an acknowledgement of successful receipt to the sender. If the checksums do not match, it would be possible for the receiver to return a 'pardon?' message to the sender. Alternatively the receiver could simply maintain a dignified silence, as it would have to do if the whole packet were lost (or were so corrupted that it could not be recognised as a packet). If the sender receives a positive acknowledgement of its first packet, it can simply follow up with the second. If on the other hand the sender receives no reply at all after some pre-agreed time (known as a 'time-out'), or if the receiver gets back a 'pardon?' it can repeat its original packet instead.

This process has strong similarity with a telephone call between two people. The listener may interject with 'yes' or 'uh-huh' from time to time to confirm that he or she is hearing the speaker. If noise on the line intervenes, the listener may respond with 'pardon?'. If the noise increases further, the 'pardon' may itself get distorted, and the speaker then 'pardon?'s the 'pardon?' — at this point complete confusion will probably set in! It is for this reason, when working where there may be severe noise problems, that the simplicity of using only positive acknowledgements, and of making no response on receipt of an error, will generally be beneficial. (Of course there is always the possibility that a positive acknowledge-

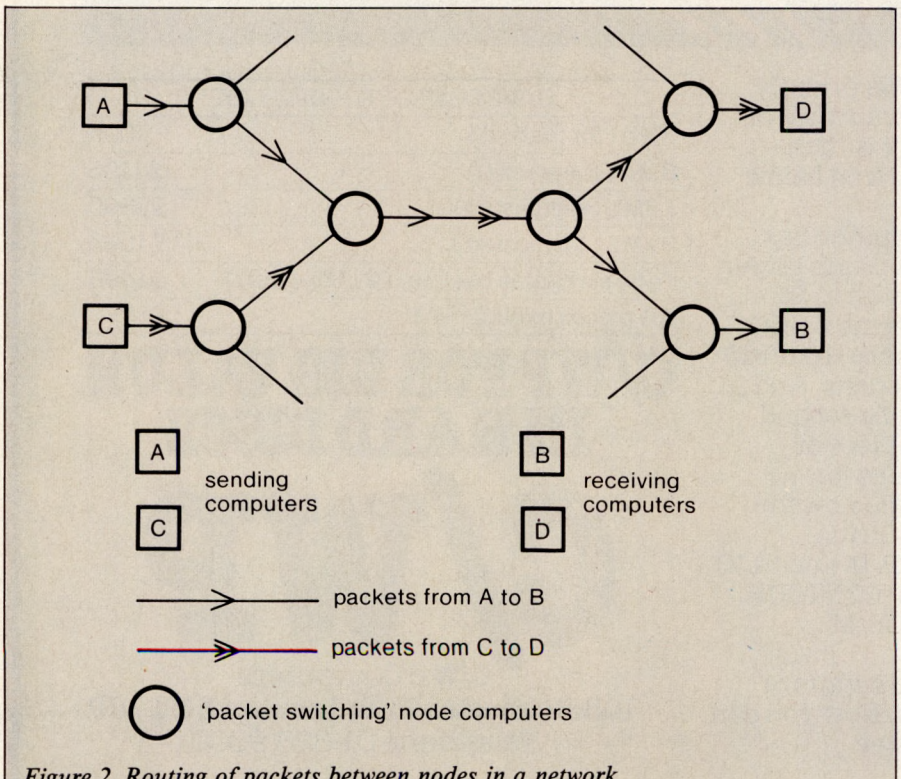

Figure 2 Routing of packets between nodes in a network

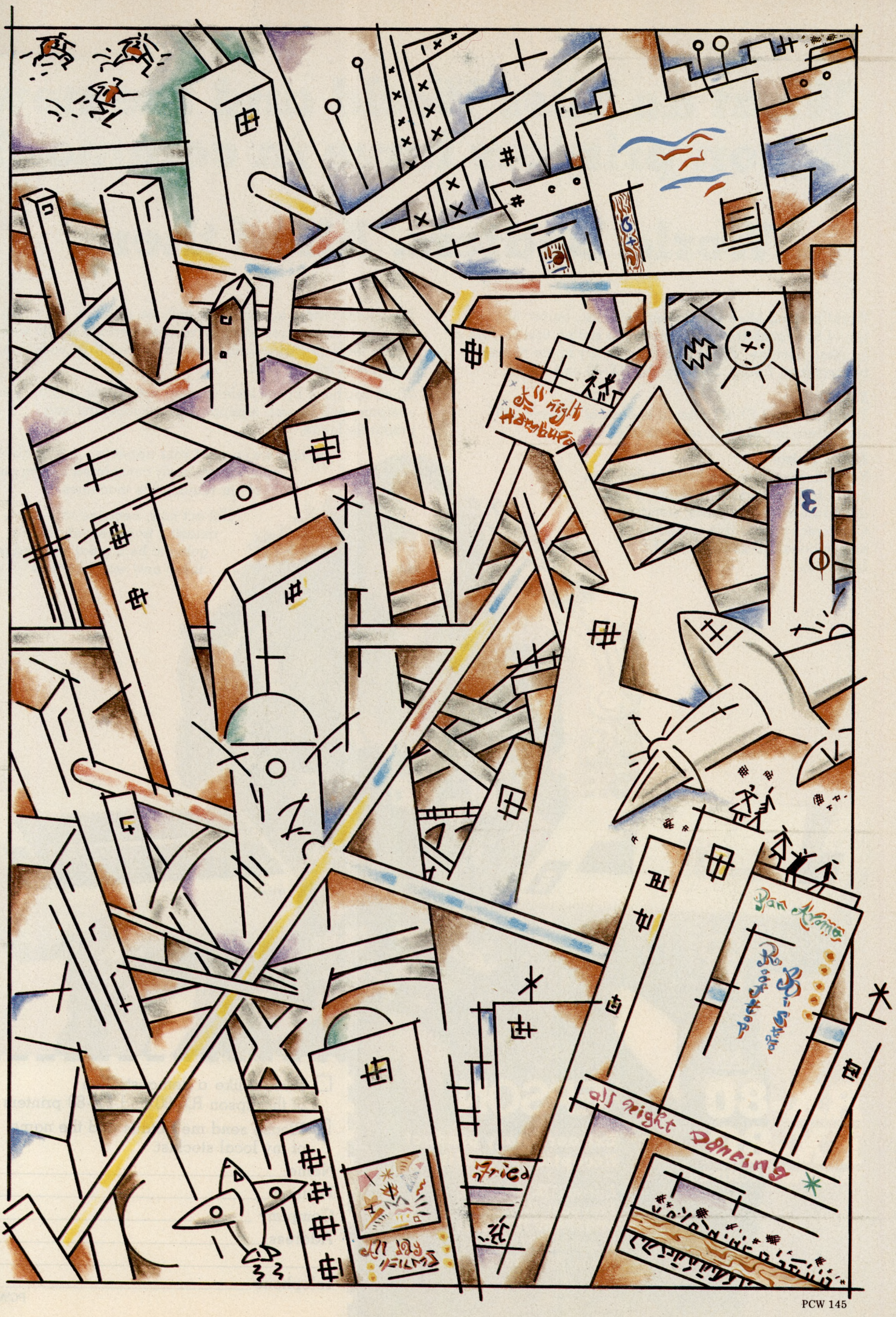

Illustration by Kevin O'Keefe

What do Miss World and the new Epson printers have in common?

World Beaters. All of them.

World beating Miss Dominican Republic, below, sits with two of her counterparts. For beautiful styling that is. And a lot more besides. Which brings us neatly to the two new printers from Epson. Namely, the RX-80 and FX-80.

Faster
The RX-80 and FX-80 print at speeds of 100 and 160 characters per second, respectively.

More Value
Yet both machines are better value than their predecessors. With features like dot addressable graphics, standard Centronics compatible interface and optional RS-232C and IEEE interfaces.

The FX-80 Printer takes a lead with the addition of various extra built-in features. And we've designed the RX-80 with tractor feed for perfect alignment, and the FX-80 with both tractor and friction feed.

When you have Epson style teamed with Epson quality, your company will be well equipped for a successful and profitable future.

So now we've whet your appetite – isn't it about time you seriously considered buying one of our remarkable machines.

But act now, because with our amazing track record, there's going to be a great demand for these new world beaters.



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EPSON

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Exceptional quality.

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Middlesex HA9 6BR.
Freefone: 2730.
Telex: 8814169

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☐ Please send me details and the name of my local stockist.

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Position _____

Company _____

Address _____

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PCW/3

SEND IT IN PACKETS

ment will itself be corrupted, and the sender will then re-transmit the packet which the receiver has already just successfully received. As they sometimes do in the harder textbook, 'we will leave as an exercise for the reader' the design of a mechanism whereby the receiver can recognise this event, and not treat the second packet as just the next in the sequence from the sender).

Routing packets through a network

Since we have gone to the trouble of tying up a packet, it seems a small extra step to add to the front of the packet the identity of the sender and the identity of the intended receiver. In fact this opens up a whole new way of working. Suppose, for example, that in our basic illustration the receiver was connected not just to the sender, but to two other computers as well. On the successful reception of a packet, the receiver could inspect the identifier of the intended destination and, if the packet was not for itself, simply pass it on to whichever of the other two neighbours it should have gone to. This can be generalised to a network of many computers and many links, as illustrated in Figure 2.

The first thing to note about this generalised scheme of 'packet switching' is the way in which any one link between nodes is shared. At any specific moment, a link will be dedicated to just one packet en route between a specific pair of correspondents. However, when that packet is dealt with, another packet for a different pair may share this same leg for part of its journey — as illustrated in Figure 2.

By what mechanism is a node to decide how to route a packet which it has just received? It should immediately recognise packets for which it is the terminal destination. Other packets have to be passed onwards, and the question is to decide which of the possibly many links also connected to the node should do this task. Perhaps the simplest way is to have a table stored within the node, listing for every possible receiver the link on which a packet should be passed on. (Clearly every node will need a different table, depending on its position in the network.) If the network is at all extensive, then a full table could be prohibitively large, and in this case it would be necessary to distinguish within a destination identifier 'sub-addresses' denoting area codes and local identifiers (just as one could break down a telephone number into its national, city, district and local components).

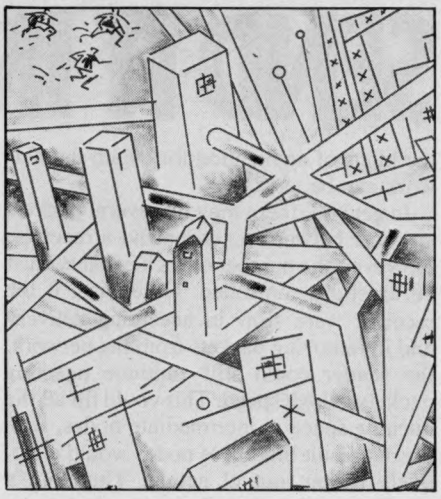
A very important feature of this system is its flexibility and its resilience. It is a relatively straightforward matter to add or remove nodes and links to match changes in traffic patterns, and to update the routing tables in existing nodes accordingly. There is no problem in connecting links and nodes in parallel to relieve congestion. In the short term, a node can quickly detect if a particular link or a neighbouring node fails, as it will receive no acknowledgement messages. When a failure is detected by a node, packets that would have been passed that way can quickly be redirected — though a number of routing tables will need to be updated consistently to ensure that re-routed packets do not end up shunted into some endless loop. It is also possible to regard over-loading or 'traffic congestion' in the same way, and to adapt routing strategies to bypass any overloaded areas. (To assist in all these re-routing situations, it is possible to arrange for nodes to exchange status messages with each other, or with some central network control node.)

Making a call

Usually a complete message between two correspondents will involve the transmission of a whole sequence of packets (eg, many records forming a large file), and often long messages will pass in either direction (eg, messages between a terminal and an on-line system). The network could treat every packet as if it were a small message in its own right (sometimes called a 'datagram'). This would have the considerable advantage that if there were a network failure at any stage in the 'conversation' or if congestion developed in some area, all further packets would simply find their way round these obstructions. However, because of the different routes which might be taken, there would be no guarantee that packets leaving the sender would arrive at the receiver in the same sequence as they were first transmitted. This would need to be overcome by including a sequence number in the header of each packet; either the receiver or the network node serving the receiver would then need to store the arriving packets and to re-sort them into correct order. Another basic problem with this approach is of course the overheads incurred in the routing process itself, which has to be invoked for every packet and at every node through which it passes.

An alternative approach to the routing problem is to tackle routing just once, when communication between two parties first starts. The sender or source starts by sending off a packet to the intended receiver, asking if the receiver will accept a 'call'. As the call request packet is routed through the network, each node through which it passes keeps a record of the details. By the time the receiver gets the call request packet, the details of the route taken stretch out behind it, like string through a labyrinth. When the original sender gets back an acceptance of the call, subsequent packets simply follow the string to pass along the same route. Because they follow the same route, and because two packets for the same link will not pass each other, the ordering of all packets is maintained.

This approach is frequently referred to as



a 'virtual circuit' or 'virtual call'. This is because the string defines a path or circuit which will be used for the whole duration of the call. In some respects this is similar to an ordinary telephone call. For the telephone call, however, a reserved circuit with fixed communication capacity ('bandwidth') is maintained throughout the call, whether or not this circuit is actually being used — this is known as 'circuit switching'.

However, for our packet switching the virtual circuit is simply the definition of a potential route. If sender and receiver are quiescent, the full bandwidth on every one of the links on that route remains available for use by other packets between other pairs of correspondents. It is for this reason that packet switched networks will usually charge the user according to the amount of information transmitted (ie, no links are used if there is no transmission). (The only overhead for a quiescent virtual call is in fact the very small amount of routing data stored by each node on the route.) Conversely, circuit switched networks charge according to the duration of the call (ie, bandwidth is always tied up, whether it is used or not.)

At the end of a virtual call, or if the original call is rejected by the nominated receiver, then the string of the virtual call is simply rolled up to remove all trace of it from the network.

Unlike the datagram approach, the advantage of the virtual call is the minimising of routing activity and the maintenance of packet sequencing. On the other hand, if a permanent fault develops on the route of a call, then the whole call has to be forcibly requested, and the network will automatically establish a new route for the new call. (Transient faults are still dealt with entirely automatically by the individual nodes.)

Flow control

A basic feature of packet switching as described here is that a complete packet has to be received and checked by a node before it can be passed on over the next link. Often queues of packets will form for transmission over one link (packets from the same call or from a mixture of a number of calls). Thus there will always be some delay at every node along a route. Whilst the network may be designed to run with small delays, the exact timing of 'deliveries' cannot be guaranteed — and that may affect

SEND IT IN PACKETS

the kinds of application for which the network can be used.

In general, there may be several packets en route between a sender and a receiver. However, the number of such packets must be carefully controlled. Otherwise, if the receiver were slow in accepting delivery and in removing packets from the network, the sender could still continue injecting packets at high speed. This could fill all the queuing space in intermediate nodes, with the net result that these nodes would effectively be put out of action. Therefore a requirement is generally imposed whereby after a sender has injected a number of packets it must wait for an acknowledgement from the receiver. The number of unacknowledged packets waiting in the network is thus restricted. This is known as 'flow control'. This is imposed at two levels, both at the call level (ie, end to end between sender and receiver) and at the individual link level (ie, between neighbouring nodes).

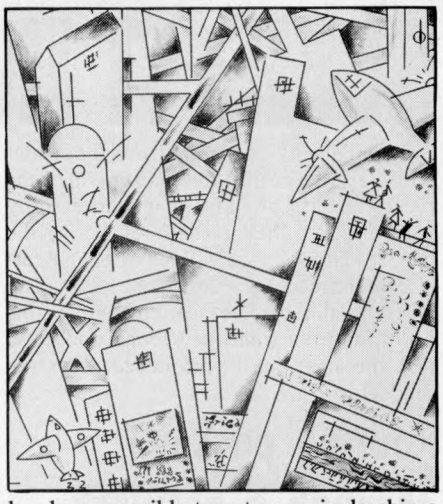
The foregoing has special implications for terminals connected through a network to a computer, when handling user input from a keyboard. If the terminal is working in 'full duplex mode', then when the user types one character this is immediately transmitted to the computer, which will interpret it and decide on the appropriate 'echo' to be returned to the terminal for display on the screen. (This type of working could be particularly appropriate for word processing or for graphics applications.) As far as the network is concerned, this would demand that for each character typed one (very small) packet be transmitted from terminal to computer, and another small packet returned from computer to terminal. The overheads of this could be extremely high (and probably the charges levied as well); furthermore any transmission delays could upset the 'user image'.

For these reasons, it is more usual to operate the terminals on a 'line at a time' basis, where the user assembles a whole line of input at a time before sending it off to the computer (making any corrections or amendments before finally requesting transmission). To support terminals not already capable of working in this way, it is common to provide a packet assembler/disassembler (usually abbreviated to PAD) which takes care of building up the packet from single characters of input before transmission, and the unpacking of packets from the computer back into single characters. The PAD may be a separate small computer or alternatively a part of a network node, and will generally be capable of interfacing a number of terminals to the network.

Conclusions

By the apparently simple device of including in a packet header the source and destination identifiers or addresses, we have thus developed a whole methodology of networking. Given a good implementation, the packet-switched network can be very flexible and resilient, reliable, and accurate in the face of transmission noise. This approach is therefore popular for 'wide area' networks where long distances are involved. The best possible use is made of transmission links, and bandwidth does not have to be held reserved for quiescent calls.

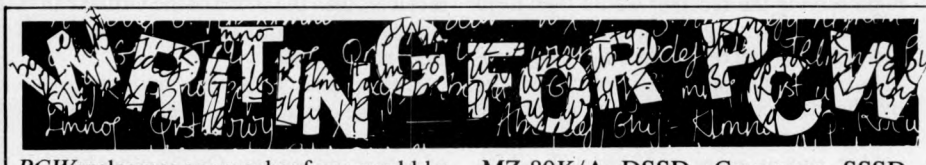
There is, of course, another side to the coin. The network nodes are necessarily somewhat complex, and still relatively expensive. However, this is a situation which is changing rapidly: for some time it



has been possible to get on a single chip a driver for one link. The overheads of dealing with packets are significant — these include the header, trailer and checksum processing, packet acknowledgement, end-to-end and link flow control, routing, internode status and management messages. Fortunately this is handled by distributed hardware rather than by a central bureaucracy!

Packet switched networks have been in operation for many years. Perhaps the best known of the early systems was ARPANET, first set up on an experimental basis to link educational and scientific research institutes across the United States, and which subsequently added links to Europe. British Telecom has already launched its Packet Switched Service, initially on a restricted basis, but destined for widespread use. Happily this is based on standards now internationally agreed for packet switched networks, based on the original 'X25' standard.

The next article in this series will look at ring networks (in which the nodes are connected to make a continuous ring) and the Ethernet approach, where all nodes share a single common transmission link or medium.



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If your article is already written, send it in — taking care to ensure that your name and address, together with a daytime phone number if possible, appears on both the covering letter and the manuscript. Manuscripts should, preferably, be typed or printed out (dot matrix output is quite acceptable) but *must* be double line-spaced with ample margins top and bottom and on each side.

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Once you've sent off your article or proposal, please don't hassle us for a decision. We receive far more submissions than we can ever use and it takes us a while to sort through them, acknowledge receipt and give an opinion one way or the other. Please be sure to tell us if you've sent the article to another magazine — it would be very awkward indeed if the same article appeared simultaneously in two publications! Frankly, we're more likely to accept something which has been offered exclusively to us.

Finally, we do pay for published work but please be patient! Payment *normally* follows about 4-6 weeks after publication.

COMMUNICATIONS

PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Sheridan Williams (see 'Computer Answers' page). Address letters to: 'Communications,' Personal Computer World, 62 Oxford Street, London W1A 2HG.

Stamp on Acorn

Since last July I have written three times to Acorn Computers, each time enclosing a stamped addressed envelope. So far I have had no reply to any of my correspondence. I have also written to the BBC (who did reply), in the hope that they might be able to stir Acorn into some activity, but this also proved fruitless.

Might I invite someone at Acorn to reply, through your columns, offering some excuse for their arrogance.

Alternatively, if there is no excuse, may I suggest, in the Aberdonian tradition, that their accountant pop two stamps in an empty envelope and return it to the address below.

R Ferguson, 43 Craighton Terrace, Aberdeen AB1 7RN.

How about it Acorn? — Ed

NEC PC8000 lacks software bite

I read with interest the item in Newsprint about the NEC PC8000.

I bought one of three computers recently and would like to make one or two observations.

I think some of the lack of interest is due to the poor support for the system. Ever since I purchased mine I have been trying to obtain information on the computer to help me write software.

Neither IBR (the distributor) nor NEC have been forthcoming. They promise you the earth and nothing happens.

Much more use could be made of the excellent hardware if the information available was as extensive as that for the Apple, for example.

Sales are generated by interest, and little interest is generated without attractive software — and software needs information to enable it to be written.

I think that I have made a serious error in purchasing the PC8000 because of this poor support for software writers.

The Basic is okay but the machine code routines in the 'N-Basic' would save much time and increase speed if they were accessible.

I would be interested in hearing from anyone who can provide me with any details of the 'N-Basic' interpreter and perhaps you could print a little of this letter.

Bob Weston, Two Boats, Ascension Island, South Atlantic Ocean.

Tremors on the Spectrum

I was interested by your review of ZX Spectrum games software (January *PCW*). However I have found several problems with this computer and feel that anybody intending to buy one should be made aware of them.

When after the usual wait I received a Spectrum, I was disappointed to find it did not give an acceptable colour picture with my TV set. On contacting Sinclair I was told that they were aware of this incompatibility, but it was incurable. They admitted that the same problem occurs with several other makes of television; but this is not even hinted at in their advertising or specifications.

Resigned to black and white or Blurrivision computing, I later ordered two of the Sinclair/Psion games tapes, from a leaflet which said they were 'immediately available'. Again there was a long wait, and again I was disappointed. Neither tape would load on my equipment, which however copes perfectly well with programs of my own; with software from an independent supplier (Bug-Byte); and with the Sinclair/Psion 'Horizons' introductory cassette. I therefore sent back the tapes with an explanatory letter.

This was in November and I have received no replacement tapes, explanation or even acknowledgement. I have tried to contact Sinclair but their 'customer service' phone number is continually engaged. I am left to wonder if this is deliberate policy, or just incompetence. In either event these experiences have just about killed my interest in home computing.

As a postscript: I have now received through the post a total of 10 reels of printer paper for a ZX printer which I do not possess — and now have no intention of ordering.

N P W Watson, London NW3

August Ada

The article on Charles Babbage, 'The Nearly Man', in the January issue does a considerable injustice in omitting all mention of the contribution to the design of the Analytical Engine made by Augusta Ada, Countess of Lovelace.

This highly gifted young woman, daughter of Lord Byron, was a self-taught mathematician of outstanding ability. She helped Babbage in a small way at first, but later appeared to have played a large part in directing the progress of the design. She suggested the use of subroutines for frequently used mathematical functions and carried out the necessary computations, often working long hours at high speed. She saw, perhaps more clearly than Babbage himself, the potentialities of a computer, and made statements on this subject which were not matched until the early 1950s.

After the tragically early death of Lady Lovelace at the age of 36, Babbage seemed to become irresolute, and the momentum of the work disappeared, perhaps lacking her guiding hand and breadth of vision. At one stage, he even gave up the project and started on the design of a second Difference Engine, which again got nowhere.

It is worth noting that some recognition of Lady Lovelace's work has been made by the United States Department of Defense in naming their new computer language 'Ada' in her honour.

L E Weaver, St Leonards-on-Sea, East Sussex

Atari losses

I see that Atari is still running those advertisements threatening divine retribution on those who dare write programs that resemble Atari games.

I wrote to Graham Daubney some 10 weeks ago, saying I was developing programs that he might consider would contravene Atari's copyright. If this 'Graham Daubney' does indeed exist, he might as well not, because I have yet to receive a reply to my offer of royalties on any program that could be considered to infringe Atari's copyright.

My suggestion to any other mug tempted to be honest about it is — forget it! These expensive advertisements are probably just designed to frighten the competition, or to make 'Graham Daubney' look more important so that his boss will give him a key to the executive washroom.

I hate to think how much money Atari are wasting, when they could just be sitting back raking royalties off programs which are often far better than theirs anyway.

Andrew Denny, London SW6

Clock on

I wish to make a few points concerning Mr D N Anderson's criticism (Letters, January 1983) of the cost of my clock card design ('Clock it to Me', October/November 1982) and the relative virtues

of a clock card marketed by Namal Associates.

Mr Anderson quite incorrectly states that the kit does not contain a battery, and having re-read the articles I can find no ambiguity to account for this. I did however use the term 'Nicad' and I can only assume that Mr Anderson is not aware that this is the commonly used abbreviation for nickel-cadmium battery.

Mr Anderson is quite right that the Namal card at 'around £70' is indeed cheaper than the Mountain Computer board at £149; it is however in the same price range (£50 — £80) as the CCS Clock Module, Superclock II, Thunderclock, March Microclock(s) and Time Machine II. All these boards have their strengths and weaknesses, and that marketed by Namal will be no different. What prompted the design of my own card was that *all* the above clock cards had the common weakness of being too expensive for me to justify purchasing and yet the concept was potentially very useful.

I note that the Namal card features a 4k operating system. Because of space limitations I was unable to discuss this approach in my original articles. Suffice it to say that if the 2k memory space starting at $C800 is used, conflicts can arise with 80-column cards, etc. (See 'Three Real Time Clocks'; D P Rivas, *Applesauce,* February 1981.) The solution is to stay within the normal $CN00 PROM space constraints and page memory — but not all clock cards do this. This is clearly important and I have been unable in the time available to find any details on this aspect of the Namal card (having checked the Advertisers Index in both *PCW* and *PC* for the last six months and having tried to find Namal's telephone number through directory enquiries).

Mr Anderson always prefixes his prices by 'around' — 'around £70', 'around £40', etc. It has been my experience that values quoted thus are nearly always too low. I myself first quoted a target price of 'just over' £30 for my design, and most people must recall the BBC's target price for its computer. . .

At the end of the day my clock card design, together with disk software and manual, is available at £36. Mr Anderson's Namal card is not comparable since it is not actually available as a kit and even if it were it would be more expensive (although by exactly how much is difficult to say, given his reluctance to quote specific values). In addition, Mr Anderson's letter ignores the fact that the articles in themselves contained *all* the information to build a clock card and provide it with a software base — there is no compulsion to buy the kit and for those with the necessary wherewithal considerable savings could be made.

In conclusion I can only assume that in Mr Anderson's rush to publicise the Namal card ('soon to be released for the BBC it is rumoured' indeed!) he lost touch with normal standards of criticism. I trust that in future he will check his facts, provide proper pricing details and actually compare one real product with another.

B Marriott, Slough, Berks.

Videx cards

In the early part of last year you published a letter of mine which explained how it was possible to duplicate program lines in Microsoft Basic-80 using the Edit command and Ctrl-A.

I tested the routine out on a Vector Graphics System-B and the office Apple II with an 80-column card and it worked perfectly on both.

Recently, however, we have bought some new Apple IIs with Z80 Softcard and Videx Videoterm 80-column cards. When I tried my little routine on these machines, however, it didn't work! Why? you may ask. Simple, Videx cards use Ctrl-A as an upper/lower case toggle. Why use Ctrl-A? Over to you Videx.

P H Elliott, Thundersley, Essex

Sinclair satisfies

Earlier this year I ordered a Sinclair Spectrum, to be delivered to my hotel address in London during my visit there in November. Upon arrival I called Sinclair and discovered to my dismay that there had been some serious misunderstanding with respect to my order. Then, remembering all the complaints published in *PCW*, referring to Sinclair's attitude in such cases — what could I expect?

Naturally, I was anxious to obtain delivery while in London and had to call Sinclair on the telephone a few times, mostly being attended to by Elizabeth or Barbara — always in a polite, friendly and helpful way. But it was not only the 'words' — they delivered!

My experience is — and I am confident I can say so also on behalf of an overwhelming majority of 'happy' Sinclair customers — that the people at Stanhope Road do their best to satisfy. Most happy customers probably don't bother writing letters like this, but it would be a great pity if only the few dissatisfied ones have their views published.

Finally, I am also a happy subscriber and reader of an excellent magazine — keep up the good work!

Oivind Grenness, Horten, Norway

A fan writes. . .

Together with my subscription to your excellent magazine, I'd like to give you a little feedback. The first reason why I subscribe is that your magazine is only sold in one bookstore in Stockholm. There, it is always sold out. I think you should take up a serious discussion with your Swedish agent to spread the product to more bookstores, so it at least are as widespread as *Practical Computer.*

Since I am a proud owner of a Sharp PC-1500 I'd like to see more material about that machine, and short programs, especially applications for business and administration. I personally use my computer (or supercalculator if you like) as a very versatile tool at all the office meetings which fill my day as an administration in the local city council.

What I like in your magazine are all the good articles dealing with programming techniques and features of general interest for the owner of a small personal computer, as well as these dealing with how to link them to bigger systems. I also like 'Brain Dump', which often opens up new fields of study and is composed in a short, clear style summing up the main points.

It is all to easy to get flimsy and 'false-artistic'. One who has fallen deeply in this trap is Guy Kewney, the 'Newsprint' regular. It is certainly the worst news review I have ever seen in any of the computer magazines I read regularly. It is flimsy, disinterested and written in an arrogant style, leaving the reader who is not an insider in a total confusion. In such a fast growing sphere as the computer-market you need a clear, sharp-eyed guide who can tell you what is coming, when, and what could be the main advantages and disadvantages of the products. To be able to give clear and neutral news reviews you need a staff of competent and independent newshunters, but I'm sure that with your vast amount of advertisements you could afford it.

Crister Skoglund, Jarfalla, Sweden

Beeb disk restrictions

I wrote to Acorn Computers Ltd with reference to the limitation of 31 entries on the disk drive for the BBC Computer.

The answer I received was as follows:

'As you have discovered, only 31 files can be created on each side of the disk, and unfortunately, no change will be made to this as this is obviously due to software code in the 8k disk operating system. I know the above information is really of no help and I therefore apologise that there are no suggestions I can make.'

This letter indicates no concern for the problem. I had hoped to receive some suggestions — perhaps a software program or perhaps some application notes.

Can you or any of your readers provide any assistance?

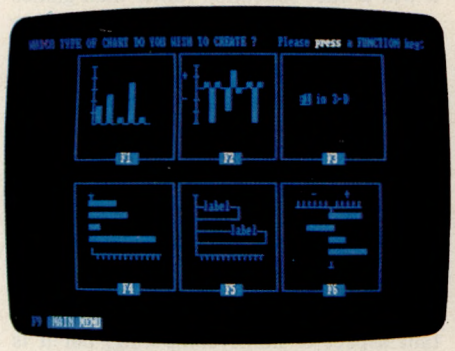
The difficulty is that a number of short items will fill the catalogue but will leave a lot of unused space on the disk.

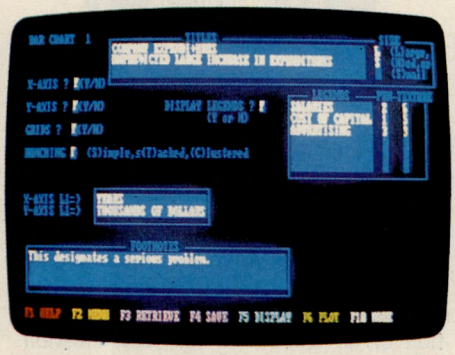
I shall be grateful for suggestions.

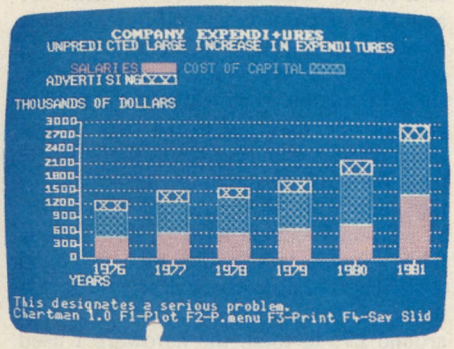
George H Foot, Tamar, Town Row Green, Rotherfield, Sussex.

CHARTMAN is here!

BONSAI BRINGS YOU THE LEADING BUSINESS GRAPHICS SOFTWARE for the IBM Personal Computer.

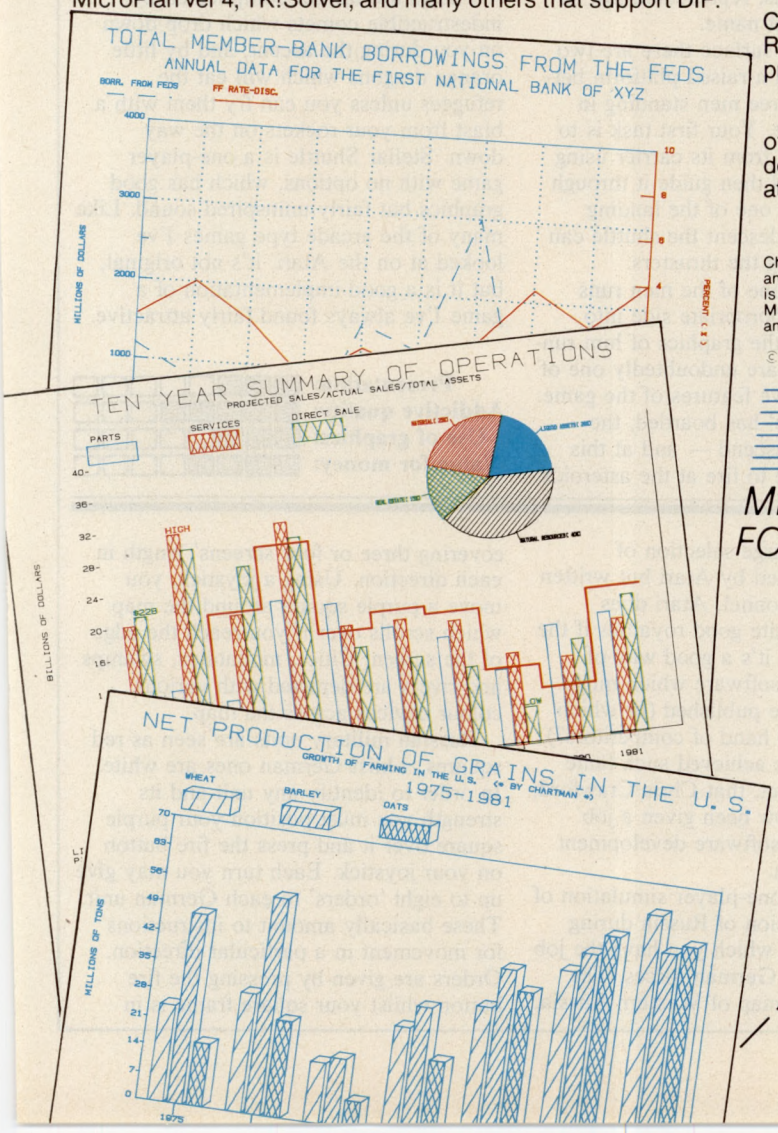






CHARTMAN brings out the messages buried in piles of data by turning columns of numbers into quickly and easily understood graphics. CHARTMAN will produce top quality horizontal and vertical Bar Charts, 2- and 3- dimensional Pie Charts, linear and logarithmic Line Charts, text pages and signs. You can display them on screen, print them on a graphics printer, and plot them onto paper or acetate transparencies.

CHARTMAN is a really easy-to-use, menu-driven program that allows you to produce presentation quality graphics immediately with little or no training. You either enter data through simple fill-in-the-blanks screen layouts, or interchange rows or columns with programs like Visicalc, MicroPlan ver 4, TK!Solver, and many others that support DIF.



CHARTMAN was designed specifically for the IBM Personal Computer to utilise its powerful features. Once charts have been created, they can be stored, then retrieved and edited later. CHARTMAN even has a slide presentation feature where charts can be saved as slides for a manually stepped or automatically timed "slide show" on the screen.

CHARTMAN I: displays everything on the screen in monochrome high resolution, prints charts on the IBM Personal Computer printer or Epson MX80 and 100 printers (all need the Epson Graftrax option), and can plot on HP7470 2-pen and HP7220 8-pen plotters. **£295**

CHARTMAN II: in addition to all the features of CHARTMAN I, CHARTMAN II can display charts in colour on RGB monitors, can print colour charts on IDS Prism colour printers, and can plot on IBM XY750 plotters. **£395**

Give Bonsai a ring, or cut the coupon, to order your copy of CHARTMAN, to receive further information, or to arrange a demonstration of CHARTMAN on the IBM Personal Computer at our London showrooms.

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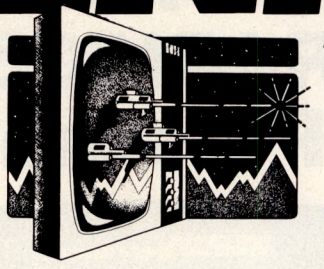
SCREENPLAY

Dick Olney investigates games for the Atari 800.



As promised, this month I've had a look at a selection of games running on an Atari 800. Except for Centipede, all of these are disk-based, although some of them are available on cassette as well. It is possible to attach a disk drive to the Atari 400 of course but it invalidates your guarantee, since to make it worthwhile you'll need to upgrade the machine to 32 or 48k and Atari itself won't support this configuration. Anyway, by the time you've paid for the upgrade and the extra RAM you might as well have bought an 800, now costing £400 (maybe less by the time you read this!). The 810 disk drive will set you back a further £300, with each joystick costing around £7. In total, the hardware I used would cost around £714 — unfortunately still outside the range of all but the most affluent home users in the country.

The vast selection of classy games available for the 800 these days is staggering. I've covered a few of the most popular.

Nearly all the games here are real time arcade type games (with the notable exception of Eastern Front), but I should mention the series of graphics adventures available for the Atari from Adventure International. Basically the adventures are of Scott Adams' usual high quality, with the addition of an illustration for each location. Unfortunately on most TVs these graphics have an appalling flicker, but it's a nice idea.

Atari, with its history of arcade successes, can undoubtedly lay down to being one of the leaders in computer games. As I said last month, the BBC Computer is the only machine I've seen that can match the Atari graphics, and the chances are that it will attract education rather than games software. It may be that, for the time being at least, we've reached a peak of sophistication in arcade style games, which will now cease to show any signs of real progression. Certainly I haven't seen any new ideas in the arcades for a while, and consequently people are now much less willing to part with their ten pences. Most manufacturers are aware that from now on educational rather than games software will become increasingly important in selling machines. Games will, of course, always be an important aspect of home computing, but it is important to bear in mind that they remain the most trivial way in which microcomputers can change our homes.

All software supplied by The Silica Shop, tel 01-309 1111 and Calisto Computers, tel 021-632-6458.



Game: **Stellar Shuttle**
Supplier: **Broderbund**
Price: **£19.75**

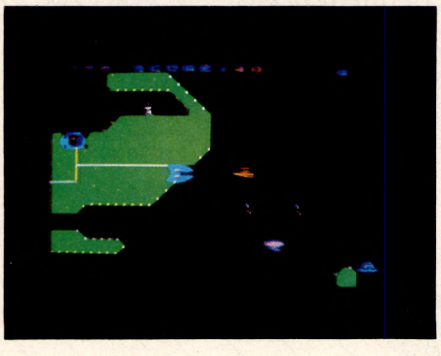
I always felt that the arcade version of this game (whose original name escapes me) was underrated in many respects. It appeared some time after Space Invaders but was quickly eclipsed by games like Asteroids and Defender. The game begins with a mother ship carrying a shuttle travelling back and forth across the top of the screen with a planet's surface below it. Between the two are numerous asteroids, represented just as in the game of that name.

On the planet's surface there are two landing bays, with a raised platform between them and three men standing in wait on either side. Your first task is to release the shuttle from its carrier using the fire button and then guide it through the asteroids onto one of the landing bays. During the descent the shuttle can be slowed by firing the thrusters.

Upon landing, one of the men runs across from the appropriate side into your shuttle, and the graphics of him running and jumping are undoubtedly one of the most impressive features of the game. When the 'refugee' has boarded, the shuttle begins to ascend — and at this point it is possible to fire at the asteroids above to try and blast your way back to the mother ship which is waiting patiently in the same position it was in when you left it.

Things are further complicated by indestructible comets which drop down on you during the ascent, and by little orange dragons which will eat the refugees unless you can fry them with a blast from your rockets on the way down. Stellar Shuttle is a one-player game with no options, which has good graphics but fairly uninspired sound. Like many of the arcade type games I've looked at on the Atari, it's not original, but it is a good implementation of a game I've always found fairly attractive.

Presentation:
Addictive quality:
Use of graphics:
Value for money:



Game: **Eastern Front**
Supplier: **Atari Program Exchange**
Price: **£23.99**

This is one of a large selection of packages distributed by Atari but written by non-Atari personnel. Atari does apparently pay quite good royalties if the program sells and it's a good way of making available software which might otherwise never be published (or which might fall into the hand of competitors?). Eastern Front has achieved such fame and success, in fact, that Chris Crawford, its creator, has now been given a job with Atari's elite software development team in California.

The game is a one-player simulation of the German invasion of Russia during World War II, in which you have the job of controlling the German forces. The playing field is a map of Western Russia, covering three or four screens' length in each direction. Using a joystick, you move a purple square around the map which scrolls over if you reach the edge of the screen. Cities, mountains, swamps and rivers are depicted with various colour devices across the map.

Russian military units are seen as red squares, whilst German ones are white. In order to identify any unit and its strength you must position your purple square over it and press the fire button on your joystick. Each turn you may give up to eight 'orders' to each German unit. These basically amount to instructions for movement in a particular direction. Orders are given by pressing the fire button whilst your square frame is in

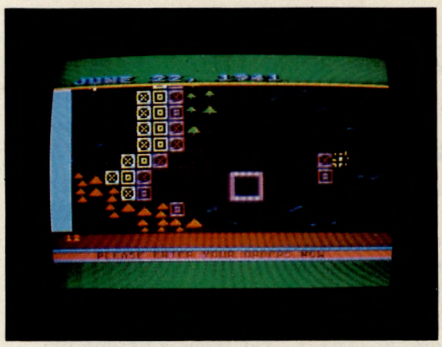
position over the appropriate unit, and — keeping the button pressed — moving the joystick in the direction you wish the unit to move (not diagonally).

When you have completed your orders, pressing the start button initiates the procedure which figures out their results. A unit will not carry out all your orders exactly for a number of reasons. Firstly it may come into conflict with an enemy unit by trying to move into the other's space. In this case, the result of the conflict will be determined by the fighting strength of each unit along with various random factors and one unit will be forced to withdraw. Associated with this is the inability — under certain conditions — of your unit to move through a Russian unit's 'zone of control', the rules for which are too complex to got into in this review.

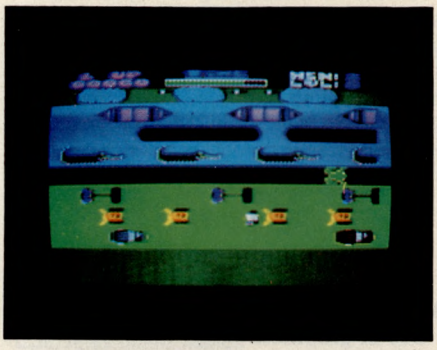
Secondly, a German unit cannot move into a space already occupied by a friendly force, and will merely wait until the other has moved. Finally, the number of spaces which a unit can move each turn is limited by its own nature (ie, infantry or tank regiment), the terrain it is crossing, and the season of the year in which the move occurs. The game runs from 22 June 1941 to 29 March 1942, with each turn representing one week (the current date is displayed at the top of the screen). Your score appears in the bottom left hand corner and is reassessed each turn, with the idea being to end the game with the highest score possible (out of 255). Since this score fluctuates in both directions there is no point in playing part of a game so as there is no game-save feature you'll either have to leave your computer on or allocate several hours each time you boot up the disk.

I have covered only the barest essentials of the game, and the real thing is extremely sophisticated. The graphics are the most obviously impressive feature, with the colours changing according to the season, but there can be no doubt that this is an admirable piece of programming. According to the manual the final product is the 317th version and the whole thing took eight months to complete. Rumour has it that, either as a result or prerequisite of this work, Mr Crawford is a rather strange fellow. Certainly an obsession with military matters in general and World War II in particular would considerably enhance your appreciation of this game. Because of a deficit of time and patience, a tendency to avoid long-term solitary leisure activites, and a total lack of interest in wars generally (beyond sheer horror), I wouldn't touch this game with a barge pole. I don't, however, wish to offend the doubtless numbers of devotees who could with some justification claim that this was one of the best games of its type ever devised. Eastern Front and Chris Crawford demand respect, if not approval.

Presentation:
Use of graphics:
Complexity:
Value for money



Game: Preppie
Supplier: Adventure International
Price: £21.99



Game: Frogger
Supplier: On-Line Inc
Price: £22.75

These two are essentially the same game, both being glossy versions of the arcade favourite, which I reviewed last year. Frogger, as you might guess by the name, is the original copyright version, while Preppie is an amusing variation (though with the traditional impertinence of direct rip-offs it is, of course, also copyrighted).

For any of you who have yet to sample its delights, Frogger involves manoeuvring a frog first across a busy road and then across a river in order to reach a home base at the top of the screen. There are four lanes of traffic on the road, two lanes in each direction, and the speed of this increases as the game progresses. The frog must avoid touching any of the vehicles. On the river the opposite applies, since the frog must leap onto moving streams of logs, turtles and crocodiles to get across. Believe it or not, the frog drowns if it falls in the water. Things are made more difficult still by deadly snakes which wander across the grass between the river and the road, and by various creatures which lie in wait at your home base ready to gobble you up.

The version of Frogger for the Atari is, from what I can remember, fairly true to its ancestry, except that it is only a one-player game, and each game consists of five frogs. There are also 'lady frogs' which wait on logs for your controlee (which is presumably considered a gentleman frog) to escort them home. Leaping on top of this frog of the fairer sex allows you to control the happy pair as if they were a single creature. The game can be played at two different speeds.

Preppie has a similar layout but with only three lanes of traffic both on the road and on the river. In fact the road is a fairway and is actually populated with lawnmowers, golf cars and bulldozers. The river starts off with boats only on it, but logs and crocodiles appear later on (though there are no turtles). Instead of a frog you control a young student ('preppie' is an American term for rich spoilt kids who have attended private — in our terms public — schools) whose name is given in the extensive story which accompanies the game as Wadsworth Overcash.

Because of a bizarre college tradition Wadsworth has the job of retrieving golfballs on a very dangerous course. In the first frame there is only one golfball, lying just the other side of the green, which must be retrieved and carried back to the starting zone. As the game progresses more balls appear. Only one ball can be carried at a time and, of course, there is a limited time to do it. Incidentally in Preppie, instead of a snake threatening you in the central reservation there is, to add insult to injury, a giant frog!

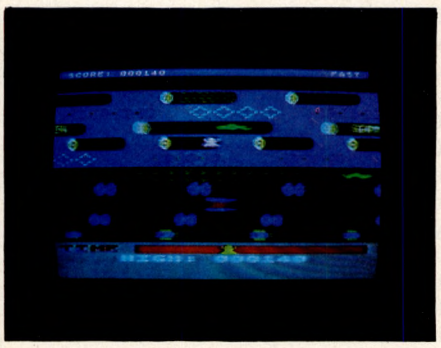
Preppie can be played by one or two players using either just one or a pair of joysticks. In both Preppie and Frogger the graphics are superb, and they both include melodic but repetitive tunes which are amusing to begin with but soon drive you mad (luckily the music can be turned off without losing the other sound effects by pressing 'select' on Frogger or CTRL? SHIFT and 'm' on Preppie). I like both of these games, and to be honest there is not much to choose between them. Preppie certainly wins out in terms of presentation, but the long sequences between each term make it slower-moving. It also includes the option of starting at any level between one and nine, which can be useful once you start to master the game.

Preppie

Presentation:
Addictive quality:
Use of graphics:
Value for money:

Frogger

Presentation:
Addictive quality:
Use of graphics
Value for money:



Game: Chopper Rescue
Supplier: Microprose Software
Price: £24.75

Chopper Rescue is one of the few games this month which needs the Basic cartridge, and is not to be confused with Chop Lifter, a game based on the abortive attempt to rescue the American hostages in Iran. Although I couldn't get hold of a copy of the latter to review, the few games I played were very impressive and it's well worth a try if you get the chance. In Chopper Rescue you use the joystick to control a helicopter (surprise, surprise) whose task is to rescue 10 prisoners from a colourful and heavily defended labyrinth.

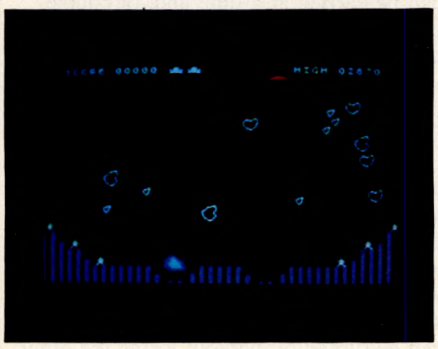
The game can be played with one to four players, and there are three difficulty levels. If more than one player is taking part two different variations are possible. A solo mission involves the first player finishing one card or losing all three helicopters before the second player takes his turn, and so on (they both use the same joystick). A team mission involves one player controlling movement with the first joystick while another player uses the button on the second joystick to fire, thus giving a possibility of two pairs. This second option is awkward to begin with but can be a lot of fun when you get the hang of it.

The labyrinth has a selection of defences. These are devices that release mines which float upwards towards you, or similar objects which shoot streams of coloured fireballs horizontally across the screen. In addition the labyrinth is populated by several different kinds of 'droid defenders' which fire directly at your helicopter if they catch up with it. These can be pretty sneaky and will take cover in the most awkward places to prevent you reaching one of the prisoners. To add to your problems the helicopter must not touch any of the walls and has a limited amount of fuel (in effect, time), although I never found the latter a problem.

Your defences are two-fold. The joystick button releases a bullet which travels horizontally in the direction the helicoper is facing. If you pull the joystick down (ie, towards you) while simultaneously pressing the button the helicopter drops a bomb onto whatever is below. The bomb can also be dropped at an angle by pulling the joystick down and to one side.

After all 10 prisoners have been rescued a similar labyrinth with a different configuration appears, and there are three different scenarios. I don't know what happens if you finish the third frame since I didn't get that good, but I assume it reverts to the first configuration and throws in a lot more 'droids'. This is one of the most addictive games I've played, and offers plenty of scope whilst being easy to come to grips with. Good use is made of the Atari graphics and the sound is realistic if a little limited. Flying the helicopter demands plenty of concentration and care, and the game should occupy anyone long enough to feel they have got their money's worth.

Presentation: ▰▰▰▰▰▱▱▱▱
Addictive quality: ▰▰▰▰▰▰▰▱▱
Use of graphics: ▰▰▰▰▰▰▰▱▱
Value for money: ▰▰▰▰▰▰▱▱▱



Games: Stratos
Supplier: Adventure International
Price: £25.49

Stratos is a rapid-action space battle game with some stunning graphics and a number of interesting features. The play itself is fairly standard. Your joystick controls a cross-hair sight targeting two guns (termed 'Armageddon war devices',) situated at the lower corner of the screen. Groups of three craft (M'korg star-jammers) appear, growing from small points of colour, and swoop down in a variety of formations to attack your city.

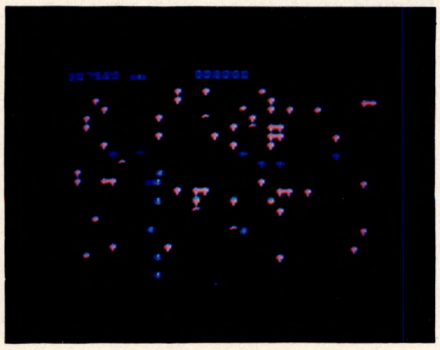
The city is made up of eight power towers, which feed your defences, and a small flying saucer. It is protected by a horizontal force field lying a few inches above the bottom of the screen. As you might guess, the object is to shoot down the M'korgs before they destroy your city with their streams of bombs ('ravagers' or 'atomic core disruptors').

The game happens in waves, with each one consisting of fifteen triplets of M'korgs, and the action is extremely fast. Between each wave you have the opportunity to repair or replace damaged sections of your force field by pressing the space bar and manoeuvring the flying saucer out of the city and over its defences. Care must be taken to return the saucer to the city before more M'korgs arrive, however, or you'll lose your repair capability.

The interesting features I referred to earlier are mostly concerned with the setting up procedures. You can change the background colour through a selection of shades from light blue to black by pressing 'B'. The 'C' key gives a variety of different foreground colour combinations, whilst the 'S' toggles the two available skill levels.

Stratos is a satisfying and spectacular space battle game, whose colourful graphics are enhanced by the optional variations of shade. The principles are hardly inspired, but this game should keep most arcade freaks happy for a few months.

Presentation: ▰▰▰▰▰▰▱▱▱
Addictive quality: ▰▰▰▰▰▱▱▱▱
Use of graphics: ▰▰▰▰▰▰▰▱▱
Value for money: ▰▰▰▰▰▱▱▱▱



Game: Centipede
Supplier: Atari
Price: £30

This is one of Atari's latest offerings, and was heavily promoted in the latter part of last year. As with most of Atari's ROM-based games Centipede started life in the arcades, where it achieved a significant following. Although in its basic principles the game is not far removed from a simple Space Invader scenario, the details are rather more complex, making for a colourful and attractive game.

The playing field consists of a black screen with a large number of coloured mushrooms scattered randomly across it. You control a small oval object, described as a 'bug blaster', which can move in any direction within a strip of a few inches wide running across the bottom of the screen (note that its upper boundary is not actually visible). The blaster gives standard auto-repeat vertical firing. Throughout the game four types of creature emerge, any one of which will

destroy your bug blaster if they touch it.

The most prolific beast which attacks you is of course the centipede itself, one of which is always on the screen. It moves horizontally across the screen, moving down and changing direction whenever it encounters a mushroom or the edge of the playing field. Your blaster can destroy one segment at a time, which generally has the effect of splitting the creature up. As the segments reach the bottom of the screen the number of centipedes increases, eventually making it impossible for you to continue.

Next comes the jumping spider, which regularly hops across the bottom of the mushroom patch and which can be quite tricky to destroy. It can appear from either side at any time, taking you unawares, so it's essential to keep your bug blaster clear of the edges as much as possible. Spider movement is not inhibited by mushrooms, though it will occasionally cause them to disappear as it passes.

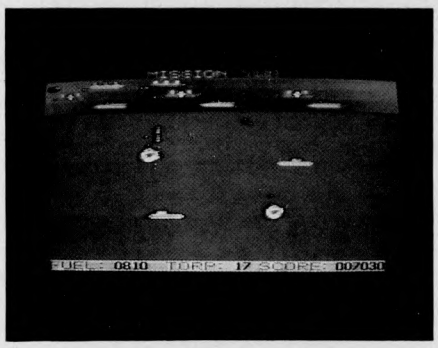
As the game progresses, increasing numbers of 'frenzied fleas' drop straight down from the top of the screen at your blaster. These little demons take two shots to destroy them, and they often leave a trail of fresh mushrooms in their wake. Remember that the mushrooms restrict the bug blasters' movement, and allowing too many of them within your area is extremely hazardous. They can, of course, be destroyed, but it takes four shots to do it.

The last creature to make its presence felt is the 'poisonous scorpion' which occasionally dashes from one side of the screen to the other changing the colour of any mushrooms it encounters. If a centipede touches one of these 'poisoned' mushrooms it changes course and makes a bee-line for the bottom of the screen. If you're lucky this can make it easier to hit it — but you'll need to be quick.

Centipede comes complete with a fully illustrated booklet describing the 'enchanted mushroom patch' (what *kind* of mushroom could this be, I wonder?), ostensibly written by one Lord Motley Bugnut, the well known bug expert. One or two players can take part and the game requires one joystick per player. As with most of Atari's games the sound and graphics are impeccable, with the colour scheme (though not the background) changing each time a centipede is completely eliminated. This game is highly recommended, though I must say I'm surprised that ROM packs (and not just Atari's) are still so expensive.

Incidentally Silica Shop sent me a disk-based version of Centipede called 'Bugg Attack', which has a slightly different selection of creatures and is interesting though rather too manic. This is produced by the Cavalier Computer Corporation, which is, I suspect, well aware of the fact that Atari is willing to ignore copyright infringements of the game on its hardware.

Presentation:
Addictive quality:
Use of graphics:
Value for money:



Game: Seafox
Supplier: Broderbund Software
Price: £19.75

I've been disappointed with many of the submarine games I've played in the past, but this one is an exception, providing an interesting arcade-style game which is easy to play but not so easy to master. Seafox is a one-player game where the joystick controls a submarine which can fire torpedoes vertically toward the surface. The sea takes up about four-fifths of the screen (and is green) with a strip at the top representing the surface (blue).

On the surface three types of ship appear. At the very top is a row of merchant ships, and sinking these is the main object of the game. Next comes a row of hospital ships, from which your torpedoes are reflected back toward you (it being against international law to sink them!); and which thus provide effective cover for your targets. After the first wave of merchant ships has been cleared, a third row of destroyers appears; these drop depth charges randomly into the water.

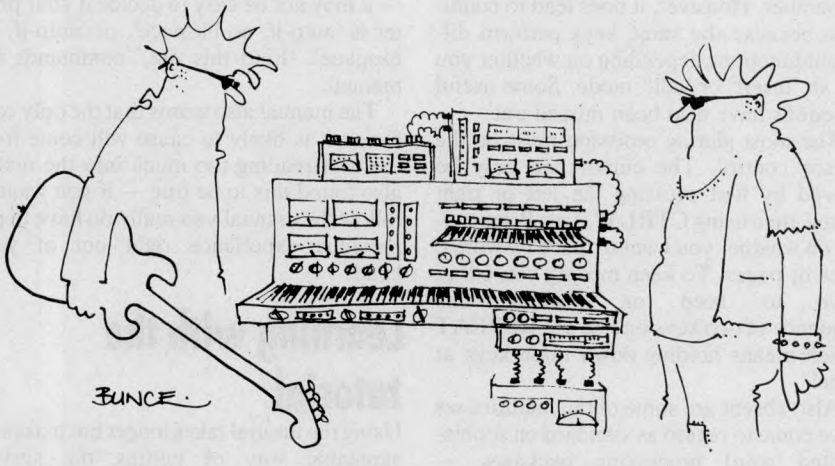
In the sea itself there is a stream of enemy submarines, which to begin with rely solely on kamikaze collision tactics, but after the second 'mission' begin to fire torpedoes from their bows. To add to your problems in later missions, magnetic mines appear floating around the water.

At the bottom of the screen is a status display which shows your fuel, number of torpedoes and score. If you run out of fuel the submarine is destroyed, so both this and your ammunition must be frequently replenished. This is achieved with the help of a supply sub and a friendly dolphin. The sub travels across the bottom, and as it nears the edge the dolphin appears carrying its relief package. Your task here is to make contact with the dolphin before the supplies are stolen by the inevitable giant clam which rushes across the centre of the screen. Quite what the poor creature does with a load of diesel and oil and 30 torpedoes is anybody's guess!

It is possible to injure the dolphin during the link-up, in which case a huge fish appears and destroys you by way of revenge. Although this happened to me several times I was never quite sure what I'd done wrong — and when I attempted to do in the dolphin on purpose nothing seemed to happen. A standard three submarines are allowed each game, with each one starting out with a full load of fuel and torpedoes.

As I said at the outset, I thoroughly enjoyed playing this game, even though the stiff joysticks combined with the slow movement of the sub gave me blisters after a while. The game is fairly limited, however, and would be unlikely to stand the test of time as well as some of its more sophisticated contemporaries.

Presentation:
Addictive quality:
Use of graphics:
Value for money:



'It's decided to go solo. . .'



APPLE WORD HANDLER

EASY HANDLING

Jane Bird proves there's still life in the Apple with this word processor Benchtest.

The Apple II is never going to be the ideal machine for word processing. It has a consummately uncomfortable keyboard with no function keys, and the standard system allows a maximum of 66 characters across the screen. However, there is an enormous number of Apple II users (about 750,000 worldwide) and these people may be very glad of an inexpensive word processing package which offers all the basic facilities.

Which is how you could describe Word Handler II, designed by Silicon Valley Systems (SVS), California and available from Pete and Pam Computers in the UK.

The oddity of the package is that SVS doesn't seem to have decided who it is aimed at — the manual talks at one moment to the complete novice who has no understanding of computers and the next moment recommends use of the DOS 3.3 manual for details of how to format disks.

My overall impression was that it is the user of the DOS 3.3 manual who will enjoy this package, not a secretary or manufacturer with no understanding of computers. I definitely see Word Handler being appreciated by a two-finger programmer who wants a go at exercising his literary skills.

I have said that Word Handler is a very minimal system. This is good in that it exercises the smallest possible number of command keys to perform the greatest possible number of tasks. There is a relatively small number of functions — so they are easy to remember. However, it does lead to confusion because the same keys perform different functions — so they are easy to remember. However, it does lead to confusion because the same keys perform different functions depending on whether you are in 'insert' or 'edit' mode. Some useful functions have also been missed out.

The most glaring omission must be the cursor control. The cursor can only be moved by first pressing the left or right arrow, then using CTRL W, L or P depending on whether you want to move by words, lines or pages. To keep moving you either have to keep on bashing this sequence of two keys or else use REPEAT which means holding down three keys at once!

Also absent are some of the facilities we have come to regard as standard on sophisticated word processing packages — namely dictionaries and spelling checkers.

But Word Handler does provide some unusual and extremely useful features — including the display, on screen, of bold, underline and superscript. In other systems these often cannot be viewed until they actually appear on the printed page. Instead you see the control characters denoting the special format and these take up space on the line. Word Handler, however, gives an unmistakable visual representation of underlining, superscripting and bold, although characters appearing in bold are almost completely illegible. You can even set and display bold superscript — should you have such an eccentric requirement.

Documentation

The documentation is to a high standard. 'There is nothing you can do that will unintentionally ruin things,' says the manual. But it does shoot off course occasionally into the realms of bytes and operating systems.

The manual includes a tutorial program but it is emphasised that you do not need to work through this to learn the system. Instead you can plunge straight into the 30-page reference section which is written in the order that you would need to know things on first using the machine. SVS claims that 'the manual will have you operating Word Handler like a professional in 20 minutes', and this is indeed true. But a novice might have a problem in the initial stages of using the system because on booting it asks which slot the printer is in. At this stage you might have to power-down, take the machine apart and check this out.

The list of printers can be a problem, too — it may not be easy to decide if your printer is 'auto-lf, no bkspace', or 'auto-lf, w/ bkspace'. 'Find this out,' commands the manual.

The manual also warns that the only confusion it is likely to cause will come from the user reading too much into the text. I also found this to be true — if you want to follow the manual you really do have to put previous experience right out of your head.

Learning with the tutorial

Using the tutorial takes longer but makes an agreeable way of putting the system through its paces and finding out just what its limitations are. The tutorial, though generally sympathetic, does throw in the occasional piece of jargon which is totally at odds with the pervasive user-friendly approach. For example, it reassuringly comforts the user in the main part of the manual that 'bringing a document to the screen is like getting papers from a filing cabinet and putting them on your desk; making changes is the "editing" process and CTRL E is putting them away'. Yet in the initial 'Setting Up' chapter of the manual you read: 'A newly initialised Apple II disk has a capacity of about 123 kbytes depending on the size of the Hello program.' This gives no indication of how much space that might mean in terms of A4 pages. And what is the newcomer supposed to make of the 'Hello' program?

I came across another difficulty in the tutorial when I tried to set up a document with the very same name that I had already allocated to the disk. The system was unable to tell me what I had done wrong and could only display the message 'Name is on file but is not a document. Press any key to begin again.'

In addition to the problems I have already mentioned with using the Apple keyboard, there is also the procedure for generating upper case. On the 48k system I used the keyboard had not been modified and upper case letters could only be generated by first pressing ESCape. This would be especially tedious if you wanted a whole word to be in upper case, but fortunately Word Handler allows you to use CTRL K to switch upper case on permanently until you switch it off with CTRL K again. One further complication: the ESCape for SHIFT does not apply to the top row of keys which are numbers and special signs. For those you use the ordinary SHIFT key. This is very awkward, especially for anyone who is a touch-typist.

Using the system

The focal point of the system is the 'idling' stage where your documents are closed and the screen displays a list of options to you. There are seven of these: INDEX, PRINT, USE DISK /, ERASE, RENAME, BACKUP and FILL-IN. The first four of these appear at the bottom of the screen and their functions are self-explanatory and hence easy to learn. Also on the screen is the instruction 'Enter name of old or new document', which is what you do if you want to start editing an existing document or creating a new one.

The document-naming facility is one of

the unequivocal plus points for this system. Your name can be up to 30 characters long, which allows it to describe its contents very accurately. At the same time, the document name can be abbreviated by using a semicolon — the letter(s) to the left of the semicolon must be unique on the index and can be used to call up the document. For example, your full document name might be: NEW: THIS IS A TEST, but you could call up the document by typing just NEW.

Editing

Once you have called up your document its first page will appear on the top two-thirds of the screen. At this stage you are in 'edit' mode and in order to start creating text you have to change to 'insert' mode.

Word Handler requires you to swap fairly frequently from edit mode to insert mode and back. 'It is a natural assumption that you use insertion for new documents and editing for old ones,' says the manual. 'In fact you need both for both'. This design leads to abundant confusion in the early days, especially as the same keys perform different functions in different modes.

Before I describe insert mode I will mention that you can stay in edit mode to make simple changes to existing text — for example, overtyping. You can type a character over a character or a space over a space. It is less congenial to try to type a space over a character or a character over a space since you precipitate a total screen refresh which is very irritating to watch and definitely not the best way to edit text. You can also delete while in edit mode.

Like cursor movement, deletion is also executed by character, word, line and page. You use CTRL D to get into delete once you have positioned the cursor at the start of the section you want erased. Then you move the cursor forwards by whatever increment and, once the piece is defined, pressing the RETURN key will execute the deletion. This is irreversible, which is rather alarming. However, you can abort the deletion at any time prior to pressing RETURN by pressing the left arrow instead.

One real drag about editing is that you cannot easily redefine words as in the alternative case, or in bold, superscript or underlined. You have to delete the word in its old form, then go into insert mode, switch on the relevant formatting facilities, and retype the word. Conversely, overtyped characters in edit mode retain any special format qualities that have been set already.

The main way to edit your document is in insert mode, however. If it is a new document then obviously you will want to start right there at the top of the screen, so all you need to do is type the logical CTRL I and you can set off.

However, if it is a long document entered on a previous occasion then you will have to locate the point you wish to add to or expand on. This is where the limitations of the system become apparent. There is no facility for calling up either the end of a document or a specific page by number, and although you can scroll through the document a page at a time this becomes very laborious. Then, if you want to find a specific point on a line, you have to arrive at it by using the CTRL Line and CTRL Word facilities — an activity which requires a much more intense level of concentration than simply holding down cursor direction keys until the right location is reached.

Once you have positioned the cursor in the right place you press CTRL I to get into 'insert' mode and you will stay in that mode until you press the right arrow which instantly saves the insertions and puts you back into edit. One minor gripe about using CTRL I is that the two keys are so far apart that unless you are a concert pianist you'll need two hands to press them simultaneously. Since the command has to be used so often it's annoying that it can't be done with one hand.

As I have said, one confusion with the system is that the same keys perform different functions depending on whether you are in insert or edit mode. Probably the first you'll notice is that the backwards arrow, instead of just moving the cursor backwards, has become a backwards delete or backspace key.

While in insert mode you have a number of formatting facilities at your disposal. CTRL V is used for — guess what? — vertical spacing. Well, it's a reasonable acronym isn't it? (Another system I've seen uses L for Line and another uses S for Spacing). Vertical spacing is operated in a manner that is typical of the Word Handler approach. As with cursor movement, you are given a series of sensible options. In the case of the vertical spacing facility it rotates round a set of options in the left hand margin each time you press CTRL V. They are ½, 1, 1½, 2, 2½, then back to 1 again. The rotating options make vertical spacing easy to remember and to use. You simply stop when you reach the appropriate reading. Like CTRL K, CTRL V affects all subsequent text but can be reset at any stage. Both should be thought of as switches to change the current mode: *change* case or *change* vertical spacing. CTRL L can also be used to insert a blank line when in insert mode, but the advantage of CTRL V is that it doesn't actually occupy any extra space on the screen.

The COPY statment is an example of exercising one function to maximum effect. There is no separate command to MOVE text — you simply COPY and then DELETE the original. The process is logical, but rather cumbersome, especially if you're used to finer things.

Justification can be done on screen. It divides space left over at the end of the line equally between words. When you have the justification switched on it is pleasing to note that the word 'justification' appears — small but legible — at the bottom right hand corner of the screen in the status line.

One horrible thing about the justification feature, at least until you get used to it, is that if you leave it until the editing stage it can only be called up a paragraph at a time. As the manual admits, 'It's a good idea to decide in advance whether you want your document to be justified — especially if it's a long one.' If you've left the justification for later then you'll have to go through the document paragraph by paragraph putting on the justification.

Other facilities for use during insertion are CTRL B for Bold, CTRL S for Superscript and CTRL Y for Underline. When any of these are switched on, the relevant word appears in the bottom right hand corner of the screen.

All these conditions are nullified by CTRL N, which takes you back to normal text.

Page breaks are indicated by a broken line across the centre of the screen and page numbers are given in the page status field at the bottom of the screen. But when you type across a page boundary the page break doesn't appear until you end the insertion and return to editing mode.

Stray beginnings of paragraphs at the bottom of a page — widows — or stray ends of paragraphs at the top of a page — orphans — are automatically taken care of by Word Handler. You can enforce a page break with the command CTRL P while in insert mode. But it is best to avoid doing this until the document is in its final form.

Search and Replace

So far all the acronyms I have mentioned have been logical, but in every word processing system I've ever tested there have been some howlers. In this case it is the use of CTRL T for search ''Til', which I found over-contrived but I daresay that it works as a mnemonic — people will remember it if only because it is contrived. (CTRL S has already been pre-empted for superscript.)

The SEARCH command is operated when in editing mode and allows you to search for a string up to 46 characters long. However, it only works for words or phrases and you can't go down to the level of parts of words.

To replace the string with something else you use the CTRL R command. One annoying thing about the replace command is that you can't set it off from anywhere in the document. You have to go back to the beginning if you want to pick up early occurrences of the string.

One formatting character which can be employed only during Insert mode is the unbreakable space. This may be because it uses CTRL W — the same keys that define a Word in edit mode. The unbreakable space is ungainly because it inserts an extra space, so if you are at the editing stage you also have to delete the space that was there before. All this leads to a clumsy command sequence CTRL DIW- to replace an ordinary space with an unbreakable one.

Printing

My own printing experiences with Word Handler were unfortunate since I was using Apple's thermal Silentype printer. This was unable to cope adequately with my text and frequently truncated or otherwise mutated the letters of the alphabet.

I was able to produce only draft quality printing which would have been illegible to anyone other than myself.

But Word Handler does include some useful printing functions. Pages to be printed can be specified in a flexible format:

EASY HANDLING

2,3-5, 3,4 and 5 or 2,5,8. The numbers have to be in ascending order and any that represent a descending order will cause the printing process to abort.

One idiosyncrasy is that you can't tell the printer to print to the end of the document. Instead you either remember the number of the last page and specify that or else you input an absurdly high number.

With Word Handler the user has the option to change the format specification. The format menus are a little opaque. The units they use are actually in inches although there is no indication on screen that this is the unit of measurement.

One very useful printing feature is that you can order alternate margins for the left and right hand sides of pages. This is designed to prepare documents that will be bound.

General points

A distinct drawback is that back-up files are not automatically created and you have to create any back-ups manually. Another worrying point is that the ERASE command is disturbingly literal. Once you have input the ERASE command the system does not come back to you for confirmation. It goes blithely ahead.

A lively if irritating feature of the system is the audible warning effect. This makes Space Invader sounds by repeating if you persist in foolish activities! The audible warning is activated when you try to move the cursor beyond the end of a document while in edit mode, or when you set up margins, or headers and footers, that are physically impossible.

Merging of two files for applications such as mailing lists is also included in the system. This facility would be extremely useful to somebody trying to run a small business on his Apple II and who wanted to send mail shots.

Beyond that there is little more I can say. I was impressed with Word Handler as a basic word processing tool that was extremely quick to use and simple to learn. The package includes a convenient and concise memo card which summarises the commands and facilities of the system at a glance.

Clearly Word Handler is a very limited tool and provides no facility for drawing tables on the screen or adding up columns of numbers. The unaccommodating keyboard would be a nightmare to somebody used to keys you only need 'stroke'. And if the system were to be used by a serious typist then the keyboard would have to be modified so that the SHIFT keys could be used for upper case. The restricted cursor movement, carefully controlled in increments of character, word, line or page, not even paragraph, is guaranteed to send an experienced word processor user crazy with fatigue and frustration.

Within these limits Word Handler offers all the basics of word processing in a very user-friendly format.

And it is good value at £109.

END

THE LYNX

Continued from page 142

This should therefore mean that sophisticated games and home software are published for it. At present three sets of games are on their way — and these will probably speak for themselves if you read a few adverts. There are also plans for educational software. Camputers sees the Lynx as having a future in schools. There is, though, no software currently available for the machine apart from a demonstration tape given with the machine when it is purchased.

It's claimed that disk drives will be launched for the Lynx in March/April. If the Lynx itself is any guide, this could turn into August. The machine is CP/M compatible and this, coupled with upper-range memory expansion and therefore 80-column display, could make the Lynx into a true dual-personality machine. Camputers is working on a manufacturer agreement with a software house (I'm not told which one) to put word processing and accounting software on the Lynx. Pascal, Forth and Comal compilers will also arrive, initially on cassette and then on disk.

EPROM additions and ROM cartridges are planned for the near future. One of these is a data file handling package which will also be available on cassette. A full graphics/sound add-on is also on the cards.

The Lynx is a very 'soft' machine and many of its capabilities depend on the quality of software produced for it. Its impact on the market also depends on its resident software — ie, Basic — which does leave more than a little to be desired. It will probably happen that other Basics (and other languages as well) are written to replace what is there already if people feel a demand for it.

Expansion

I've already mentioned the disks. These, says Camputers, will be single-sided, double-density with a capacity of 250k per drive. There's the option of either single or twin disk units and a disk unit includes a Centronics interface. As well as CP/M, a 'primitive' Lynx DOS has been pointed at for the future but it's probably better to go for CP/M when it's available (which will be at the same time as the disks).

Memory expansion is great on the face of it but it's essential to remember that if you buy a 192k machine you only have 64k of RAM immediately available for programming. The rest is video/graphics RAM but this can, apparently, be accessed using machine code. Details on how this is done will be made available to users.

The Lynx printer will be a tiny printer of the 'till roll' type and will cost in the region of £60. For more serious minded people, the recommended printer, the Seikosha 250X, can be run from a Lynx through the RS232 using a special lead and software available from Camputers. Prices of these are not available yet.

A light pen is also on its way but Camputers will not commit itself to a date on that. It will be connected to the Lynx through the port marked 'LP' which also runs a black & white monitor. An RGB port is provided for a colour monitor.

A look at the prices listed will reveal that you can set yourself up with a theoretically decent business machine for £299 (96k Lynx with 64k user RAM) + approx £400 (twin disks) + approx £100 (black & white monitor) + approx £250 (Seikosha printer) which comes to about £950. Then on top of that you've got to buy software. Better deals have been known. Unless you've had a Lynx for a while and don't want to sell it this can't be said to be the best proposition if you only want to do stock control or whatever.

Support and availability

Camputers has made dealer agreements with Spectrum Computer Centres and Lasky's who should have the Lynx in stock by the time this Benchtest is published (and don't write to me if they haven't. . .). No plans for further dealers are in the air as Camputers doesn't want to encounter stock flow problems. It plans to have 40,000 Lynxes produced by the end of this year.

A 12 month warranty is wisely tacked onto the whole package but this excludes labour. Servicing after that will be carried out by the subcontractors and by 'one of the retailers'. Just which one will soon become apparent.

A Lynx newsletter will be published and sent out to every user who sends back the guarantee card.

Technical specifications

CPU:	4 mHz Z80A
RAM:	48k (16k graphics, 16k user) expandable to 192k total
ROM:	16k
I/O Ports:	Expansion bus, cassette, RS232, RGB, Composite video
Disks:	Single or Twin, SS/DD, 250k/drive
O/S:	CP/M-80
Languages:	Basic. Pascal and Forth to come.

Conclusions

I'll begin by saying that Camputers has, as a company, the best intentions and follow that up with 'the best-laid plans of mice and men. . .'. You see, there have been problems. So far the machine itself has been late and there are no definite dates on other hardware to come. If you bought one now

GOTO page 223

Moore on Kuma



Filing with New Brain

Good news for New Brain users. KUMA has two new programmes to help you with your filing. Card index is a versatile multi-purpose data management package offering search, sort, amend and delete. Just think of it as an electronic filing cabinet for £35.

The second package is called File Manager and is for sequential tape file handling. It can be used as a standar M programme or incorporated with one of the users.

Ring 0628 71778 for more details.

Royal Quiz

Kings and Queens is the latest educational programme from KUMA and is written for the New Brain. In keeping with KUMA's policy of offering learning programmes that are fun to use, Kings and Queens provides facts and figures on the monarchs of England using a 3 ability level quiz system and randomising technique that ensures a different quiz every time.

It is suitable for users of 8 years and upwards, and no previous computing experience is necessary. But don't be fooled into thinking it is child's play, even 'A' level students have trouble with Level 3.

Is there an author in the house

If you have written a useful programme for the Sharp, Series Osborne 1 New Brain or the Epsom HX 20, contact KUMA. As a leading publisher of software for these machines, we are always interested in new talent.

Unique 4th for Osborne 1

A 4th that conforms to the international standard 6th forth is available from KUMA for the Osborne 1. It operates under CPM and incorporates a unique Z 80 assembler using standard dialogue mnemonies.

Other features include screen editor floating point operators, use of CPM 4 all purpose, and a comprehensive editorial manual that offers a starting point to newcomers to 4th, and progresses to advanced use of the language.

KUMA 4th also allows the user to exploit the machine's excellent parallel IEEE and serial RS 232 interfaces. At £85 the 4th will have a major impact on development times and batch assembly.

We're backing the HX 20

KUMA has examined the new Epsom HX 20 in depth and has found it to be a very very pleasing machine for authors to work with. The excellent basic coupled with the ability to insert large sections of machine code sub routines for enhanced performance have proved very attractive.

One of the great benefits of the HX 20 is that when you power down the machine, all the information is still in it. This opens up possibilities which we are sure many people haven't even considered yet.

Every feature we have found on the HX 20 has proved to be user friendly. We are putting in a great deal of effort to enhance it with our own style of software and make it truly the machine to have on your office table or to take with you on your travels, as this is a very portable computer.

Kuma is going all the way with this small but power-packed desk top machine, and our enthusiasm is assured by PCW which in its HX 20 bench test said: "for tasks such as stock control, sports result calculations and sales records, as well as general scientific and engineering work, it is an excellent tool and an impressively well made one at that".

CPM Recovery Service

All new product has been launched with the Sharp MZ 80 B. Called DISMOD, it is one of the standard CPM tool kits and allows every single bite on the disc to be inspected, altered and saved to anywhere else on the disc sector by sector.

It, in fact, allows track sector and bite inspection and modification. Also it allows the copying of certain sectors — a most useful aspect of it is for recovering accidently erased CPM files or offering the best possible means for recovering after a disc crash. Discmod is for CPM base MZ 80 Bs and is priced at £39.50.

WD Pro 2.24

WD Pro, the market leader in Sharp word processing software, has been enhanced to version 2.24. This latest version allows a re-entry possibility for users who have accidentally exited from a programme and have a larger amount of data still locked inside. A re-entry command has now been added to make the programme even more friendly.

WD Pro 2.24 costs £39.50 on cassette or £79.95 on disc, but if you have a previous version KUMA will update it for just £5.

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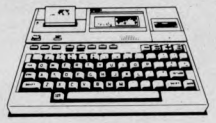

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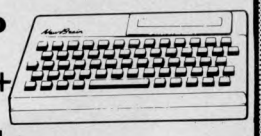

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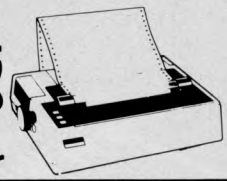

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BREAKING DOWN THE BARRIERS

In the wake of Information Technology Year, Maggie Burton takes a look at one of the Department of Industry's ITEC projects.





A prototype music synthesiser, an EPROM burner & one of Notting Dale's staff.



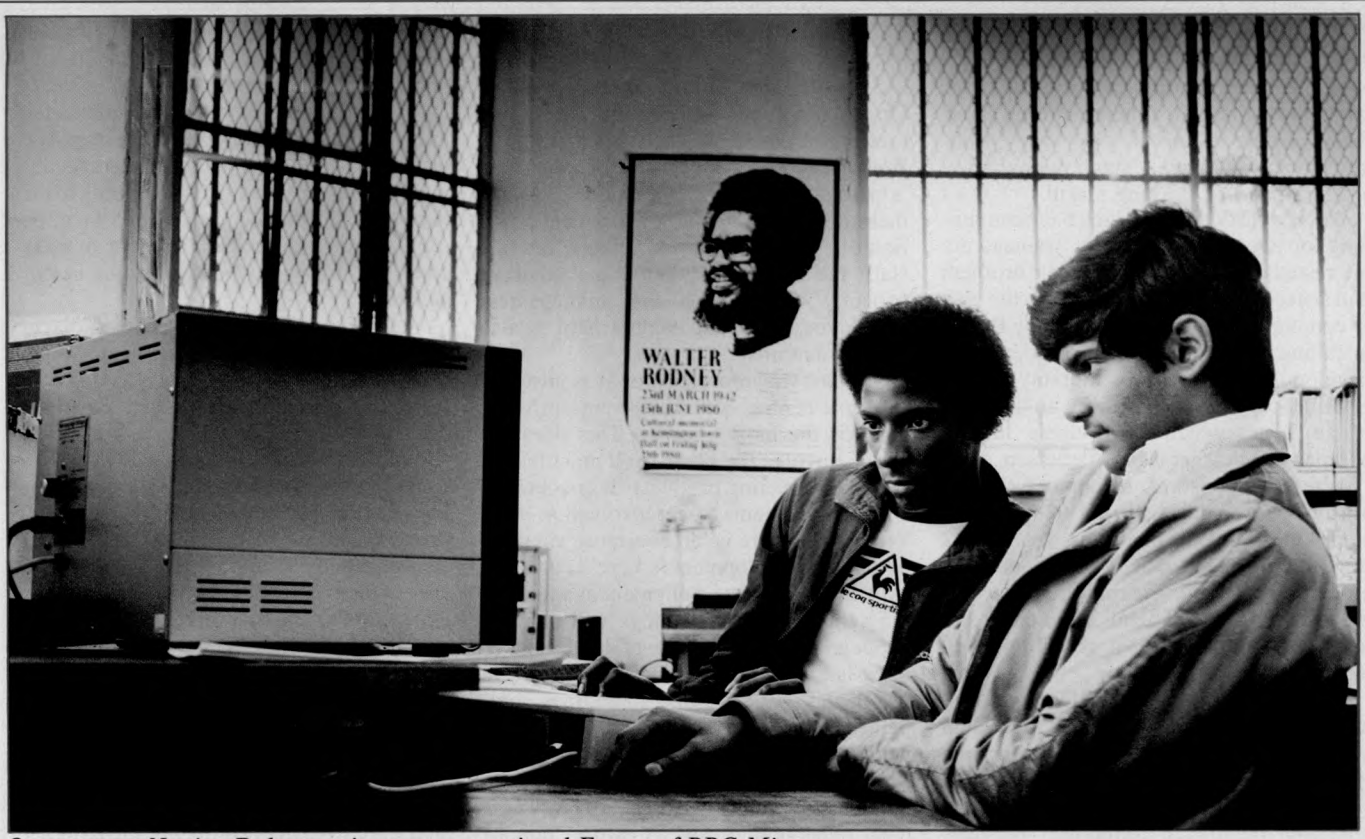
Drilling PCBs

IT Year achieved its purpose. It made people aware of the importance of electronic technology, and helped to bring it into people's lives for their benefit. But many more changes and adaptations need to be made.

There is still a need for the public to become familiar rather than fascinated with IT. The educational system is one of the most prominent areas for the application of microelectronics. Youngsters need to be taught now what they can do in the future with computers. And to cope with today's problems, the underqualified, disillusioned and unemployed members of the population need to be brought up to date — in the way which will most benefit them.

Perhaps one of the biggest steps in this direction is the formation of the ITeC (Information Technology Centres) project.

The first ITeC was at Notting Dale in West London. It began as an 'Urban Studies Centre'. This, says director Chris Webb, was 'a response to local job skills mismatched with the kind of jobs which were available in new technology'. Notting



One room at Notting Dale contains a pre-operational Econet of BBC Micros.

Dale ITeC now forms a model for other more recent centres. It is also the home base for Webb's Department of Industry Consultancy Team, which acts as a focal point for ITeCs nationwide, helping with any problems which might arise and also advising groups on how to set up an ITeC.

Webb's ideas came to fruition when Information Minister Kenneth Baker paid a visit to Notting Dale in 1981. The sight of several hitherto unemployed and under-occupied young people training to use microcomputers was a justifiable inspiration. He asked Webb to lead the project further using DoI and later Manpower Services Commission funds after hearing what Webb describes as 'some fairly unconventional proposals'.

Originally 20 ITeCs were allowed for. This number grew to 50, then 100 and now there are plans to cater for about 150 nationwide. Of this number, roughly 70 are in various stages of existence and several more are at the blueprint level.

Funding does not only come from the government. Local businesses are encouraged to sponsor ITeCs in various ways, be it with financing, donations of equipment or secondment of expert staff. Government funding for one ITeC usually runs to '£55,000 over the first three years,' says Webb. When it is considered that setting up an ITeC can mean an outlay of £250,000 (although it is often less than this), it becomes plain that sponsorship provides a great deal of the necessary capital.

The idealism that surrounds ITeCs is based on a three-pronged system. In the first place, ITeCs are a training base for the unemployed — particularly those under 25. Trainees stay in an ITeC for a year on a £25 per week allowance and are then theoretically better able to seek permanent work.

Secondly, centres provide an 'access base for the community'. This means that all sorts of people are able to carry out their own projects, learn about microelectronics or, in some cases, run business enterprises, using ITeC equipment. Thirdly, ITeCs are expected to provide some of their own capital by designing, floating and drawing profits from various products. An example of this is Notting Dale's G007 graphics board for the ZX81.

The third part of this system is strengthened by Webb's recommendation that ITeCs become limited companies. He describes this as a 'vehicle'. It gives protection if anything goes wrong with a product and it gives 'independence and autonomy —which is very important for ITeCs'. Profit is, naturally, channelled back into the centre.

This is a radical way in which to approach education. Webb, who had experience as a department head in a comprehensive school in the early 70s, is a self-confessed radical educationalist. He acknowledges that his ideas are a definite deviation from the norm, but he believes firmly in what he has done. He is anxious that ITeCs shouldn't become 'an aggregate part of the further education system in this country and take on some of its very different (and sometimes, in my view not very good) habits'. In 1978 he published a paper under the heading 'Dancing with the Silicon Devil' and many of the ideas put forward then are implicit now in the ITeC project. One of his feelings then was that microtechnology would be a 'job killer in the immediate sense' and that to counteract and combat this a local approach was needed both to education and to providing worthwhile employment. He is fascinated by the cottage industry characteristics of microcomputing and feels that it lends itself well to his educational philosophy. 'But I'm not a whoopee merchant about IT. A lot of very important issues have been ignored by people,' he says.

Hand in hand with his ideas on microtechnology come Webb's ideas on teaching it. He describes the ITeC approach as 'modular hands-on'. 'Most teaching', he says, 'is still a number of kids going into a unit of space and a unit of time to study a unit of subject supposedly at the same speed. There are enormous failure rates in inner city schools. Literally 40-50 percent of kids have no qualifications at all, not even miserable little CSEs. They become disenchanted, they abscond, but within that we know there are many kids who are immensely bright but immensely disenchanted.'

In an ITeC, youngsters learn what interests them at a speed which is in keeping with their ability. Furthermore, they learn by doing rather than by listening. Experts are on hand to answer any questions, get projects started and provide fresh ideas. Webb calls it 'person-shaped', with the big emphasis being on using computers and putting newly acquired knowledge to good use.

The only prerequisite a young person needs when looking to join an ITeC is self-expressed interest. Under no circumstances are interested youngsters turned away if there are places for them. Notting Dale works on a first-come-first-served basis and other ITeCs follow this example.

Trainees begin by discovering the basics. At the same time, they learn fast by doing. 'Our kids build a power supply for their own use in virtually their first week at Notting Dale,' Webb explains. They are taught how to get software up and running, Prestel editing and alpha-mosaic graphics, etching PCBs and fitting components, keyboard skills. . . the list is a very long one. And Notting Dale ITeC is full of electronic

BREAKING DOWN THE BARRIERS

equipment and youthful enthusiasm. From talking to trainees it's plain that they enjoy their work, even if, as one said, 'the money's a joke'. A small price to pay, all the same, for learning a skill.

At Newcastle ITeC, which has been running for about seven months, trainees are interested enough to bring in their brothers and sisters. There is plenty to do in the way of commercial enterprise — making PCBs, installing programmable controllers and developing software, most notably for the Rediffusion Teleputer. This is an example of an ITeC which is a viable limited company. Manager Mike Pedersen says, 'We're not sponsored by anyone. We're always within budget and we're hoping for some kind of income in the next year.' He is fully in agreement with Webb's ideas. He explains that 'training in real-life projects is the priority, not artificial situations', and adds 'we're all having a good time and that matters'.

The amazing thing about ITeCs is that all of them are different. Their individual characteristics depend on who is running them and what equipment they have. An ITeC starts when a group of people approach their local Manpower Services Commission office and express an interest in setting one up. This group can be a Chamber of Commerce, a group of concerned teachers, a computer club, a local authority or a combination of these.

If the MSC has not allowed for an ITeC in that area then, Webb says, 'There's usually little point in pursuing the application any further.' But if it deemed appropriate a management committee is formed which meets with Webb's consultancy team to organise the 'nuts and bolts of the thing'.

'A lot of people are desperately worried about what's happening to kids in their locality,' says Webb. 'You find a lot of groups are lay-groups. They don't know anything about the new technology and they find that disturbing. They're trying to manipulate something they don't really understand.' The consultancy team explains to these groups exactly what an ITeC is and helps it to control its understandably large capital outlay. It's surprising how very many things have to be considered in painstaking detail before an ITeC can be considered mobile and operational. The hands-on characteristic of entries means a great deal of equipment is needed and therefore complicated insurance procedures. Premises have to be found, sponsors interested and equipment chosen. It's not an overnight job.

Several large companies are involved in sponsorship. Of course, it's a mutually beneficial thing, because the company involved cannot fail to gain from acting to improve the workforce in its locality. Rank Xerox, for instance, has donated £20,000 to Camden ITeC. DEC's DECmate word processor is a favoured price of equipment in the Consultancy Unit's latest equipment update. DEC is involved in Reading ITeC. And GEC, ICL and IBM are all making donations — to Coventry, Gateshead and Portsmouth respectively.

Sponsors are not always companies. Universities, education authorities and local government all make contributions. Webb describes this category of sponsor as 'a mainstay'. Neither do sponsors restrict their donations to money or machinery. Some provide premises, others provide staff and still others act in an advisory capacity by joining the management committees. A great deal of help is also given voluntarily.

The last way in which money is provided to run a centre, community enterprise, is perhaps the most unusual. This does not simply involve the ITeC itself manufacturing and marketing products. It encourages anyone who wants to get involved as well. Webb feels there is 'an enormous range of potential developments here'. 'If', he explains, 'you make equipment available to different user groups things will start to happen.' Sometimes use of ITeC equipment is granted free, sometimes engineers use it and pay a fee and sometimes companies enter into contracts with ITeCs. But it could lead in future (and indeed already is leading) to many educational, social and commercial developments. Each ITeC determines how it uses its own resources, which means that new ideas are constantly being thrown into the pool. Mike Pedersen in Newcastle says 'You'll find that every ITeC is different. They all develop their own characteristics.' Webb's attitude to community enterprise is a little more concrete: 'We can be very competitive in a volatile marketplace to get products up to the production stage. The challenge for us is to productionise and market them properly.'

Notting Dale ITeC has about six products in various stages of completion. Among these are an EPROM programmer and a laboratory interfacing system called Isis which will intelligently control and monitor experimental machinery. It also boasts a near-operational Econet for which it has written the software. Webb is naturally anxious to see that these products are viable.

In its main aim — helping young unemployed people to find work — Notting Dale is already a successful model. Some of the trainees have moved on to interesting and rewarding occupations. An example of this is one youngster who found work as a prototype wireman. Not a production line worker, note, but someone who is given an idea on paper and is there to turn it into reality ready for the production line. Others have found work servicing equipment such as computers, typewriters and copiers. And others still are now working in teletext editing and software modification. 'Some of the kids have taught themselves two or three programming languages. They're fearless within it. It's just what we're not in our generation.'

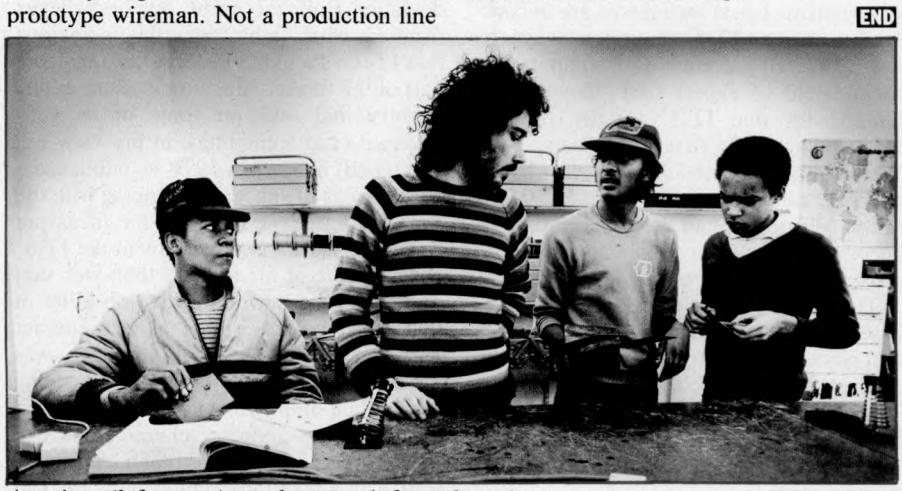
Webb claims a 65-70 percent job placement rate for Notting Dale so far. When considered against the profile of youngsters there is no way in which that could be deemed a failure. Many trainees are utterly unqualified when they join an ITeC.

To the speculative mind it is plain that Information Technology Centres will have their casualties. Webb's ideas are unconventional and uncompromising — and they are not for everyone. He is the first to admit that, and also the first to admit that ITeCs have not been in existence long enough to be judged in terms of winning or losing. 'In a few years maybe we'll learn some lessons from ITeCs,' he says, 'but it's too early yet.' Notting Dale, the oldest centre, has only existed as it is today for just over a year. Others are only now beginning to take on trainees and many more are still to be set up.

But the project cannot simply be laughed off or dismissed as a silly idea. If it teaches 20 youngsters in the whole country something they would not otherwise have learned, it is ethically something of a success. It has implications for all of us, for our microelectronic industry and the initiatives within it, for our economic climate therefore, and so for our future. Microelectronics is the only real growth industry in Britain and it needs imagination, inspiration and financial courage to keep it going and make the best of the many useful ideas which will come forth from it.

I'll finish on a similar note to that on which I began. IT Year achieved its purpose. It broke down some of the barriers which separated Joe Public from the computer expert and gave microelectronics its aura of secrecy and dubious practice. ITeCs, given the right combination of finance, government backing, expertise and motivation, will break down still more of those barriers and make it possible for anyone who is sufficiently motivated to use and learn from the silicon chip.

END



A trainer (left centre) conducts an informal session.

TJ's WORKSHOP

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', PCW, 62 Oxford Street, London W1A 2HG. Please keep your contributions as concise as possible. We will pay £5-£30 for any tips we publish.
PCW can accept no responsibility for any damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.

ZX81 ROUND-UP

Having had some problems rounding off decimals in programs, I have consequently worked out this subroutine, to round off decimals with optimal reliability.

A routine like this unfortunately is not built in the ZX81 from start, and the approximate function INT, unfortunately, is too inconsistent and does not work when there is an exponent after the figure. The routine which I have constructed is not very fast in SLOW, but lasts less than 1 sec during FAST — on the other hand it saves time in more extensive programs when the computer does not have to use so many decimals.

The program is constructed so that you yourself can decide how many decimal places you want, by adjusting the variable Z for the wanted decimals. The figure that you want to round off is to be placed in the variable X and then returned to the variable Y.

As the program is a subroutine it is called by means of GOSUB 9000.

Jens Bang Petersen

```
9000  FAST
9010  LET X2 = 0
9020  LET BXY = 0
9030  DIM A$(14)
9040  DIM B$(1)
9050  IF X<0 THEN LET X2 = 1
9060  IF X<0 THEN LET X = X*-1
9070  LET A$(2 TO) = STR$ X
9080  FOR N = LEN A$ TO 2 STEP -1
9090  IF CODE A$(N) = 42 THEN DIM B$(4)
9100  IF CODE A$(N) = 42 THEN LET B$ = A$(N TO)
9110  IF CODE A$(N) = 27 THEN GOTO 9140
9120  IF N = 2 THEN GOTO 9440
9130  NEXT N
9140  LET AXY = N+ 1+Z
9150  IF CODE A$(AXY) >= 33 THEN LET BXY = CODE A$(AXY-1)
9160  IF BXY<> 27 THEN GOTO 9250
9170  LET A$(AXY-1) = CHR$ 27
9180  IF CODE A$(AXY) >= 33 THEN LET BXY = CODE A$(AXY-2)
9190  LET BXY = BXY+1
9200  IF BXY = 38 THEN LET BXY = 28
9210  LET A$(AXY-2) = CHR$ BXY
9220  IF BXY<> 28 THEN GOTO 9430
9230  LET CXY = 2
9240  GOTO 9320
9250  IF CODE A$(AXY)< 33 THEN LET A$ = A$(TO AXY-1)
9260  IF CODE A$(AXY)< 33 THEN GOTO 9430
9270  LET BXY = BXY+1
9280  IF BXY = 38 THEN LET BXY = 28
9290  LET A$(AXY-1) = CHR$ BXY
9300  IF BXY<> 28 THEN GOTO 9430
9310  LET CXY = 1
9320  FOR N = AXY-2 TO 2 STEP -1
9330  LET CXY = CXY+1
9340  LET BXY = CODE A$(AXY-CXY)
9350  IF BXY = 27 THEN NEXT N
9360  LET BXY = BXY+1
9370  IF BXY = 1 THEN LET BXY = 29
9380  IF BXY = 38 THEN LET BXY = 28
9390  LET A$(AXY-CXY)= CHR$ BXY
9400  IF BXY<> 28 THEN GOTO 9430
9410  IF CODE A$(2) = 28 THEN LET A$(1) = CHR$ 29
9420  NEXT N
9430  LET A$ = A$(TO AXY-1)
9440  LET C$ = A$+B$
9450  SLOW
9460  LET Y = VAL C$
9470  IF X2 = 1 THEN LET Y = Y*-1
9480  RETURN
```

ATOMFORTH LIBERATOR

ATOMFORTH users who have RAM above the system at address hex 3C00 may like to try the following definition, which will give a noise-free display as well as liberating the entire graphics memory.

The example works where there is continuous RAM from hex 3C00 to hex 8000, though other configurations may be catered for by adjusting the values of UP,LIMIT and FIRST. If Top is the address of the last byte of RAM plus one, UP and LIMIT equal Top minus 60, and FIRST equals Top minus 576. The new FORGET behaves, for better or worse, exactly like the old one.

Saving a modified system is more tricky, not least because of the uncertain copyright position.

Adrian Taylor

```
SCR # 998
 0  ( ATOMFORTH SYSTEM CHANGE - SCREEN 1 )
 1  FORTH DEFINITIONS HEX
 2  : MAGIC
 3  3C00 DUP 281C ! 281E !    ( Reset FENCE, DP )
 4  7FC4 DUP 2810 ! 2E04 !    ( Reset UP, LIMIT )
 5  7DC0     2DF8 !           ( Reset FIRST )
 6  3AC2 DP !                 ( Initialise DP in FORGET )
 7  -->

SCR # 999
 0  ( ATOMFORTH SYSTEM CHANGE - SCREEN 2 )
 1
 2  3B20 2F45 3774
 3  378C 3C00 2828
 4   6 0 DO , LOOP            ( Store six new codes )
 5     C EMIT                 ( Clear screen )
 6       COLD                 ( Cold start )
 7  ;
```

BLUDNER

With reference to 'ZX Spectrum Bug' in *PCW*, January 1983, let us hope that the Spectrum designers do not try to 'fix' it. The bug is in the method, not the machine, and shows once again how lack of a proper understanding of computer science can lead people astray.

The proper way to decompose a positive integer X into its digits base B, within the limitations of the Basic language, is to repeat the sequence:

LET X1 = INT(X/B)
LET D = X - B * X1
LET X = X1

until X is zero, with each D being the successive digits from the least significant end.

As has been pointed out over and over again, the values 0.1, 0.01, 0.001, etc, are recurring binary fractions so any machine that uses binary arithmetic (as opposed to binary coded decimal) cannot accurately represent these numbers. This is not a bug, it is a well known fact about this type of number representation. Hence any operation such as 10 * (X/10) may well not equal X on such machines, and if the result is just under X and X was a positive integer then INT(10 * (X/10)) may equal X — 1. This explains the so-called 'bug'.

D Broughton

TJ's WORKSHOP

NEWBRAIN DISPLAY CASE

The Newbrain, with its easy portability and integral display, has many applications for obtaining data in the field. Sometimes it is important to retain and check the use of upper and lower case, but the display window shows both as capitals. The following routine displays the data held in memory with an additional special character after every capital, without keeping this in memory. This is introduced as part of an editing routine to check, and correct if necessary, the data input. It is designed with minimal prompts in view of the limited 16-character display. A longer line can, of course, be real using the cursor control keys.

Newbrain Basic beheads all input strings of initial spaces, so that if any are required (eg, in the letters to be replaced) an introductory non-space character must be used, and edited out later if necessary.

The flag input routine in lines 250 to 280 is useful wherever a menu requires an alphabetical answer, and line 270 is a general lower to upper case conversion if followed by Z$=CHR$(S).

A Sandison

```
1 REM Routines to Display Input with Caps Markers,and Edit as necessary
2 REM For Newbrain, Model AD
4 REM Copyright A. Sandison, 1982, London, WC1E 7AZ
10 REM Set for Window display
20  OPEN £0,3
30 REM Input Test Line
40  INPUT("ENTER LINE-")A$
50  GOSUB 110:GOTO 40
60  END
100 REM Edit Test Line, A$
110  GOSUB 210:REM Display
120  ?"CHK'"+D$+"'Y/N-";:GOSUB 260
130  IF S=89 THEN RET
140  INPUT("WRG CHCS-")X$
150  Z=INSTR(A$,X$)
160  IF Z=0 THEN ?"NOT THERE":GOTO 140
170  INPUT("RPLMT-")Y$
180  A$=LEFT$(A$,Z-1)+Y$+MID$(A$,Z+LEN(X$))
190  GOTO 110
200 REM Display with Caps Markers
210  D$="":FOR N=1 TO LEN(A$)
220   Z$=MID$(A$,N,1):D$=D$+Z$
230   IF Z$>"@" AND Z$<"[" THEN D$=D$+CHR$(124)
240  NEXT N:RET
250 REM Input a String Flag
260 INPUT(""")Z$:S=ASC(Z$)
270 IF S>96 AND S<123 THEN S=S-32
280 RET
290 END
```

MZ80B CURSE

I have always thought it a pity that the special cursor symbols of the Sharp MZ80K are not available on the 80B. I think they make for easy programming and they certainly make a program neater and much shorter and easier to read than their equivalents on the 80B.

This little program will display the MZ80K cursor symbols on the MZ80B.

1) Type in MON to get into machine code.
2) Type M and then enter the machine code program at $CF01. This will switch-in the video RAM.
3) Return to Basic and enter the Basic program.

To use the program:
1) Press DEFKEY 1 and line 10010 will appear at the top of the screen.
2) Enter appropriate values for V and H into the equation.
3) Press the required DEFKEY and the symbol will appear at the correct position on the screen.

Sounds a bit clumsy, but with the screen controls on the MZ80B it is very easy to use.

John Hunt

```
 1 REM PROGRAMME TO PRINT MZ-80K CURSOR SYMBOLS ↓ ↑ → ← ▯ ◆
   ON MZ-80B
 2 PRINTCHR$(6):CONSOLEC80:LIMIT$CF00
 3 DEF KEY(2)=10010 S=53440+80*V + H↵
 4 REM ↓ :DEF KEY(3)=RUN10000↵
 5 REM ↑ :DEF KEY(4)=RUN10001↵
 6 REM ← :DEF KEY(5)=RUN10002↵
 7 REM → :DEF KEY(6)=RUN10003↵
 8 REM ▯ :DEF KEY(7)=RUN10004↵
 9 REM ◆ :DEF KEY(8)=RUN10005↵
 10 REM ENTER MZ-80K PROGRAMME BETWEEN 10 & 10000:END
 10000 D=1:GOTO10010
 10001 D=2:GOTO10010
 10002 D=3:GOTO10010
 10003 D=4:GOTO10010
 10004 D=5:GOTO10010
 10005 D=6:GOTO10010
 10010 S=53440+80*V + H
 10011 USR($CF01)
 10012 POKES,D
 10013 END

MACHINE CODE PROGRAMME TO SWITCH VIDEO RAM
MON
*M
M-ADR.$CF01
CF01 DB
CF02 E8
CF03 CB
CF04 FF
CF05 D3
CF06 E8
CF07 C9
*J
J-ADR.$1280
Ready
```

TANDY TIPS

I have noticed that the good old Tandy TRS-80 Level II seems to have been neglected of late. So here are a few of my favourite and useful tips which may or may not be known by other owners.

The current position of the cursor is held in locations 16416 and 16417 (4020H and 4021H). This is useful for positioning the cursor during a machine-code program but it can also be used from Basic.

If you have a printer there has, doubtless, been a time when you need to output to the printer instead of the screen. There is an easier method than going through the program and physically changing the program statements. Here is the solution: POKE 16414,141 : POKE 16415,5

However, when you have finished outputting to the printer, it is important that the following is executed: POKE 16414,88 : POKE 16415,4

Here is an idea for all budding machine-code programmers. When you have finished a machine-code routine and want to return to Basic 'READY', may I suggest that you jump location 0072 Hex. This has the advantage of not affecting any registers which are altered by jumping to some other locations.

When retrieving data from cassette using the command INPUT#, the maximum number of bytes which can be read using one INPUT# statement is 248 and not 255 as stated in the Level II manual.

Also, after using the INPUT# statement, all DATA will be RESTOREd automatically after each READ. To prevent this, POKE 16553,255 before each READ.

If you've got tired of debugging your master program and typed NEW in frustration, you will immediately think 'I wish I'd SAVEd it first'. But all is not lost. Before you enter any new line numbers, execute the following:
POKE 17130,1
then
SYSTEM.

When the monitor prompt appears, enter — /11395. You can now list your program. However, when you've done this, I advise you only to use the commands 'LIST' or 'CSAVE' otherwise you may be treated to a system crash and you won't be able to get your program back this time.

To alter the top of memory without switching off your machine, use the following.
POKE 16561, LS (least significant byte)
POKE 16562, MS (most significant byte)

Immediately after entering the above, you must use the 'CLEAR' command to allow the computer to check the new location of RAMTOP. It doesn't actually matter how much string space you clear — 'CLEAR 50' will do.

To get a SYSTEM tape to start immediately after Cloading, enter the following:
POKE 16866, 195
then
POKE 16867, LS (least significant byte)
POKE 16868, MS (most significant byte)

The 'LS' and 'MS' refer to the *entry* address of the program, not the *start* address.

Dave W. Winnett

TANDY SOFTWARE COPIER

Recently I bought some foreign system tape programs for the TRS-80 Level II (Model I), and because of their poor quality I needed a method to copy them on to more reliable tapes.

Copying the tape with a second cassette recorder is a possibility, but the results are even worse than the original tape. The only good way of copying them is with software, but this is not included in the ROMs. Tandy doesn't sell such programs because of the bad guys, who would copy their software and sell them. But my object was honest, so I developed a copier that copies system tapes as well as Basic and Tiny Pascal tapes. In fact it copies a tape bit by bit, puts it all in RAM and writes it back on cassette. The only condition is that the tapes must be 500 baud.

The assembly program listing is shown below. I hope this program can be useful for other TRS-80 users.

Danny Smalle

```
00100 ;*****************************************************
00110 ;**          'COPIER' COPY PROGRAM  V1.0             **
00120 ;**            (C) 1982 DANNY SMALLE                 **
00130 ;**                                                  **
00140 ;**     START: SYSTEM */                             **
00150 ;**   COPIES ALL TAPES FROM CASSETTE TO CASSETTE      **
00160 ;*****************************************************
00170 ;
00180          ORG     32000
00190 COPIER   JP      START ;SYSTEM */32000 IS ALSO USEABLE
00200 BEGIN    EQU     17135
00210 EINDE    DEFS    2
00220 ERR      DEFS    1
00230 M1       DEFM    ' TRS-80 COPY PROGRAM'
00240 M1L      EQU     $-M1
00250 M2       DEFM    '(C) 1982 DANNY SMALLE'
00260 M2L      EQU     $-M2
00270 M3       DEFM    'SET TAPE TO COPY READY'
00280 M3L      EQU     $-M3
00290 M4       DEFM    'PUSH <PLAY> ON CASSETTE, AND <ENTER>'
00300 M4L      EQU     $-M4
00310 M5       DEFM    'TAPE LOADED'
00320 M5L      EQU     $-M5
00330 M6       DEFM    'SET EMPTY TAPE READY'
00340 M6L      EQU     $-M6
00350 M7       DEFM    'PUSH <PLAY> AND <RECORD> ON CASSETTE, AND <ENTER>'
00360 M7L      EQU     $-M7
00370 M8       DEFM    'TAPE COPIED'
00380 M8L      EQU     $-M8
00390 M9       DEFM    'ANOTHER COPY (Y/N)?'
00400 M9L      EQU     $-M9
00410 M10      DEFM    'END OF COPIER'
00420 M10L     EQU     $-M10
00430 ;
00440 START    CALL    CLS       ;CLEAR SCREEN
00450          LD      HL,M1     ;OUTPUT OF MESSAGES
00460          LD      BC,M1L
00470          CALL    OUTP
00480          LD      HL,M2
00490          LD      BC,M2L
00500          CALL    OUTP
00510          LD      HL,M3
00520          LD      BC,M3L
00530          CALL    OUTP
00540          LD      HL,M4
00550          LD      BC,M4L
00560          CALL    OUTP
00570 ENT1     CALL    0384H     ;READ KEYBOARD CHAR.
00580          CP      13
00590          JR      NZ,ENT1 ;MUST BE <ENTER>
00600          CALL    CLS       ;CLEAR SCREEN
00610 ;-------------------------------------------------------
00620          LD      HL,BEGIN ;START OF COPY-MEMORY
00630          LD      A,0
00640          LD      (ERR),A ;ERR CONTAINS 1 IF EOF IS REACHED
00650          PUSH    HL
00660          CALL    0212H     ;CASSETTE ON
00670          CALL    0296H     ;SEARCH DRIVER
00680          POP     HL
00690          PUSH    BC
00700          LD      BC,3C00H ;START OF VIDEO MEMORY
00710 CLOOP    PUSH    HL
00720          CALL    READB     ;READ ONE BYTE, SPECIAL ROUTINE
00730          LD      (BC),A    ;PUT BYTE ON SCREEN
00740          INC     C         ;NEXT VIDEO LOCATION
00750          PUSH    AF
00760          LD      A,(ERR)
00770          CP      1
00780          JR      Z,ENDCLP ;IF ERR=1 THEN STOP READING
00790          POP     AF
00800          POP     HL
00810          LD      (HL),A    ;SAVE BYTE IN MEMORY
00820          INC     HL        ;NEXT MEMORY LOCATION
00830          JR      CLOOP     ;READ NEXT BYTE
00840 ENDCLP   POP     AF
00850          POP     HL
00860          POP     BC
00870          LD      (EINDE),HL ;LAST MEMORY LOCATION
00880          CALL    01F8H     ;CASSETTE OFF
00890          CALL    CLS       ;CLEAR SCREEN
00900          LD      HL,M5     ;MESSAGES
00910          LD      BC,M5L
00920          CALL    OUTP
00930 ;-------------------------------------------------------
00940 COPY     LD      HL,M6
00950          LD      BC,M6L
00960          CALL    OUTP
00970          LD      HL,M7
00980          LD      BC,M7L
00990          CALL    OUTP
```

```
01000 ENT2     CALL    0384H     ;READ KEYBOARD
01010          CP      13
01020          JR      NZ,ENT2 ;MUST BE <ENTER>
01030          CALL    CLS       ;CLEAR SCREEN
01040          LD      HL,(EINDE) ;CALCULATE
01050          LD      DE,BEGIN  ;NUMBER
01060          SBC     HL,DE     ;OF BYTES TO COPY
01070          EX      DE,HL     ;--> DE
01080          LD      A,42
01090          LD      (15422),A
01100          LD      A,0
01110          CALL    0212H     ;CASSETTE ON
01120          CALL    0287H     ;WRITE LEADER AND SYNC BYTE
01130          LD      HL,BEGIN ;START OF COPY-MEMORY
01140 WLOOP    LD      A,(HL)
01150          PUSH    HL
01160          PUSH    DE
01170          LD      (15423),A
01180          CALL    0264H     ;WRITE ONE BYTE
01190          POP     DE
01200          POP     HL
01210          INC     HL
01220          DEC     DE
01230          LD      A,D
01240          OR      A
01250          JR      NZ,WLOOP ;DE=0 --> END OF WRITING
01260          LD      A,E
01270          OR      A
01280          JR      NZ,WLOOP ;ELSE WRITE NEXT BYTE
01290          CALL    01F8H     ;CASSETTE OFF
01300          CALL    CLS       ;CLEAR SCREEN
01310 EINDC    LD      HL,M8     ;MESSAGES
01320          LD      BC,M8L
01330          CALL    OUTP
01340          LD      HL,M9
01350          LD      BC,M9L
01360          CALL    OUTP
01370 YNLOOP   CALL    0384H     ;READ KEYBOARD
01380          CP      89
01390          JR      Z,COPY    ;IF 'Y'--> NEXT COPY
01400          CP      78
01410          JR      NZ,YNLOOP ;IF NOT 'N'-->READ AGAIN
01420          CALL    CLS       ;CLEAR SCREEN
01430          LD      HL,M10
01440          LD      BC,M10L
01450          CALL    OUTP
01460          JP      1A19H     ;RETURN TO BASIC
01470 OUTP     LD      DE,(16416)
01480          LDIR
01490          LD      A,13
01500          CALL    33H
01510          RET
01520 READB    PUSH    BC        ;SPECIAL READ-BYTE ROUTINE
01530          PUSH    IY
01540          LD      B,08H
01550          LD      C,0
01560 LOOP1    CALL    BITL      ;READ-BIT ROUTINE
01570          PUSH    AF
01580          LD      A,C
01590          CP      1
01600          JR      Z,ENDR
01610          POP     AF
01620          DJNZ    LOOP1
01630          POP     IY
01640          POP     BC
01650          RET
01660 ENDR     LD      (ERR),A
01670          POP     AF
01680          POP     IY
01690          POP     BC
01700          RET
01710 BITL     PUSH    BC        ;THIS ROUTINE READS THE TAPE
01720          PUSH    AF
01730          LD      BC,6000H ;IF BC COMES 0000,EOF IS REACHED
01740 LOOP2    IN      A,(0FFH)
01750          PUSH    AF
01760          DEC     BC
01770          LD      A,B
01780          OR      A
01790          JR      NZ,VT
01800          LD      A,C
01810          JR      Z,ENDTP ;BC=0000 --->END OF TAPE
01820 VT       POP     AF
01830          RLA
01840          JR      NC,LOOP2
01850          LD      B,60H
01860 LOOP3    DJNZ    LOOP3     ;LOOP FOR 500 BAUD
01870          CALL    021EH     ;KEEP RELAY ON
01880          LD      B,85H
01890 LOOP4    DJNZ    LOOP4     ;LOOP FOR 500 BAUD
01900          IN      A,(0FFH)
01910          LD      B,A
01920          POP     AF
01930          RL      B
01940          RLA
01950          PUSH    AF
01960          CALL    021EH
01970          POP     AF
01980          POP     BC
01990          RET
02000 ENDTP    POP     AF
02010          POP     AF
02020          POP     BC
02030          LD      C,1
02040          RET
02050 CLS      LD      A,28      ;CLEAR SCREEN ROUTINE
02060          CALL    33H
02070          LD      A,31
02080          CALL    33H
02090          RET
02100          END     COPIER
```

BBC HEX INPUT

If you have ever wanted to get a hex number input into your BBC Computer for disassembly, etc, try the following:

10 INPUT A$

20 A%=EVAL ("&"+A$)

A% now has the value of A$.

L Kellett

TJ's WORKSHOP

SIRIUS WITH ITOH

The article 'Sing and Dance' (*PCW*, Jan) made me look at my own combination of a Sirius 1 with an Itoh printer.

The CP/M ED and TYPE utility is quite useful as a simple word processor and print-out facility. Unfortunately some of the printer directives are incompatable with the ED and TYPE utilities. For example, control L cannot be written into the text since it is a new line command. This is the printer form feed directive. There are other directives which cause the system to fail.

The simple Basic program overcomes these difficulties. Control characters are normally entered from the keyboard as a single byte and appear on my system as ^L for example. If this is entered as two characters the program will locate and then print the following character with an ASCII code value less 40 hex. Escape sequences can be entered in the same way by choosing the appropriate character, which for my machine is [. This will give 1B hex, the escape byte.

```
10 PRINT CHR$(27);"E"
20 PRINT TAB(20);"TEXT PRINTING PROGRAM WITH PRINTER DIRECTIVES"
30 PRINT:INPUT"Enter name of text file :",N$
40 ON ERROR GOTO 200
50 OPEN"I",1,"B:"+N$
60 IF EOF(1) THEN SYSTEM
70 LINE INPUT# 1,A$
80 WHILE INSTR(1,A$,"^")
90 L%=INSTR(1,A$,"^")
100 LPRINT LEFT$(A$,L%-1);
120 M%=ASC(MID$(A$,L%+1,1))
140 LPRINT CHR$(M%-64);
150 A$=RIGHT$(A$,LEN(A$)-L%-1)
160 WEND
170 LPRINT A$
180 GOTO 60
200 PRINT"No file of that name":RESUME 30
```

The method has the advantage that the text containing the printer directives looks identical to the true text. Those control sequences which are known to be compatible can be entered in the usual way.

Would the query raised by the author in table 1 be overcome?

P W Roberts

ATOM STRING-ALONG

The following information, which is not documented by Acorn, extends the facilities available on the Atom for the handling of strings. A demonstration of all the points is included.

When strings are dimensioned in a program, memory space is reserved for them, starting at TOP. This is sometimes an inconvenient location — for example, when machine code is assembled there. This can be overcome by defining where the dimensioning is to start by setting the free space pointer. The low byte of this memory space is stored in location 35 and the high byte in 36. (Line 10 of the program. The values stored in these locations are given by PRINT &LL7 after assembly.) This also has the added advantage that *RUN can be used to load and run the program automatically without causing an error which would otherwise occur when line 10 is omitted.

Although it is possible to use string arrays on the Atom they have to be dimensioned in a rather inconvienient way using a dummy string variable. It is easy, however, to dimension string arrays directly as shown in the example. The array AA has six elements AA0-AA5; each of which can point to the first character of a string in a vacant section of RAM. Line 40 thus allocates space for $AA0 starting at #2800, $AA1 at #8200 and $AA2 at #8400. Lines 50-70 show how the three strings AA3, AA4 and AA5 can be sequentially dimensioned. Lines 90-120 input data to be stored in the six strings. Note that if all of the strings were to be located directly above the elements of the array AA then four bytes for each element must be allowed — ie, if array AA is dimensioned from TOP, AA0= TOP+24 should be used to contain the first character of the string.

Although the Atom can handle strings up to 255 characters in length, in practice a limit of 64 is imposed by the size of the input line buffer. This can be overcome with the assembler routine shown. If this facility is not required line 110 should be changed to 'INPUT $AAN' and subroutine 'a' omitted. The value of W should be chosen so that there is room for 255 bytes and so that it will not overwrite other data, #3B00 is used here. This can be thought of as an input line string buffer in which the data is entered and terminated with a CR, the contents of $W are then transferred to $AAN, line 110.

A final point concerning strings is that the base address can be used directly without the need to dimension — that is, a string can be entered by typing, for example, $#2800="A STRING" and can be displayed by entering PRINT $#2800. This can be useful for displaying from one program the lines of another program which are effectively strings; they start with a line number and end with a CR. After entering the example try PRINT $#2901 or PRINT $#8200, for example.

T Rae

```
 10 REM ?35=#7B:?36=#2C
 20 REM REMOVE REM L.10 AND INSERT VALUE OF LL7 AFTER ASSEMBLY
 30 DIM AA5,LL7,P-1:W=#3B00
 40 AA0=#2800:AA1=#8200:AA2=#8400
 50 FOR N=3 TO 5
 60   AAN=AA(N-1)+256: REM DIM EACH STRING ARRAY OF SIZE 255
 70 NEXT N
 80 GOSUBa
 90 FOR N=0 TO 5
100   PRINT"INPUT STRING"N'
110 LINK LL1:$AAN=$W
120 NEXT N
130 FOR N=1 TO 5
140   PRINT $AAN'
150 NEXT N
160 END
170a FOR M=1 TO 7:LLM=#FFFF:NEXT M
180 PRINT $21
190 FOR M=1 TO 2
200[
210:LL1 LDX@0
220:LL2 JSR#FFE6 \ OSECHO
230     CMP@#1B  \ ESC?
240     BEQLL5
250     STAW,X   \ STORE VALID
260     INX      \ CHARACTER AT W+X
270:LL3 CMP@#D   \ ?CR
280     BEQLL6
290     JMPLL2
300:LL5 LDA@0    \ RETURN
310     STA5     \ CONTROL TO
320     LDA#29   \ BASIC INTERPRETER
330     STA6     \ AND TEXT SPACE
340     JSR#C2F2 \ #2900
350:LL6 RTS
360:LL7 NOP
370\ GIVES FIRST FREE MEMORY LOCATION AFTER MACHINE CODE
380]
390 NEXT M
400 PRINT $6
410 RETURN
420 END
```

PRINT USING PET

I offer the following program as a simple method of setting up a 'Print Using' facility on a PET.

```
50000 X=LEN(STR$
(INT(V))):REM V=VALUE
50010 IF INT(V)=0 THEN
X=X-1
50020 PRINT TAB(T-X)V:
REM T=TAB OF " "
50030 RETURN
```

To demonstrate this program in action enter:

```
10 T=24
20 FOR A=1 TO 20
30 V=RND(1)*10↑INT
(10*RND(1))
40 GOSUB 50000;REM
PRINT USING ROUTINE
50 NEXT
```

This routine does not accommodate more than two noughts after the decimal point, but this would not interfere with its use in formatting accounts.

J L Dunscombe

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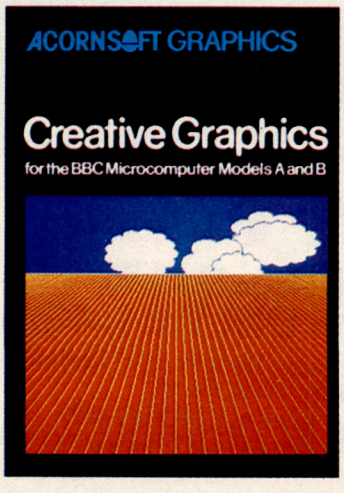

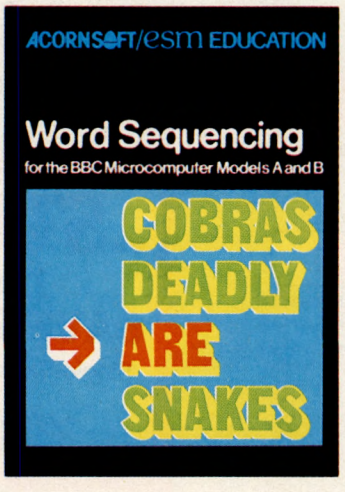

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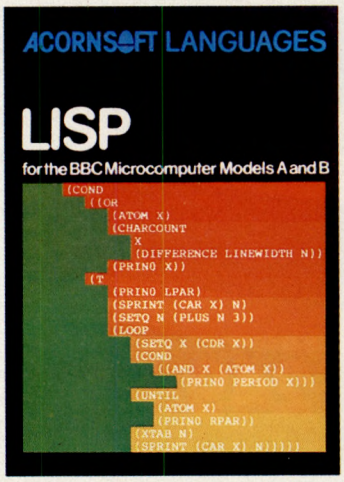

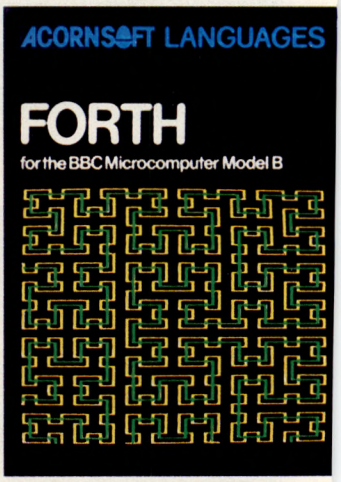

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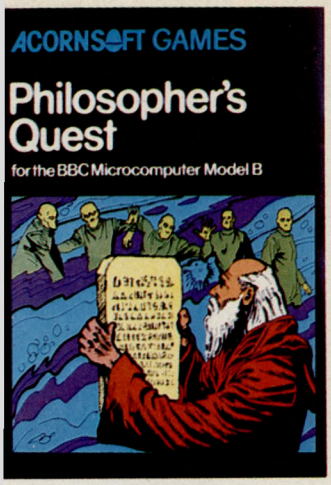

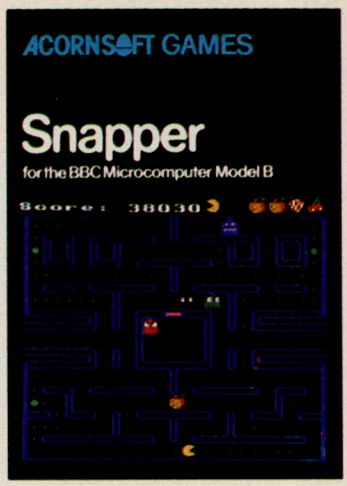

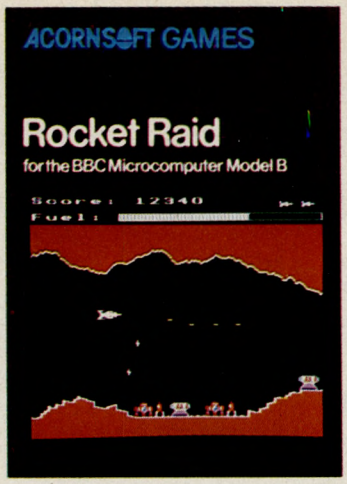

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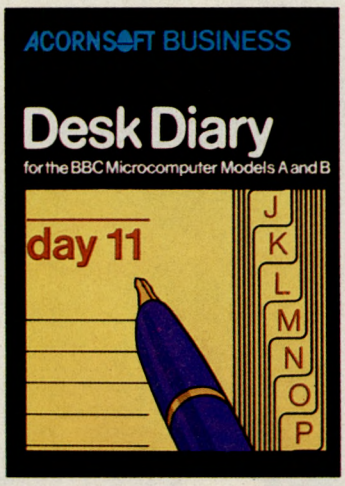

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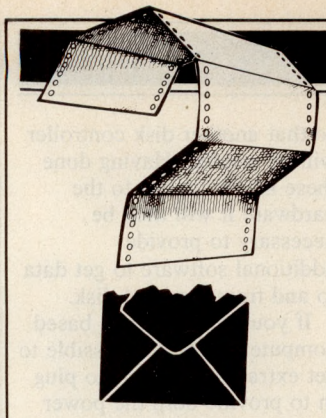


COMPUTER ANSWERS

Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.

Mask ask

Please can you tell me about a technique called 'masking'? A friend said that you can use this technique for converting all lower case letters to upper case letters when entered on the keyboard of a computer; unfortunately he didn't know how how to do it.
R Nicholls, Westminster

Suppose your computer uses the function GET$ to get a character from the keyboard; then to print the correct letter regardless of whether a lower or upper case letter was pressed use this program:

```
10 A$=GET$
20 PRINT CHR$(ASC(A$)
AND 223);
30 GOTO 10
```

Now whatever you type will appear as upper case letters. The masking takes place in line 20. It will be easier to understand masking if you work in binary. 223 in binary is 11011111. A 'mask' works by masking out (erasing) those bits within the number that are not wanted. You will see that the third digit of the mask is a 0, this will replace the third digit with a zero if it is ANDed with the number to be masked. For example if the binary number 10101010 is masked by ANDing with 11011111 then you get 10001010, ie:

```
      10101010
AND   11011111
      10001010
```

Up until now you have probably not noticed that there is any connection between the ASCII codes for a lower and an upper case letter A. They are 97 and 65 respectively; however, if you work in binary these become 01100001 and 01000001 respectively. It is now easier to see that the only difference is that the third bit from the left is changed. To summarise: if the third bit from the left is a 1 then we want to mask it out to convert it to upper case; the mask is 11011111 which is 223 in denary. If you wanted to reverse procedure (always getting lower case letters) then you will have to force the third bit to a 1. This can be done by using the OR operator with a 1 in the third bit and zeros elsewhere. For example:

```
20 PRINT CHR$(ASC(A$)
OR 32)
```

I am afraid that there is not space to go into the details of the logical operators AND and OR here, but the following tables should help you understand what happens when two bits are ANDed or ORed:

A	B	A AND B	A OR B
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	1

Sheridan Williams

Drive doubts

I require some disk drives for my BBC Micro. According to the original BBC specification most makes of drive should connect directly to the BBC machine. Which types are preferable? It appears to me that there are two main types — 40 and 80 track. It would be most useful for me to be able to read both of these formats on any disk drive that I buy.
D C Adams, Shirley, Croydon

You are wise to be a little wary. Not all drives will connect straight to the BBC micro. However, if you look through the advertisements for suppliers of BBC compatible disk drives then you should have no problems. At the present time (January 1983) Acorn still has the policy that it will not supply you with a 'Utilities' disk, or a disk operating system manual, unless you buy its own disk drives. So you must check that the supplier that you choose will let you have his version of these items.

We reviewed five different disk drives in our December newsletter, and the only one that will allow you to use both 40 and 80 track was supplied by Microware Ltd, 637 Holloway Road, London (01-272 6237). These performed very well, but we are unable to give any long-term report on them as yet.
BEEBUG — Independent User Group for the BBC Micro.

Getting the lowdown

I reckon I am a typical *PCW* reader — use mathematics in my work, program mainframe machines, am getting interested in micros, but know nothing of the hardware jargon. Is there a good cheap book or a dictionary which I could readily keep to hand telling me what RS232 interfaces, ULA, Centronics-type parallel printers, etc, all mean?
Michael Batty, Cowbridge, S Glamorgan

As far as I'm aware the best value for money currently around is *International Microcomputer Dictionary* 2nd Edition by the staff of Sybex. It is available by mail order from Mine of Information, 1 Francis Avenue, St Albans, Herts for £4.70 (includes postage and packing).
Sheridan Williams

Resolving the question

In Computer Answers in the May 1982 issue of *PCW*, you gave a method for calculating monitor bandwidth.

I have ordered a Newbrain model A, and am looking for a monitor which will give good resolution at 640 dots to a row. On a 12in monitor with an active screen width of 21cm it seems a bandwidth of 20 MHz would be needed. Grundy appear to be using a BMC monitor at 18 MHz in their literature on the Newbrain. Could I get away with 18 MHz?
M Stabb, Bristol

As the earlier reply indicated, the calculated bandwidth is only a guide to the sharpness of resolution actually achieved, as many other factors affect this. I would not expect much degradation when using an 18 MHz monitor for an application calculated as needing 20 MHz. In fact my own calculations on your intended application suggest that a bandwidth of 16 MHz should be adequate. Bearing in mind these various factors I would not expect a limitation of 18 MHz on the specification of a monitor to render it unsuitable for the display of lines at 640 dots. However, that is not to say that all 18 MHz monitors will give the same quality picture, and it would be wisest, even if the delay is frustrating, to wait tell you have your Newbrain, and then try it out with various monitors, before you decide which one to buy. The portability of the Newbrain should make this easier.
P L McIlmoyle

Beeb m/c

Do you know of a book that will introduce assembly language programming to me? I am currently using the BBC Computer, so one aimed at this machine in particular would be especially useful.
George Nicholls, Watford, Herts

We have been looking at a book called *Assembly*

Language Programming for the BBC Micro by Ian Birnbaum, published by Macmillan at £8.95. It seems to be the best book on the market at the present time. It contains 300 pages and is clear, thorough, methodical, and BBC-specific. It also contains some useful machine code programs, including a monitor and string sort. It appears to be far more useful than even classics such as Zak's *Programming the 6502.*
BEEBUG

False economy

I bought 20 second hand disks that had been used previously on another system. I am using them on a double-sided drive even though they are clearly labelled single-sided disks. How can this be? Surely if they were double-sided they would have been sold as such.
David Moss, Smethwick, W Midlands

Your very last statement is the truth of the matter. The other side of the disk did not pass the verification checking process. There must be a dropout, scratch, or poor quality magnetic coating somewhere on the surface. The fact that you have not encountered it yet does not mean it's not there.

It really is *false economy* to use disks that are not the specified ones for your particular drives. One program or data file can be worth many times the cost of the disk, and you may have several on one disk.
Sheridan Williams

Simulator sought

As I am taking flying lessons, could you tell me if there is a program to simulate flying on instruments, etc, which will run on a Sharp MZ-80K (tape-based 48k)?
D G Annies, Retford, Notts

'Airport '83' from Highlight Software of 3 Nether Court, Halstead, Essex C09 2HE; tel (0787) 475714 is stated to be a 'Full and exacting aircraft simulator'. You could also try D TEC Digital Technology of 254 Bridle Road, Eastham, Merseyside L62 8BX, which, like Highlight Software, advertises a wide range of software for both the Sharp MZ-80K and MZ-80A.
P L McIlmoyle

Cable query

I have recently bought a Texas Instruments computer, and find that a cassette cable is not included. Could you please advise the location of my nearest dealer, and as regards the price of this cable?
A Bell, Blyth, Northumberland

Newcastle Camera & Computer Mart, 16 Northumberland Ct, Newcastle-on-Tyne (0632 327461) is a Spectrum Home Computer Centre, and hence should be able to help as they are dealers for the Texas Instruments TI99/4A micro computer. You would have to phone for a precise price, but I would expect something in the region of £5.
P L McIlmoyle

Newbrain streams

I am using a Newbrain for a business application. By using different 'streams' it is easy to build up, store, and retrieve screens containing different information, thus allowing very rapid switching from one display to another. Can you please tell me how well the Newbrain compares in this ability with other micros?
D A Symington, London SW15 3NY

This 'data stream' feature of the Grundy Newbrain is extremely powerful, allowing up to 255 data sets to be routed to or from a number of devices and ports. I have not met an exactly similar feature on any other micro, although that is a rather rash statement, with so many machines on the market these days (and more appearing each month!). If you have a disk drive, then it is always possible to change screens by pulling a new one in off the disk (as WordStar does with its help screens), but this is obviously not as fast as the Newbrain transferring from memory to screen. A closer approach could be made using 'bank switching' memory, and swapping from bank to bank, but, for example, CP/M does not support bank switching (although it seems likely that CP/M version 3 will do so, when it is released). You could also emulate this feature using machine code routines. But I do not know of another micro which offers such a facility from within Basic.
P L MIlmoyle

Winchester problems

Now that 5¼in winchester drives can be obtained in the same size mountings as 5¼in floppy drives, is it possible to change to a winchester just by undoing the appropriate bolts and plug connections, removing the floppy drive, and inserting and connecting the winchester drive in its place?
D N Shepherd, Sheffield

Unfortunately things rarely seem to be that simple and this is no exception. Firstly, most winchester drives will need an additional power supply, which is more substantial than that for 5¼in floppy drives. Secondly, the disk controller circuitry is different, so that another disk controller will be needed. Having done these modifications to the hardware it will then be necessary to provide additional software to get data to and from the hard disk.

If you have an S100 based computer, then it is possible to get extra circuit cards to plug in to provide both the power supply, and the hard-disk controller. You may also be able to buy appropriate software to go with these, especially if your system runs under CP/M.

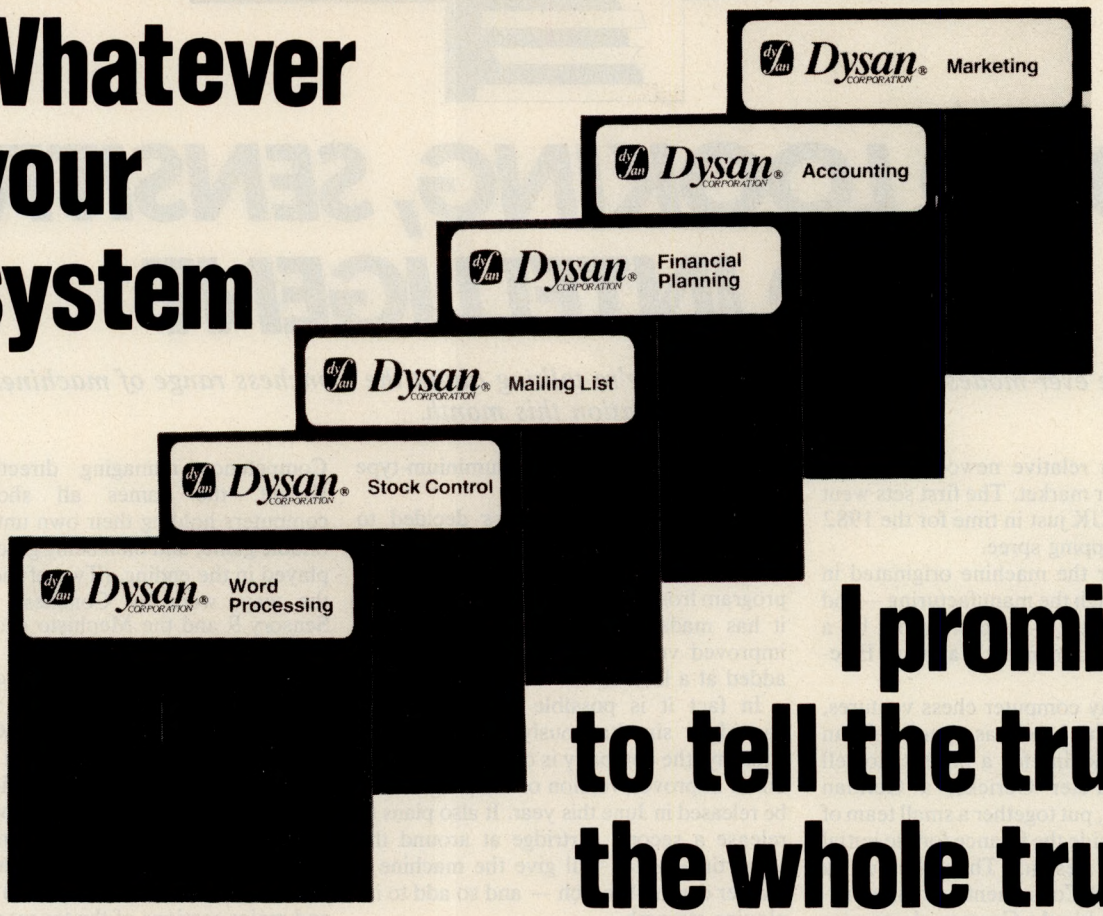
Similar facilities are sometimes available for other computers that can take plug-in cards. If you have a single board machine (and many 64k CP/M machines are now of this type), or other computer that does not have appropriate plug-in cards available, you would be better considering one of the externally mounted 'stand alone' 5¼in winchester disk drive units which are available. These usually include the power supply, disk controller and disk drive all in one cabinet, and exchange data with the computer via one of its existing ports. Suitable software is usually supplied with these units.

Alternatively, it may be possible to get your computer upgraded by your supplier to take a built-in 5¼in winchester.
P L McIlmoyle



I'm the last person to question a chap's credibility but let's face it — he's not *being sued by Atari.*

Whatever your system



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MICRO CHESS

GOOD LOOKING, SENSITIVE AND INTELLIGENT

No, not the ever-modest Tony Harrington... we're talking about the Conchess range of machines under investigation this month.

Conchess is a relative newcomer to the chess computer market. The first sets went on sale in the UK just in time for the 1982 Christmas shopping spree.

The idea for the machine originated in Germany, though the manufacturing — and the UK marketing — is carried out by a Dublin-based company, Waltham Electronics.

Like so many computer chess ventures, the starting point here was once again an entrepreneur looking for a product to sell for a profit. Peter Gericke, a German marketing man, put together a small team of backers to provide the finance for the initial research and design. They formed a company called Consumenta Computers.

Gericke then hired a German electronics engineer to design a magnetic sensitive board and chassis and asked a Swedish computer engineer and programmer, Ulf Rathsmann, to write the chess program and software.

The Dublin company got into the act through the Irish Development Agency's German office. Gericke was looking for a suitable site to manufacture the machine and the IDA was offering very attractive grants for hi-tech ventures.

According to Brian Reddy, one of the directors at WE, the Irish government provides grants to cover the cost of training the workforce from scratch up to the necessary level of technical proficiency required to manufacture the machine. It also provides up to 35 percent of the operating cost.

Production went fairly smoothly and, according to Conchess design and production manager, Dominic Murphy, the company is now geared to producing 2000 units a week if demand warrants this kind of effort. 'It is almost impossible to anticipate what the level of demand will be. We're at trade shows in Amsterdam and Nuremburg in the next few months and we're doing our best to get the name known. If things go well we could sell 50,000 units in the UK by the end of the year. But we might finish up with half that number,' he told me.

There are three models: the Monarch at £249.00, the Ambassador at £199 and the Escourter at £159.95. All the models have the same program — the difference is in the quality of the chassis. The Monarch is a good-looking wooden board and chassis. The Ambassador has a wood veneer while the Escourter has an aluminium-type chassis and board.

From the start, Conchess decided to have the program load in cartridge fashion in a slot under the board. By separating the program from the firmware and electronics, it has made it possible for updates and improved versions of the program to be added at a later date.

In fact it is possible to plug in two cartridges simultaneously. According to Murphy, the company is currently working on an improved version of the program, to be released in June this year. It also plans to release a second cartridge at around the same time which will give the machine a greater depth of search — and so add to its playing strength.

The US Chess Federation has given the machine a provisional rating of 1720, though the current version of the program did not do too well at the Third European Microcomputer Chess Tournament, in September 1982. It only achieved two-and-a-half points out of seven. (One of its wins there, incidentally, is given in the games section below.)

It plays a reasonable game, though, and it has one feature which all the other machines I've looked at lack — and that is a built in timer for lightning chess. This is absolutely murderous. You have three minutes to play the whole game and when time's up the machine beeps and refuses to play on. There's no appeal. It concentrates the mind wonderfully.

Recent tournaments

Now for some tournament news. In October 1982 Competence (a London computer-chess shop) arranged for three different suppliers' chess computers to be entered in the last four rounds of the North London Autumn Chess Congress, held at the Sir William Collins School. The machines were the Mephisto II, the Conchess Ambassador and Fidelity's Sensory 9.

Four machines of each type were entered to give a useful spread of results. The first two rounds were played in the open and major sections of the tournament and the results look somewhat unhappy for the computers. They played 21 games, lost 15, drew 2 and won 4. But, according to Competence managing director Terry Knight, the games all showed the computers holding their own until the late middle game, and then being gradually outplayed in the ending. (Two of the wins, by the way, were by Conchess, with the Sensory 9 and the Mephisto each scoring one win.)

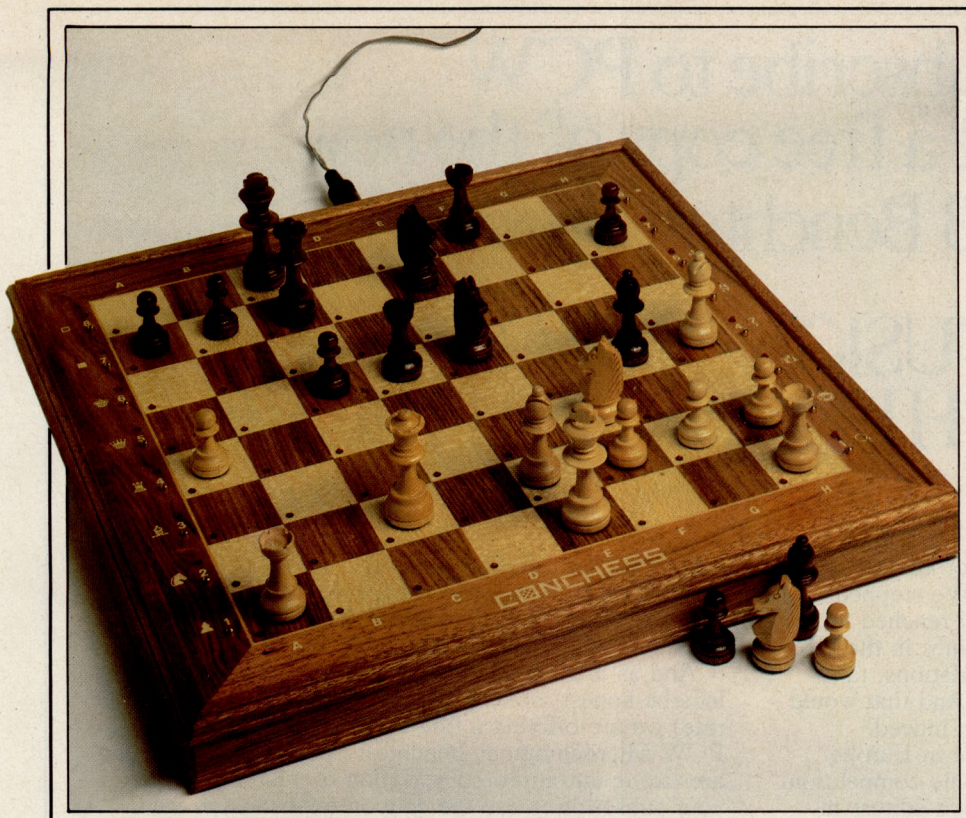
For the final two rounds, the computers played in the minor section only, which had an upper limit of BCF135, or ELO rating of 1680. Of 17 games they scored 7 wins, 6 draws and 4 losses. A BCF official grade gave the three machines a provisional rating on the basis of this tournament. This was a little distorted by the number of losses the machines suffered in the open and major sections of the tournament. The provisional BCF grades are: Conchess 132; Mephisto II 121; and Sensory 9 120

Games section

In addition to the Conchess game from the 3rd European Microcomputer Tournament, I have included a game from the North London Congress (my thanks to Competence for providing the scoresheet). According to Richard Parker, who played and beat the Sensory 9, the game was his best for the season. It consists of a fairly even struggle which Parker brings to an abrupt end by a crushing Queen sacrifice.

It provides a nice contrast to the slogging match fought out by the two computers. This game, between Competence and a private entry, White Knight Mk10 (which eventually took the prize for the best amateur entry) had, unfortunately to be adjudicated on move 53 with Competence two pawns up. Whether the computer would have been able to force a win in a Rook and Pawns ending is another story.

	Conchess	White Knight (MK10)
1	e4	e6
2	d4	Nc6
3	Nf3	d5
4	exd5	exd5
5	Qe2+	Be6



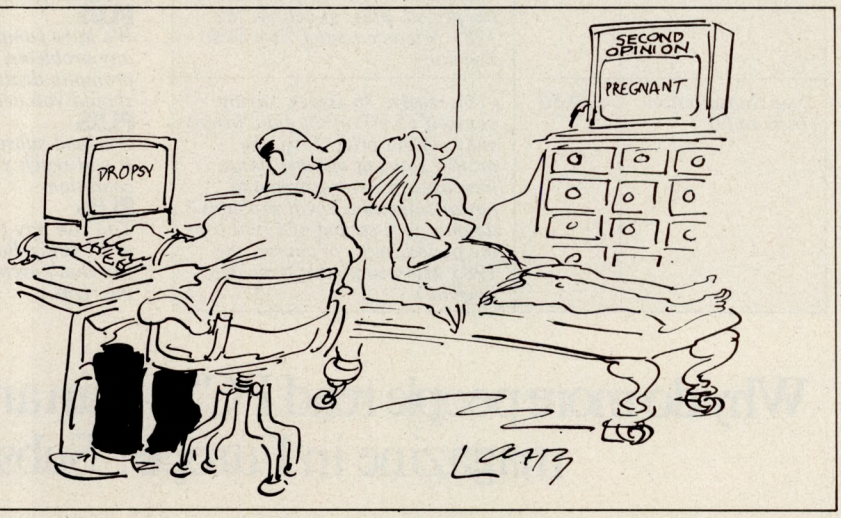
The Conchess Ambassador

	R. Parker	Sensory 9
1	e4	e5
2	Nf3	Nc6
3	Bb5	a6
4	Ba4	Nf6
5	O-O	Be7
6	Re1	b5
7	Bb3	O-O
8	c3	d6
9	h3	Na5
10	Bc2	c5
11	d4	Qc7
12	Nbd2	cxd
13	cxd	Be6
14	d5	Bd7
15	Nf1	Rac8
16	Bd3	Nc4
17	b3	Nb6
18	Be3	Qd8
19	Qd2	Nbxd
20	exd	e4
21	Be2	exf
22	Bxf	Bf5
23	Rac1	RxR
24	RxR	Be4
25	BxB	NxB
26	Qd4	Nc5
27	b4	Bf6
28	Qd1	Ne4
29	Rc6	Qa8
30	Qd3	Re8
31	Bd4	Be5
32	Bxe	Rxe5
33	Ne3	Qb7
34	Qd4	Ng5
35	Qa7	Nxh3
36	gxh	Qxc6
37	dxc6	Resigns

6	Qb5	a6
7	Qb3	Na5
8	Qa4+	c6
9	Bd2	Nc4
10	BxN	dxc4
11	Ba5	Qf6
12	c3	b5
13	Qc2	Bf5
14	Qe2+	Be7
15	Nd2	Bd3
16	Qe3	Qg6
17	Rg1	Rc8
18	O-O-O	Nf6
19	Ne5	Qf5
20	g4	Qe6
21	g5	Nd5
22	Qf3	Qf5
23	NxB	QxQ
24	NxQ	d3
25	Rxd3	h6
26	h6	g6
27	Kb1	O-O
28	Ng5	BxN
29	RxB	Rfe8
30	Re5	RxR
31	e5	Re8
32	Rd4	Rxe
33	c4	c4
34	Rxc	Re6
35	Rh4	Kh7
36	f4	Re4
37	Bc3	g5

38	Rh5	NxB+
39	c3	f4
40	h4	f6
41	Rf5	Kg6
42	h7	Re1+
43	Kc2	Kxh
44	Rxf6	Re2+
45	Kb3	Kg7
46	Rxf	Re5
47	Rc4	c5
48	Ra4	Re6
49	Rc4	Re5
50	Ka4	Re2
51	a3	Re5
52	Ka5	Kf6
53	Kxa	Ke6

Adjudicated a win for White



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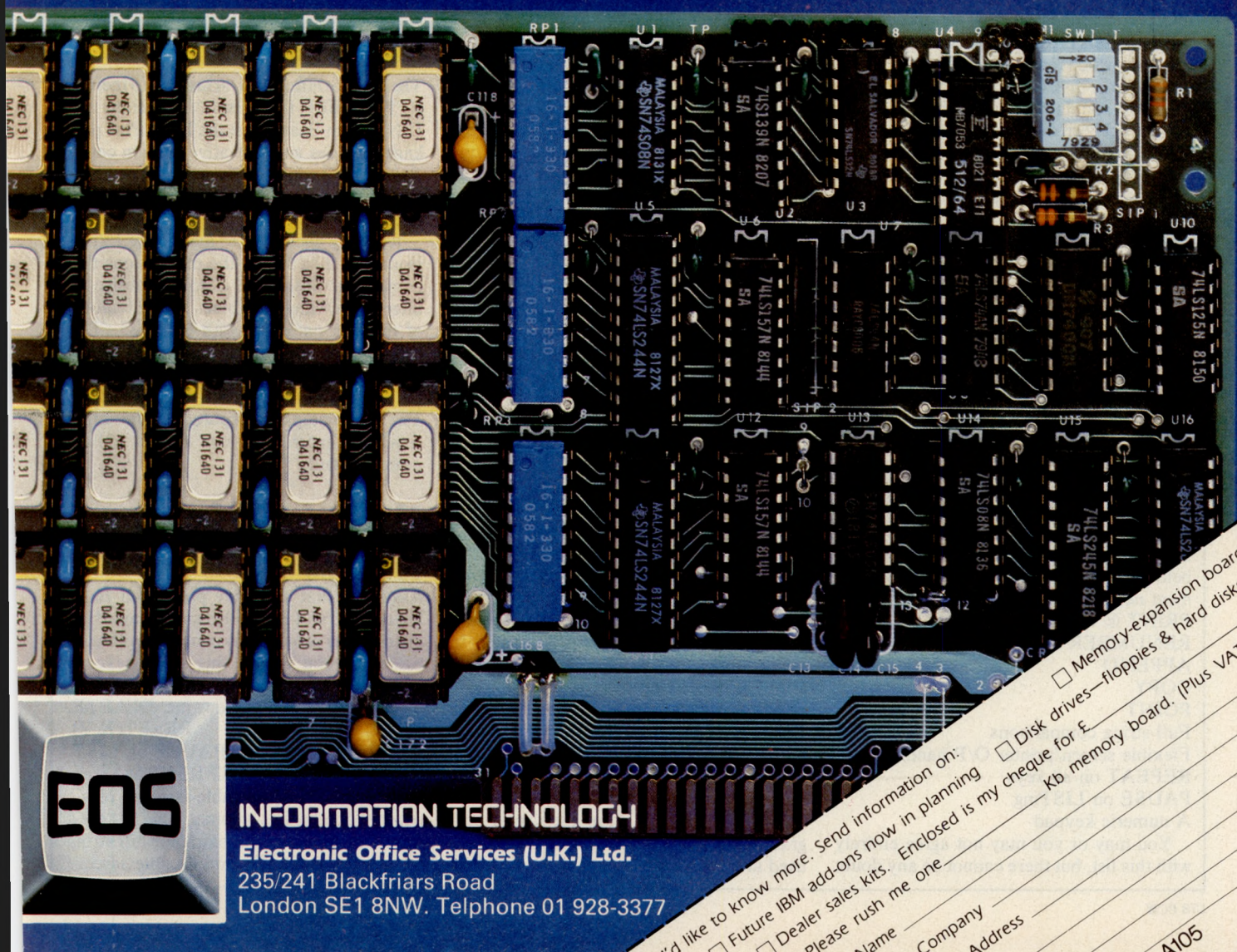

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A105

MAKING THE MOST OF THE MZ80K

Maurice Hawes delves into Sharp's popular home micro.

The Sharp MZ-80K is a reliable microcomputer with a good built-in cassette system, a clear VDU and a sound channel all in one economical package. The recent introduction of the MZ-80A seems to make the MZ-80K somewhat outdated.

There must be an understandable reluctance to part with a 'K', especially if the owner has invested in one or more of the specially designed peripherals such as the I/O box, printer or disk unit. The temptation to trade-in a 'K' arises mainly on two counts. First, that the Basic interpreter supplied with the machine is somewhat limited; and second, that the keyboard, though it has a large number of extra keys dedicated to graphics, lacks one or two useful features which can be found on many similar machines, including the MZ-80A.

Thanks to the 'soft' design of the MZ-80K most of the deficiencies may be remedied by modifying and extending the interpreter, either on tape or disk. Sharp itself markets a package for the disk-based machine which remedies many of the weaknesses in the disk Basic (SP-6015) and also provides double-precision arithmetic. But this has not been done for the tape Basic (SP-5025) and it has been left to other software houses to fill the gap. At least five packages exist, but unfortunately there is no single package which provides what might be considered a totally satisfactory group of enhancements.

The purpose of this article is to describe how the MZ-80K under a tape-based interpreter may be enhanced to a very satisfactory degree by modifying and extending SP-5025, utilising the best features from three packages already on the market, other published material and some ideas of my own.

Limitations of SP-5025

No Basic is perfect, but SP-5025 has a number of obvious weaknesses. The list below contains what seem to me to be the most needed missing features:

PRINT @
RENUMBER and DELETE
APPEND
COPY
POINT
Full string comparisons
Flexible screen/printer O/P handling
REPEAT on all keys
PAUSE on LISTing
A numeric keypad

You may or you may not agree entirely with this list, but there cannot be any doubt that an MZ-80K with the above features added would be much more powerful, more flexible and more convenient to handle than the normal model.

There are three packages which between them contain all of the features listed above. They are:

Extensions to Sharp Basic SP-5025 by Dr B R Gladman (about £14.95);
Basic Plus by C D Hearn (about £13.80);
Speed Basic (author unamed) (about £11.50).

The facilities offered by the three packages are shown in Table 1, which is aligned to illustrate where features are duplicated. The initial task is to decide which of these duplicated features we wish to incorporate.

Duplicated features

STEP in Basic Extensions is intended to perform essentially the same function as SLOW in Speed Basic. Of the two I prefer SLOW because the delay between lines is automatic and pre-settable. STEP is not automatic; stepping between lines involves pressing a key. Furthermore, the current line number in STEP is printed after the current cursor position and this can confuse the display; whereas the current line number in SLOW is printed in the top left corner of the screen and thus is less likely to interfere with the display.

AUTO, AND, OR and DELETE are essentially the same wherever they occur, although the syntax for DELETE differs as indicated above.

RENUMBER is more powerful in Basic Extensions than it is in Speed Basic. RENUMBER mm-nn/new, inc allows renumbering in blocks anywhere within a program; whereas RENUMBER start, inc will only renumber a whole program.

PRINT @ differs between Basic Extensions and Speed Basic in that the X and Y coordinates are reversed. PRINT @ X, Y; is more common but the reversed form as used in Basic Extensions is in fact more logical for text work. The difference is not significant once the user has adjusted to his version.

LINK in Basic Plus has the same purpose as APPEND in Speed Basic. However, LINK is more convenient in practice as it allows the use of program names and will ignore other programs if found first, in the way that the Sharp LOAD command does. APPEND does not allow the use of program names, and in fact it fails if they are used at all, which means that all programs have to be positioned correctly in the cassette deck before pressing PLAY. This is sometimes inconvenient.

OFF is not really a duplicated feature as it has its own special function(s) in each of the packages. However, the author of Basic Plus has taken care to ensure that his OFF command as it is used does not clash with the OFF command in Basic Extensions.

PAUSE in Basic Plus operates only when LISTing; whereas in Speed Basic it operates when LISTing, when tracing a program in SLOW, or when using DUMP to dump the values of variables to the screen.

From the comparisons above it is clear that, ideally, we should take RENUMBER from Basic Extensions and LINK from Basic Plus. The remaining differences are either insignificant or do not apply to our list of most needed features.

Adding Basic Extensions and Basic Plus

There is no difficulty in arranging to include RENUMBER from Basic Extensions and LINK from Basic Plus; the Basic Plus package includes an alternative version called Basic Plus 2 which loads at a different location from Basic Extensions and is compatible with it.

It is only necessary to load Basic Extensions and then follow the instructions that come with Basic Plus 2 to synthesise an interpreter which combines all the features of the two packages with SP-5025. This produces an interpreter with many of the features we require, including LINK and the preferred version of RENUMBER. The next step, incorporating the other required features on our list, is a little more difficult.

Making room for extra features

Assuming that you have purchased Basic Extensions and Basic Plus and followed the instructions provided to combine both with SP-5025, you will at this stage have an interpreter which includes PRINT @ Y,X, RENUMBER mm-nn/new, inc, DELETE, LINK, SET(X,Y), RESET(X,Y), REPEAT on all keys, PAUSE on LISTING and a NUMERIC KEYPAD from our original list of desirable features, plus a number of others as a bonus. This is a good start, but we are still looking for full string comparisons, COPY, and flexible screen/

printer output handling.

These are all available in Speed Basic or elsewhere, and we must now find a way of incorporating them. We cannot do it by simply loading the Speed Basic package as instructed, because this would overwrite Basic Extensions.

In order to understand the problem, let us examine the memory map of the MZ-80K at each stage we have been through so far, in diagrams 1 to 3 below:

Diagram 1 shows the map with SP-5025 loaded alone. Important points are:

a) The block of redundant code from 3DDCH to 43FFH.

b) The start of the Basic program space at 4806H.

The block of redundant code is a curious feature of SP-5025 for which there has never been an explanation; but it has encouraged the writing of packages to improve SP-5025 without increasing its apparent size, such as Basic Extensions, Speed Basic, and even Basic Plus when it is used on its own.

Figure 2 shows the map with Basic Extensions added to SP-5025. The redundant block of code has been almost completely replaced by the extensions, which run from 3DEDH to 43FCH. Note that the start of the Basic program space is not changed in this case and is therefore still at 4806H.

The addition of any other *single* extension package, such as Speed Basic or Basic Plus on its own would produce a very similar map, with the block of redundant code more or less completely replaced by the new code, and the start of the Basic program space unchanged at 4806H.

Figure 3 shows the map with Basic Plus 2 added after Basic Extensions. Note that the start of the Basic program space has been moved up to 4C8FH to make room for the Basic Plus 2 code, which runs from 4806H to 4C8EH.

This gives us the clue we need to make room for further additions of our own. The start of the Basic program space is defined as 4C8FH at the following locations within the new interpreter:

17A9 1839 1AA6 1CF1 1FCF 29C8 2A13 2AC3 2ADC 2AE8 2B49 2B61 410F 4290 and 4820 (all in hex).

In decimal these locations are:

6057 6201 6822 7409 8143 10696 10771 10947 10972 10984 11081 11105 16655 17040 and 18464.

Each of these locations is the first of a pair which contains the relevant address (4C8FH) in lo-hi order, ie, 8F 4C. We can change this value to any higher value we choose and this will create room within the interpreter for more code. In my own case I chose 5200H (00 52) as this gave plenty of room for the additions I had in mind, and is easy to remember.

It leaves 32,126 bytes free, which is enough for most applications. If you feel that this is too generous, and do not foresee additions other than full string handling, COPY, and flexible screen/printer output handling (see below), you may put the start of Basic at 4DB6H (B6 4D), leaving 33,224 bytes free.

The chosen value may be poked into the various locations by a short Basic program; but this operation and the subsequent work of adding new code in the space created is very much easier if you have the machine code Monitor/Disassembler mentioned in the next paragraph, and a printer.

The monitor/ dissassembler

This Monitor/Disassembler, written by R Tanswell, is a very good investment for anyone interested in enhancing an MZ-80K. It sits near the top of memory (BA00-CDD3H on a 48k machine) and may therefore be used to disassemble any part of the interpreter.

It may also be used to write machine code to any location, to search for specified bytes, to dump any section of memory to screen and to save machine code programs in object code or ZEN-compatible source code.

Security copies

At this stage you will need a security copy of the interpreter with the new high start of Basic program space at 5200H or wherever you have chosen. This is easily done using the Monitor/Disassembler 'C' command which will ask for START, FINISH, LOAD and EXECUTE addresses before displaying the instruction to press record/play. At this stage it is theoretically adequate to record up to 4C8EH, but I am in the habit of copying a few extra bytes because, on my machine, the last byte of a copy sometimes gets corrupted.

The memory map now looks like this:

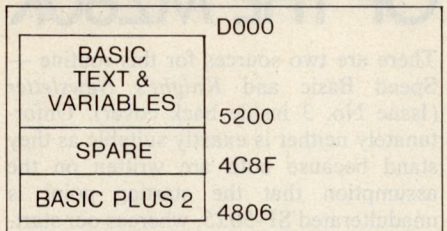


Fig 4 Start of Basic text moved up to 5200H.

There is now a spare area within the interpreter starting at 4C8FH and running up to 51FFH (or wherever).

NB: If you do not have the Monitor/Disassembler, the security copy as above may be made by USR(33):USR(36) *providing* that you first enter a suitable name into HEADBUFFER at 10F1H — 1101H and the file size, start and execute addresses into 1102H, 1104H and 1106H respectively.

Adding extra routines

We may now fill the gap we have created within the interpreter with any routines we choose. To start with, let us consider the problems involved in adding full string handling, COPY (in the form of PRINT/S) and the flexible screen/printer output handling (in the form PRINT/A/N/O/Bnn). These features will complete the set defined as most needed in the second section of this article.

The implementation of the screen/printer output handling commands is the more straightforward and is therefore dealt with first.

a) COPY and flexible screen/printer output handling:

These are all available in Speed Basic as PRINT/S and PRINTA/N/O/Bnn. The code is relocatable as it stands and may therefore be copied directly into its new location, in this case 4C90H to 4CECH is suitable.

The procedure is as follows:

1) Return to the monitor and load SP-5025 and Speed Basic.

2) Copy* the code from 40A8H to 4104H to load back in at 4C90H.

3) Return to the monitor and load your copy of the new interpreter — ie, the one that includes space from 4C8FH up to 51FFH (or wherever).

4) Load in the new code at 4C90H to 4CECH.

5) Change the address at 1C41H, from 138EH to 4C90H (remember that the code is in lo-hi order — ie, change 8E 13 to 90 4C).

6) Take a security copy of this interpreter. For safety copy up to 4CEFH.

PRINT/S/A/N/O/Bnn should now all be working on the new interpreter.

*On my copy of Speed Basic there appeared to be a bug in the PRINT/Bnn routine at 40C2H. The code there should be 5C H (on my copy it was 61 H). Change it as you are copying the routine, if necessary.

b) Full string handling:

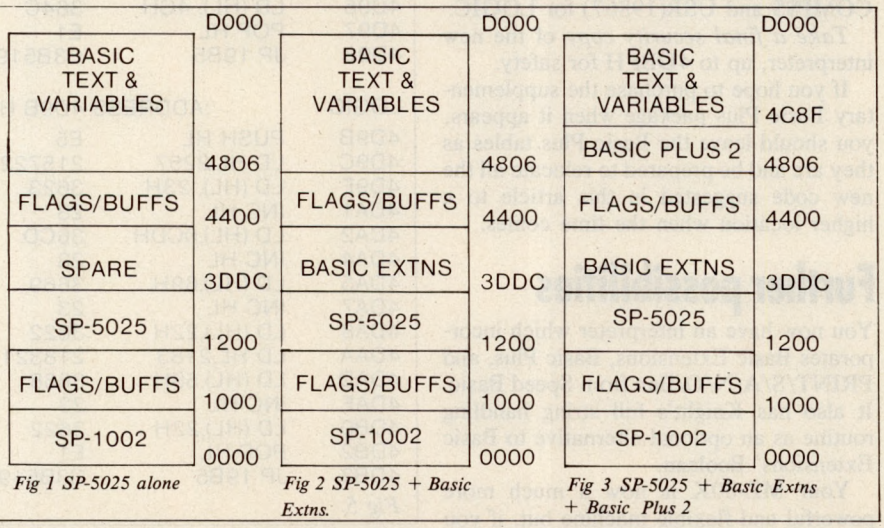


Fig 1 SP-5025 alone

Fig 2 SP-5025 + Basic Extns.

Fig 3 SP-5025 + Basic Extns + Basic Plus 2

MAKING THE MOST OF THE MZ80K

There are two sources for this routine — Speed Basic and *Knight's Newsletter* (Issue No. 3 inside back cover). Unfortunately neither is exactly suitable as they stand because both are written on the assumption that the starting point is unadulterated SP-5025, whereas our starting point is SP-5025 plus Basic Extensions and Basic Plus. In this context the difference is important.

There are many ways of tackling this problem and I tried two or three before arriving at my answer. It is possible to reinstate the relevant SP-5025 code and then add Knight's routine as it stands, but this method has the disadvantage that it cuts out AND, OR and NOT from Basic Extensions. It is possible to incorporate the Speed Basic routine by rewriting it so that it does not clash with buffers in Basic Extensions, but this method cuts out NOT from Basic Extensions, and is also rather complicated.

There is another factor to be considered. The two routines do not handle string comparisons in quite the same way. The Speed Basic routine treats strings according to length before content and therefore will not give a true alphabetic sort unless strings are first padded out (or truncated) to the same length. Knight's routine, on the other hand, treats strings letter by letter and then treats a longer string as greater. This gives a true alphabetic sort whatever the length of the string.

In the end I decided to leave Basic Extensions intact and offer Knight's routine as an optional alternative. Knight's routine depends on a short section of original SP-5025 code which has been overwritten by Basic Extensions. It is therefore necessary to provide this code at a new spare location and add Knight's routine to it. Both sets of code have to be altered very slightly to suit the new location. To complete the job, two very short new routines with associated keywords are added to provide easy selection of one option or the other from the keyboard or within a program.

The procedure is as follows:

1) Load the MZ-80K with an unmodified version of SP-5025.
2) Copy the code from 2257H to 2271H to load back in at 4CF0H.
3) Return to the monitor and load your copy of the new interpreter (ie, the one with PRINT/S/A/N/O/Bnn and space up to 51FFH or wherever).
4) Load in the above code at 4CF0H — 4D0AH.
5) Alter the code at 4CFE — 4CFFH from 72 22 to 10 4D.
6) Alter the code at 4D03 — 4D04H from 5B 22 to F4 4C.

(The steps above reinstate and modify the necessary short section of SDP-5025 in its new location, 4CF0H to 4D0AH.)

7) Return to the new Basic at 1200H.
8) Type in the data lines from Knight's Basic program *except* for the last *two* figures which should be changed from 91, 34 to 244, 76.
9) Add a short Basic program to poke this data into locations 19728 to 19838. Use Knight's checksum technique (with the total suitably amended) but leave out all other lines in Knight's program.
10) RUN this program.

(The three steps above add Knight's routine at 4D10H to 4D7EH.)

We now have a full string handling routine at 4CF0H and available as an alternative to the Basic Extensions Boolean routine at 2257H. All we have to do is arrange that, if we wish to compare strings, any calls or jumps to the routine at 2257H are directed instead to corresponding points in the routine at 4CF0H.

In most cases the entry point is 2257H, and these may be dealt with by inserting a jump instruction there (C3 F0 4C). In one case the IF routine enters at 2258H and the best way to deal with this is to change the address in the IF routine (at 2183 — 2184H) from 58 22 to F1 4C.

All these changes could be made by a series of five POKEs but, to simplify things and remove the chances of errors, I decided that it was better to write two machine code routines to do the work, under the control of two new keywords. I chose COMP$$ to select Knight's routine at 4CF0H, and LOGIC to select the Basic Extensions routine at 2257H.

The routines for these two new keywords are given in Figure 5. Copy these routines into the locations given.

The keywords themselves and the addresses of the routines may be inserted in place of unused keywords and addresses in the Basic Plus tables. You may use your own words, but they *must* have the right number of letters. For example, APPEND at 4C54H may be changed to COMP$$, and MERGE at 4C5A may be changed to LOGIC (note that all keywords have the last letter set 'high' — ie, increased by 80H). The corresponding addresses at 4C81H and 4C83H should then be changed from 8E 13 (ERROR) to the addresses of the routines in Figure 5.

When this has been done, COMP$$ or LOGIC entered from the keyboard in direct mode, or used in a program, will switch the interpreter accordingly.

If you do not wish to upset the Basic Plus tables you can use the USR command instead of keywords — USR(19840) for COMP$$ and USR(19867) for LOGIC.

Take a final security copy of the new interpreter, up to 4DBFH for safety.

If you hope to purchase the supplementary Basic Plus package when it appears, you should leave the Basic Plus tables as they are and be prepared to relocate all the new code suggested in this article to a higher location when the time comes.

Further possibilities

You now have an interpreter which incorporates Basic Extensions, Basic Plus, and PRINT/S/A/N/O/Bnn from Speed Basic. It also has Knight's full string handling routine as an optional alternative to Basic Extensions' Boolean.

Your MZ-80K is now a much more powerful and flexible machine but, if you are willing to get really involved in machine code, you can with the aid of the Monitor/Disassembler do even better.

For example, there are three other useful routines in Speed Basic which we have not implemented and which add considerably to the power of the MZ-80K. They are SLOW nn, DUMP n, and the fast data filing routine from which Speed Basic gets its name.

The fast data filing routine is easy to deal with. It is a relocatable replacement for PDATA at 0024H, and sits in Speed Basic at 43C2H to 43FFH. It may be copied to any other spare location and called at 2C63H.

SLOW and DUMP are more difficult for two reasons. First, the code is not relocatable and uses buffers and subroutines in Speed Basic for which equivalents have to be created in the new area of code. Second, even when the code has been properly relocated, it will not respond correctly to a new keyword inserted in the Basic Plus table becaus it picks up the text pointer from the wrong register.

The first problem may be overcome by disassembling the relevant parts of Speed Basic, rewriting the code for whatever location you choose, and adding the relevant buffers and subroutines. The complete new code may then be loaded at the new location. (Note that the code for DUMP must be relocated so that all the final subroutines start on the same hex page.)

The second problem may be overcome by using spare locations in Basic Plus 2 for SLOW, DUMP, and a new keyword to turn off SLOW (I used NORMAL), and then changing the first instruction in SLOW and DUMP from EB to 00 so that the text pointer is picked up from the correct register.

It is also possible to make SLOW and

COMP$$	: ADDRESS 4D80 H	
4D80	PUSH HL	E5
4D81	LD HL,2257	215722
4D84	LD (HL),0C3H	36C3
4D86	INC HL	23
4D87	LD (HL),0F0H	36F0
4D89	INC HL	23
4D8A	LD (HL),4CH	364C
4D8C	INC HL	23
4D8D	LD (HL),00H	3600
4D8F	LD HL,2183	218321
4D92	LD(HL), 0F1H	36F1
4D94	INC HL	23
4D95	LD (HL), 4CH	364C
4D97	POP HL	E1
4D98	JP 19B5	C3B519
LOGIC	:ADDRESS 4D9B H	
4D9B	PUSH HL	E5
4D9C	LD HL,2257	215722
4D9F	LD (HL), 23H	3623
4DA1	INC HL	23
4DA2	LD (HL),0CDH	36CD
4DA4	INC HL	23
4DA5	LD (HL),69H	3669
4DA7	INC HL	23
4DA8	LD (HL),22H	3622
4DAA	LD HL,2183	218321
4DAD	LD (HL),58H	3658
4DAF	INC HL	23
4DB0	LD (HL),22H	3622
4DB2	POP HL	E1
4DB3	JP 19B5	C3B519

Fig 5

NORMAL programmable by stacking the text pointer before entering the LDIR routine in each case and then retrieving it just prior to the final jump, which should be changed to go to 19B5H instead of 124BH.

I have successfully incorporated SLOW, NORMAL, DUMP, and SPEED DATA in my own interpreter and thus, for about £50 (including the Monitor/Disassembler), have an MZ-80K with all the features listed in Table 1. Note, however, that SLOW clashes with BREAK/TRACE/STEP and they *must not be called simultaneously.*

Finally, it is of course possible to add your own routines. If you have put the start of Basic text at 5200H as suggested there will still be plenty of room for these to be incorporated as a permanent part of your interpreter, even if you have made all the additions described above.

Examples of my own routines are given in Figure 6. &D and &H perform conversions between decimal and hexadecimal integer numbers in the range 0-65535 (0-FFFFH) and are very useful when writing machine code or calculating POKE addresses and data. I purposely chose short keywords so that they could be fitted into spare locations at the end of the Basic Plus tables. If you think that you may need several new routines and keywords of your own it would be a good idea to extend these tables before you start adding any of the code mentioned in this article. This is easy to do as they sit at the very end of the Basic Plus 2 code, just before the erstwhile start of Basic at 4C8FH.

```
&D (DECIMAL TO HEX)              :Origin 0000H — put it where you like
0000  CALL 198C   CD8C19   :Get decimal integer (0-65535) after keyword as
0003  EX DE,HL    EB       :hex in DE and then transfer it to HL
0004  CALL 03BA   CDBA03   :Print HL as hex number
0007  LD A,48H    3E48     :Add an H
0009  CALL 0012   CD1200   :Print it
000C  LD A,11H    3E11     :11H = Cursor Down
000E  CALL 0012   CD1200   :Do it
0011  JP 1274     C37412   :Exit

&H (HEX TO DECIMAL)              :Origin 0020H — put it where you like
0020  CALL 162D   CD2D16   :Skip blanks after keyword
0023  EX DE,HL    EB       :DE now points to next character
0024  CALL 0410   CD1004   :Read 4 chars from (DE) into HL as hex number
0027  JP C, 138E  DA8E13   :Error if not proper hex string
002A  LD DE,4400  110044   :DE now points to textbuffer
002D  PUSH DE     D5       :Stack pointer
002E  CALL 16F7   CDF716   :Convert HL to ASCII decimal string at (DE)
0031  POP DE      D1       :Get Pointer back
0032  INC DE      13       :Skip sign
0033  CALL 0015   CD1500   :Print string (ASCII decimal number) from (DE)
0036  LD A, 11H   3E11     :11H = Cursor Down
0038  CALL 0012   CD1200   :Do it
003B  JP 1274     C37412   :Exit
```

Fig 6

Conclusions

I bought my MZ-80K over two years ago and in that time have had to do no more than clean the tape heads three or four times. Given that sort of reliability, I find myself reluctant to part with the machine in spite of its limitations. It seems rather strange that Sharp Electronics (UK) Ltd has not yet taken the seemingly logical next step, after designing such a 'clean' machine, and introduced a better interpreter than SP-5025 for tape-dependent users.

However, it is possible to achieve a great deal with currently available software and a little patience and ingenuity, as I hope I have demonstrated. In particular, it is a great boon to have a comprehensive RENUMBER command, PRINT @, a numeric keypad, REPEATing keys (especially those cursor keys and the space bar), a PAUSE facility, a command for LINKing named programs, and flexible screen/printer output handling including PRINT/S to copy the screen to the printer; not forgetting SPEED DATA filing at three times normal speed. And space for as many more routines as you can devise if you are so inclined.

If you do not need the printer commands, you can obtain most of the other features simply by buying Basic Extensions and Basic Plus 2 and loading them as directed.

Last, but by no means least, you may find, as I have done whilst carrying out the developments described above, that the MZ-80K, in some mysterious way, encourages you to explore and learn the intricacies of machine code. In this connection the Monitor/Disassembler by R Tanswell has proved 'worth its weight in gold'; it is usually advertised and sold as a Disassembler, but it is much more than that, as its full name implies.

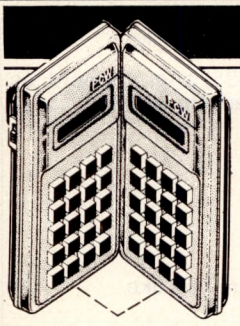
Basic Extensions	Basic Plus	Speed Basic
(BREAK or STEP)+TRACE		SLOW nn
AUTO start,inc	AUTO start,inc	AUTO start,inc
A$<>B$		A$>B$, A$<B$, etc
AND		AND
OR		OR
NOT		
SET(X,Y)		
RESET(X,Y)		
DELETE mm-nn		DELETE mm, nn
RENUMBER mm-nn/new, inc		RENUMBER mm,nn
USR(X)		
USR(X,Y)		
PRINT @ Y,X;		PRINT @ X,Y;
	display ERROR line	
	PAUSE on LIST	PAUSE on LIST,SLOW, DUMP
	SINGLE keyword entry	
	NPAD (Numeric PAD)	
	REPEAT on all keys	
	LINK ('Progname')	APPEND
OFF	OFF	OFF
	CLS	
		PRINT/S
		PRINT/A
		PRINT/N
		PRINT/O
		PRINT/B nn
		DUMP n
		Fast data filing

Table 1

Postscript

While I was writing this article, Crystal Research Ltd announced the launch of XTAL Basic 3(K) for the MZ-80K, on tape or CPM/disk. The 14k tape version provides most of the facilities I have been describing, plus a number of other features, many of which are unique, at approximately the same total cost as the packages mentioned above. It merits serious consideration, providing a somewhat different and in many ways superior operating system to that created by SP-5025 even with its various supplements.

There are, however, weaknesses in XTAL Basic for some applications. I use my MZ-80K for financial work, and find the XTAL six-figure limit too low in many situations (there is a lot of difference between £9999.99 and £999999.99). Furthermore, though XTAL Basic 3(K) redefines a number of keys (eg, ESCAPE, CONTROL, Upper/Lower Case toggle), it does not provide a numeric keypad, and I find this an annoying omission. If Crystal Research eventually offers higher accuracy and a numeric keypad facility for XTAL Basic 3(K) then it could be argued that such an interpreter would provide a better and more standard all-round solution to the problem of making the most of the MZ-80K than any solution involving a multiplicity of additions and improvements to SP-5025.



HEXADECIMAL MADNESS

This month's column is devoted to long lists of figures and funny symbols, as part of my continuing vendetta against our typesetters. These lists should be of some interest to some of you out there, though, as they represent complete hex listings of the instructions and character sets of the Casio fx602p and the Sharp PC1211/ Tandy PC.

The Casio listings were obtained by Malcolm Ray of Godalming who used the crafty device of downloading to his UK101. The Tandy list is from Nicholas Bodley of New York. Nicholas also informs me of the existence of an excellent US magazine called *Pocket Computer Newsletter.* **I shall investigate this further and report in due course.**
Dick Pountain

Malcolm Ray writes:

One of the first things I did after buying my FA-1 cassette interface was to try reading the tapes into my UK101 computer. Sure enough, it worked, and I was able to build up a picture of how programs and data were held in the calculator. Now, thanks to Messrs Smithurst and McLeod I have been able to fill a few gaps in the scheme, and I have drawn up a table giving the internal hex codes of all the instructions and characters. This table is reproduced below.

In this table, the first column is the hex code. The next two columns give the corresponding instruction and alpha character respectively. Most of this will be self-explanatory, but there are one or two points to note:

(i) Most of the characters appear more than once. The 'extra' appearances are showing in square brackets where it has been possible to determine which is which.

(ii) Unknown instructions are marked '???'.

(iii) Some of the alphas appear to be ARs of illegal memories — not, I think, the L registers or program memory so this is probably not very useful.

(iv) The calculator also has an open-single-quote (') character, but I have been unable to pin this down. My guess is that it is at EA or EB. I discovered this character while messing around with LOAD — rewinding while loading, in fact. The calculator suddenly displayed CF '6'. Assuming this is a feature rather than a bug, what does that C stand for? Perhaps Casio are going to release a magnetic card reader in the near future!

(v) The compound prefixes are used with memory reference instructions. For example, 2C 64 is Min24, 2D F7 is MR5 F, etc. 2C is also used to turn RND into FIX.

So there you have it. I haven't included details of how programs appear on tape or how numbers are represented in the registers, since this will only be of interest to those who can find out for themselves anyway. If only I could get the 602 to read cassettes produced by the computer I might have come up with something interesting, but unfortunately this won't work. I think the frequencies used for '0' and '1' are slightly different, with the UK101's interface being more tolerant. As soon as the computer comes out of dry dock I intend tweaking the interface to confirm this; I realise this is cheating, but I must have those extra instructions!

If anyone else has a 602P and a computer with a 300 baud CUTS cassette interface try to get the two of them on speaking terms, and let me know the results. Happy bug hunting!

00	P0	7-segment digit codes	33	GOTO3	D	67	Min07	AR07	9A	ˣDEL	k	CE	1/x	[=]
01	P1		34	GOTO4	E	68	Min08	AR08	9B	SAC ⁞	l	CF	x!	[space]
02	P2		35	GOTO5	F	69	Min09	AR09	9C	ENG←	m	D0	M-10	[:]
03	P3		36	GOTO6	G	6A	???		9D	⁰₀ ⁰₀ ←	n	D1	M-11	[■]
04	P4		37	GOTO7	H	6B	DSZ	AR??	9E	10^x	o	D2	M-12	[?]
05	P5		38	GOTO8	I	6C	x=0	AR??	9F	e^x	p	D3	M-13	[!]
06	P6		39	GOTO9	J	6D	x=F	AR??	A0	X↔M10	q	D4	M-14	[μ]
07	P7		3A	ˣd	K	6E	RAN#	AR??	A1	X↔M11	r	D5	M-15	[<]
08	P8		3B	SAC	L	6F	π	AR??	A2	X↔M12	s	D6	M-16	[>]
09	P9		3C	ENG	M	70	MR00	0	A3	X↔M13	t	D7	M-17	[Σ]
0A	0	D (as in DEL)	3D	⁰₀ ⁰₀	N	71	MR01	1	A4	X↔M14	u	D8	M-18	[(]
0B	1	10 (as in 10^x)	3E	LOG	O	72	MR02	2	A5	X↔M15	v	D9	M-19	[)]
0C	2	L (as in DEL)	3F	LN	P	73	MR03	3	A6	X↔M16	w	DA	DEG	["]
0D	3	in (as in Min)	40	GSBP0	Q	74	MR04	4	A7	X↔M17	x	DB	RAD	[π]
0E	.	. (3rd row, 5th column)	41	GSBP1	R	75	MR05	5	A8	X↔M18	y	DC	GRA	[E] (exponent)
			42	GSBP2	S	76	MR06	6	A9	X↔M19	z	DD	SINH	[:]
0F	EXP	[space]	43	GSBP3	T	77	MR07	7	AA	ABS	*	DE	COSH	[#]
10	RND0	[a]	44	GSBP4	U	78	MR08	8	AB	INT	/	DF	TANH	[space]
11	RND1	[b]	45	GSBP5	V	79	MR09	9	AC	FRAC	→	E0	M+10	A (as in AR_)
12	RND2	[c]	46	GSBP6	W	7A	ISZ	.	AD	SIN^{-1}	←	E1	M+11	R (as in AR_)
13	RND3	[d]	47	GSBP7	X	7B	x ≥0	"	AE	COS^{-1}	%	E2	M+12	√
14	RND4	[e]	48	GSBP8	Y	7C	x ≥F	'	AF	TAN^{-1}	⇋	E3	M+13	+/−
15	RND5	[f]	49	GSBP9	Z	7D	$\bar{x}$	°	B0	Min10	AR10	E4	M+14	≥
16	RND6	[g]	4A	+/−	x	7E	σ_n	−	B1	Min11	AR11	E5	M+15	σ
17	RND7	[h]	4B	(	÷	7F	σ_{n-1}	space	B2	Min12	AR12	E6	M+16	$\bar{x}$
18	RND8	[i]	4C	)	+	80	M-00	7-segment digit codes	B3	Min13	AR13	E7	M+17	^{2} (as in x^2)
19	RND9	[j]	4D	SIN	−	81	M-01		B4	Min14	AR14	E8	M+18	$^{-1}$ (as in SIN^{-1})
1A	4	[k]	4E	COS	=	82	M-02		B5	Min15	AR15	E9	M+19	−1 (as in σn−1)
1B	5	[l]	4F	TAN	[space]	83	M-03		B6	Min16	AR16	EA	???	
1C	6	[m]	50	X↔M00	:	84	M-04		B7	Min17	AR17	EB	???	
1D	7	[n]	51	X↔M01	■	85	M-05		B8	Min18	AR18	EC	password end	−
1E	8	[o]	52	X↔M02	?	86	M-06		B9	Min19	AR19	ED	$SINH^{-1}$	^{x} (as in e^x)
1F	9	[p]	53	X↔M03	!	87	M-07		BA	x^y	AR??	EE	$COSH^{-1}$	$^{1/}$ (as in $x^{1/y}$)
20	LBL0	[q]	54	X↔M04	μ	88	M-08		BB	$x^{1/y}$	AR??	EF	$TANH^{-1}$	space
21	LBL1	[r]	55	X↔M05	<	89	M-09		BC	R→P	AR??	F0	X-MF	[ARF]
22	LBL2	[s]	56	X↔M06	>	8A	PAUSE	D (as in DEL)	BD	P→R	AR??	F1	MinF	ARF
23	LBL3	[t]	57	X↔M07	Σ	8B	IND	10 (as in 10^x)	BE	%	AR??	F2	MRF	[ARF]
24	LBL4	[u]	58	X↔M08	(	8C	SAVE	L (as in DEL)	BF	invEXE	AR??	F3	M-F	[ARF]
25	LBL5	[v]	59	X↔M09	)	8D	LOAD	in (as in Min)	C0	MR10	[Q]	F4	M+F	[ARF]
26	LBL6	[w]	5A	x	,	8E	MAC	. (3rd row, 5th column)	C1	MR11	[R]	F5	X↔MIF	[AR1F]
27	LBL7	[x]	5B	÷	π				C2	MR12	[S]	F6	Min1F	AR1F
28	LBL8	[y]	5C	+	E (exponent)	8F	SAC	space	C3	MR13	[T]	F7	MR1F	[AR1F]
29	LBL9	[z]	5D	−	;	90	M+00	a	C4	MR14	[U]	F8	M-1F	[AR1F]
2A	HLT	[*]	5E	=	#	91	M+01	b	C5	MR15	[V]	F9	M+1F	[AR1F]
2B	"		5F	EXE	empty	92	M+02	c	C6	MR16	[W]	FA	AC	???
2C	compound-20	empty	60	Min00	AR00	93	M+03	d	C7	MR17	[X]	FB	???	
2D	compound-40	empty	61	Min01	AR01	94	M+04	e	C8	MR18	[Y]	FC	???	
2E	compound-60	empty	62	Min02	AR02	95	M+05	f	C9	MR19	[Z]	FD	???	
2F	???		63	Min03	AR03	96	M+06	g	CA	GSB(0)	[x]	FE	???	
30	GOTO0	A	64	Min04	AR04	97	M+07	h	CB	X→Y	[÷]	FF	???	
31	GOTO1	B	65	Min05	AR05	98	M+08	i	CC	√	[+]			
32	GOTO2	C	66	Min06	AR06	99	M+09	j	CD	x^2	[-] (minus)			

Casio Fx602p code listing.

Hex Byte	Displayed Form	Meaning
00	00	end of line (Basic)
11	11	SPC (space code)
12	21	"
13	31	?
14	41	!
15	51	#
16	61	%
17	71	¥
18	81	$
19	91	π
1A	.1	√
1B	E1	'
1C	%1	;
1D	¥1	:
30	03	(
31	13	)
32	23	>
33	33	<
34	43	=
35	53	+
36	63	−
37	73	*
38	83	/
39	93	↑
3A	(.3)	□
40	04	0
41	14	1
42	24	2
43	34	3
44	44	4
45	54	5
46	64	6
47	74	7
48	84	8
49	94	9
4A	.4	.
4B	E4	E
51	15	A
52	25	B
53	35	C
54	45	D
55	55	E
56	65	F
57	75	G
58	85	H
59	95	I
5A	.5	J
5B	E5	K
5C	%5	L
5D	¥5	M
5E	$5	N
5F	π5	O
60	06	P
61	16	Q
62	26	R
63	36	S
64	46	T
65	56	U
66	66	V
67	76	W
68	86	X
69	96	Y
6A	.6	Z
82	28	>=
83	38	<=
84	48	<>
90	09	TO
91	19	STEP
92	29	THEN
A0	0.	SIN
A1	1.	COS
A2	2.	TAN
A3	3.	ASN
A4	4.	ACS
A5	5.	ATN
A6	6.	EXP
A7	7.	LN
A8	8.	LOG
A9	9.	INT
AA	..	ABS
AB	E.	SGN
AC	%.	DEG
AD	¥.	DMS
B0	0E	RUN
B1	1E	NEW
B2	2E	MEM
B3	3E	LIST
B4	4E	CONT
B5	5E	DEBUG
B6	6E	CSAVE
B7	7E	CLOAD
C0	0%	GRAD
C1	1%	PRINT
C2	2%	INPUT
C3	3%	RADIAN
C4	4%	DEGREE
C5	5%	CLEAR
D0	0¥	IF
D1	1¥	FOR
D2	2¥	LET
D3	3¥	REM
D4	4¥	END
D5	5¥	NEXT
D6	6¥	STOP
D7	7¥	GOTO
D8	8¥	GOSUB
D9	9¥	CHAIN
DA	.¥	PAUSE
DB	E¥	BEEP
DC	%¥	AREAD
DD	¥¥	USING
DE	$¥	RETURN

Hex digits >9 as displayed

HEX	DISPLAY
A	.(DEC.PT)
B	E
C	%
D	¥
E	$
F	π

This list is not necessarily complete; it simply shows the codes discovered so far. Unlisted codes are either unused or have functions not yet discovered.

PRINT USING
PRINT#
INPUT#
CLOAD?

} These commands are represented by two consecutive bytes. For instance, PRINT USING is C1 followed by DD.

Tandy Pocket Computer/Sharp PC1211 code listing.

HOW LUCKY ARE LUCKY NUMBERS?

1 6 15 20 15 6 1
1 5 10 10 5 1
NUMBERS COUNT
1 1
1

Mike Mudge sets another poser for all you maths freaks.

The positive integers consist of 1,2,3,4,5,···. The removal of the even integers from this sequence produces the sequence of odd integers: 1,3,5,7,9,···. The removal of every third integer then yields: 1,3,7,9,13,15,19,21,···. The removal of every seventh integer then yields: 1,3,7,9,13,15,19,21,25,31,33,37,43,49,···. (ie, this process will remove 1,118 terms from the first 10,000 integers).

In 1956 Stanislav M Ulam, then director of the Mathematics Division of the Los Alamos Scientific Laboratory, formulated this 'sieving' algorithm and coined the name Lucky Numbers for those integers 'fortunate enough' to survive it — eg, the fifth lucky number is 13, the tenth 33, the hundredth 613, and the one-thousandth 809.

Many questions arise concerning lucky numbers, parallel to the classical onces asked about prime numbers; the latter being those positive integers exactly divisible by themselves and unity *viz* 2,3,5,7,11,13,17,19,23,29,··· eg, the fifth prime is 11, the tenth 29, the hundredth 541, and the one-thousandth 7919. There are 1,229 primes less than 10,000.

Problem

Can every positive integer be expressed as the sum of two lucky numbers?

Historical note

In a letter to Leonhard Euler written on 7 June 1742, Charles Goldbach conjectured that every positive integer greater than four could be expressed as the sum of two odd prime numbers. This conjecture has yet to be proved (or disproved).

Submit a program which generates all of the lucky numbers less than or equal to a given integer and counts them — together with the number of twin luckies (that is, pairs of lucky numbers differing by two, eg, 67-69, 2113-2115); these counts to be available for comparison with the known results for primes and twin primes.

Use the output of the program to attempt to represent every positive integer greater than 4 as a sum of two lucky numbers. This representation need not be unique, but the upper bound to which it is completely achieved is an essential part of the output.

All submissions should include program listings, hardware descriptions, run times and output; they will be judged for accuracy, originality and efficiency (not necessarily in that order) and it is hoped to award a suitable prize to the 'best' entry.

Entries, to arrive by 1 April, to: Mr M. R. Mudge BSc FIMA FBCS, Room 560/A, Department of Mathematics, The University of Aston in Birmingham, Gosta Green, Birmingham B4 7ET.

Note: Submissions will only be returned if suitable stamped addressed envelopes are included.

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PCW SUBSET

Alan Tootill and David Barrow present more useful assembler-language subroutines. This is your chance to help build a library of general-purpose routines, documented to the standards we have developed together this this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW *will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to SUB SET,* PCW, *62 Oxford Street, London W1A 2HG.*

6502 SQUARE ROOTS

For the method of extracting square roots, we refer you to Sub Set for August 82 and to Sub Set for January 83 for the improved Z80 code to implement it. This month we have Datasheets SQR16 and SQR32, both from John Kerr of Glasgow, for two byte and four byte integer square roots in 6502 code. Newcomers please note that 16 bytes of zero page RAM are reserved for Sub Set 6502 routines. These are referred to as M0 to MF in the mnemonics and as ZZ in the machine code.

Datasheet

```
;= SQR16 - Two byte integer square root
;/ CLASS:  2
;/ TIME CRITICAL ? No
;/ DESCRIPTION:  Calculates the square root of a positive 16-bit
;/               two's complement binary number, giving remainder.
;/ ACTION: Terminate if input is negative
          Store input in 24-bit working accumulator X,Y,M3
;/        Initialise subtrahend in M1,2 = 0040 hexadecimal
;/         If M1,2<X,Y then let X,Y = X,Y - M1,2
;/         Rotate left M1; if the subtraction was performed,
;/         this will move '1', otherwise '0', into the LSB
;/         X,Y,M3 := 4 * X,Y,M3.   Repeat to eight times.
;/ SUBr DEPENDENCE:  None
;/ INTERFACES:  None
;/ INPUT:  M2,1 contains input number ( M2 is the MSB )
;/ OUTPUT: N Flag set if input was negative:  otherwise,
;/         M2,1 = 8-bit square root, M4,3 = 9-bit remainder
;/ REGs USED:  A,P,X,Y,M1 - 4
;/ STACK USE:  None
;/LENGTH:  64
;/ T-STATES:  615 max, ignoring page boundaries.
;/ PROCESSOR:  6502

SQR16   LDA   M2      ;find sign of input number     A5 ZZ
        BMI   END16   ;and terminate if negative.    30 3B
        TAY           ;input moves to 24-bit         A8
        LDA   M1      ;working accumulator           A5 ZZ
        STA   M3      ;in X,Y,M3.                    85 ZZ
        LDX   #0      ;clear MSByte of accumulator   A2 00
        STX   M1      ;and of subtrahend M1,2.       86 ZZ
        LDA   #8      ;set loop                      A9 08
        STA   M4      ;counter in M4.                85 ZZ
SQRL1:  CPX   M1      ;if the subrtahend             E4 ZZ
        BBC   SQRJ5   ;in M1,2 is greater            90 0E
        BNE   SQRS3   ;than X,Y then                 D0 04
        CPY   #$40    ;skip over the                 C0 40
        BCC   SQRJ5   ;subtraction.                  90 08
SQRS3:  TYA           ;X,Y := X,Y - M1,2             98
        SBC   #$40    ;condition codes ensure        E9 40
        TAY           ;that the carry flag is set    A8
        TXA           ;on entry to                   8A
        SBC   M1      ;this subtraction              E5 ZZ
        TAX           ;and also on exit.             AA
SQRJ5:  ROL   M1      ;rotate carry status into      26 ZZ
        ASL   M3      ;answer,modifying subtrahend.  06 ZZ
        TYA           ;multiply working acc. by four 98
        ROL   A       ;to get next bit pair into     2A
        TAY           ;place.                        A8
        TXA           ;                              8A
        ROL   A       ;                              2A
        TAX           ;                              AA
        ASL   M3      ;second shift left begins.     06 ZZ
        TYA           ;                              98
        ROL   A       ;                              2A
        TAY           ;                              A8
        TXA           ;                              8A
        ROL   A       ;                              2A
        TAX           ;                              AA
        DEC   M4      ;                              C6 ZZ
        BNE   SQRL1   ;do eight times;               D0 D8
        STX   M3      ;low order remainder in M3.    86 ZZ
        ROL   M4      ;MSBit of remainder in M4.     26 ZZ
        STY   M2      ;clear MSByte of result.       84 ZZ
END16:  RTS           ;end of SQR16.                 60
```

The comparison between the 6502 and Z80 code is interesting. In the 16-bit versions, the Z80 routine takes 35 bytes and 843 maximum T-states against the 6502's 64 bytes and 615 maximum T-states. In the 32-bit versions, the Z80 routine takes 50 bytes and 2792 maximum T-states against the 6502's 75 bytes and 4350 maximum T-states. Z80 processors generally run faster than 6502 procesors. The Z80 routines differ in method by subtracting and adding back if the subtraction doesn't go, whilst the 6502 routines compare and subtract if the subtraction will go.

Datasheet

```
;= SQR32 - Four byte integer square root
;/ CLASS:  2
;/ TIME CRITICAL ? No
;/ DESCRIPTION:  Calculates the square root of a positive 32-bit
;/               two's complement binary number, giving remainder.
;/ ACTION:  Terminate if input is negative
;/          Clear M6,5 ( high order word of 48-bit accumulator M6,1 )
;/          Initialise subtrahend in MA-7 = 00 00 40 00 hexadecimal
;/           If MA-7< M6-3 then let M6-3 = M6-3 - MA-7
;/           Rotate left MA,9; if the subrtaction was performed,
;/           this will move '1', otherwise '0', into the LSB
;/           M6-1 :=M6-1 * 4. Reapeat to sixteen times.
;/         Move answer from MA-9 into M2,1
;/SUBr DEPENDENCE:  None
;/ INTERFACES:  None
;/ INPUT:  M4-1 contains input number ( M4 is the MSByte )
;/ OUTPUT: N flag set if input was negative; otherwise,
;/         M4-1 = 16-bit square root, M8-5 = 17-bit remainder
;/ REGs USED:  A,P,X,Y,M1-A ( M1-6 assumed contiguous, as are M7-A )
;/ STACK USE: None
;/ LENGTH:  75
;/ T-STATES:  4350 max, ignoring page boundaries
;/ PROCESSOR:  6502

SQR32:  BIT   M4      ;find sign of input number     24 ZZ
        BMI   END32   ;and terminate if negative;    30 46
        LDA   #0      ;prepare to clear subtrahend   A9 00
        LDX   #5      ;& high order accumulator M6,5.  A2 05
CLRL1:  STA   M5,X    ;clear areas.  For this short  95 ZZ
        DEX           ;form of clear procedure, M6   CA
        BPL   CLRL1   ;& M7 must be contiguous.      10 FB
        LDA   #$40    ;low order subtrahend :=       A9 40
        STA   M8      ;4000 hexadecimal.             85 ZZ
        LDY   #$10    ;Y is loop counter.            A0 10
BITL2:  LDX   #3      ;compare subtrahend            A2 03
CMPL3:  LDA   M3,X    ;with accumulator M6 to M3     B5 ZZ
        CMP   M7,X    ;byte by byte and              D5 ZZ
        BCC   NOSUB   ;skip subtraction              90 10
        BNE   SUBOK   ;if it is greater.             D0 03
        DEX           ;                              CA
        BNE   CMPL3   ;do for 3 bytes if necessary.  D0 F5
SUBOK:  LDX   #$FD    ;prepare to subtract 3 bytes,  A2 FD
SUBL4:  LDA   M6+1,X  ;carry will be '1'             B5 ZZ
        SBC   MA+1,X  ;after subtraction.            F5 ZZ
        STA   M6+1,X  ;                             95 ZZ
        INX           ;                              E8
        BNE   SUBL4   ;                              D0 F7
```



Saunderson speaking...

This is the first of a series of columns I am writing to keep you up to date with the latest developments on Commercial Microcomputers and Software. A good place to start seems to be the 8 versus 16 bit debate. Is the 16 bit really better or is it just marketing puff devoid of any substantial proof and put out purely to persuade the market to spend more money?

I reckon that at KGB we have as much experience as anyone in this field. We sell both 16 bit — Sirius and IBM — and 8 bit — Superbrain and Apollo. As usual, the truth appears to lie somewhere between the two. If you want to do conventional things, such as Word Processing it would seem quite unnecessary, certainly as far as we are concerned, to purchase a 16 bit machine. A much better buy would be the Apollo with dedicated function keys, detachable keyboard and green screen.

Where the 16 bit machines score is in the spreadsheet programs. Supercalc has 55,000 characters of memory free on a Sirius compared with 33,000 on the 8 bit Superbrain. Actually, it's rather difficult to put that statement into a form that can be easily grasped but, for instance, I use Supercalc to produce our price lists at KGB. It takes one spreadsheet on the Sirius (a 256K one) but three on the Superbrain! Again the Sirius also has very large floppy disks which makes it suitable for programs that require a lot of storage such as accounting systems about which, incidentally, I shall be writing more in my next column. In the end, like all good things, it comes down to value for money. The Sirius is excellent at £2395.00 but if you don't need the features why pay for them? Try the Superbrain at £1650.00 instead.

Talking of value for money reminds me that we have just dropped our LSI dealership for reasons I need not go into here. This leaves us with a twin 5¼ inch 700K Floppy Disk CP/M machine. It is about twelve months old and has had little use! I'd like to sell it for around £1250.00 including a three months return-to-base warranty. The list price is currently £1995.00. In fact, I wouldn't refuse any reasonable offer on the grounds that if I did it wouldn't be reasonable!

Must go. The phone is ringing. Perhaps somebody already wants the LSI! Incidentally all prices in this column are exclusive of VAT.

Sandy Saunderson.

Sandy Saunderson is Managing Director of KGB Micros Limited, the fast growing commercial microcomputer company based in Slough. He has extensive knowledge of the microcomputer industry and if you would like to speak to him, either on general computer matters or particularly about his own products at KGB, give him a call on Slough (0753) 38581/ 38319 or drop him a line at KGB Micros Limited, 14 Windsor Road, Slough SL1 2EJ.

```
NOSUB:  ROL   M9      ;rotate carry status into          26 ZZ
        ROL   MA      ;answer, modifying subtrahend.     26 ZZ
        TYA           ;bit 7 of Y used as counter in A.  98
ROLAC:  LDX   #$FA    ;rotate left working accum.        A2 FA
FLAL5:  ROL   M6+1,X  ;(all 48 bits).                    36 ZZ
        INX           ;                                  E8
        BNE   RLAL5   ;                                  D0 FB
        EOR   #$80    ;toggle bit 7 of A and             49 80
        BMI   ROLAC   ;repeat rotation if it is '1'.     30 F5
        DEY           ;                                  88
        BNE   BITL2   ;do sixteen times.                 D0 D5
        LDA   MA      ;put answer in M2,1.               A5 ZZ
        STA   M2      ;(high order answer M4,3           85 ZZ
        LDA   M9      ;is already clear).                A5 ZZ
        STA   M1      ;                                  85 ZZ
        STY   M8      ;clear remainder MSByte.           84 ZZ
        ROL   M7      ;MSBit of remainder in M7.         26 ZZ
END32:  RTS           ;end of SQR32.                     60
```

FOR THE RECORD

Last month's BINX, binary to any base conversion, attributed to Dennis May, was in fact a synthesis of two routines, Dennis's original version and a version from Vincent Fojut. Although specified in the action section, the original version omitted to terminate the ASCII string with a carriage return character. The neat method of doing this, by initially pushing 0DH onto the stack to mark the end of string and then stacking converted ASCII digits which can not be confused with it, was taken from Vincent's version.

OSBORNE 1 CP/M

A note from Jim Chance of Birmingham University

advised that his file handling package (Sub Set Jan 82), successful on a number of different microcomputers, crashed on an Osborne 1. CP/M is an 8080 system and one would assume that it would either not use the Z80 specific IX and IY registers or would make their use transparent to the programmer. In fact, if you call Osborne's CP/M, you will find that the IX and IY registers contain Osborne's values, not yours. This might affect other Z80 commercial software running on the Osborne 1.

The remedy is to save the IX and IY registers before entry to Osborne's CP/M and restore them afterwards. Jim offers this register saving subroutine and redefinition of "ENTRY" for incorporation into his file handling package:

```
ENTRY1  EQU 5          ;CP/M entry
ENTRY:  PUSH IX
        PUSH IY
        CALL ENTRY1
        POP IY
        POP IX
        RET
```

Z80 DIVISION

John Kerr of Glasgow has sent an improvement to the signed 32-bit division routine SDIV4 given in Sub Set June 1981. At the cost of one extra byte it saves between 1760 and 2048 T-states.

The original routine used the sequence:

```
EX   (SP),IX
EX   (SP),HL
ADC  HL,HL
EX   (SP),HL
EX   (SP),IX
```

To effect an "ADC IX,IX" which is not included in the Z80 instruction set. John's improvement takes advantage of the fact that the value in A at this time does not exceed 32 and temporarily stores Cy in Bit 0,A by rotation. The ADD IX,IX instruction can then be used and at the earliest opportunity the Cy bit is rotated back out of A, restoring A to its original value, and IX is incremented if Cy is set.

```
SDIV4   (section improvement)
LOOP4:  ADD   IY,IY     ;shift left dividend into 32-bit   FD 29
        RDA             ;accumulator, saving Cy out from   17
        ADD   IX,IX     ;IY in a spare bit of A            DD 29
        ADC   HL,HL     ;                                  ED 6A
        EX    (SP),HL   ;                                  E3
        ADC   HL,HL     ;                                  ED 6A
        EX    (SP),HL   ;                                  E3
        RRA             ;recover saced Cu from IY and      IF
        JR    NC,SKIP4  ;add it to IX                      30 03
        INC   IX        ;                                  DD 23
        CCF             ;reset Cy for subtraction          3F
SKIP4:  SBC   HL,DE     ;                                  ED 52
```

PCW SUBSET

The improved section replaces lines 33 to 43 of the original routine. The relative jump displacements in lines 18,19,26 and 55 of the original routine need to be adjusted to take account of the extra byte.

THE LONG AND THE SHORT OF IT

If you have ever tried to disentangle the workings of your monitor or any other piece of code from a hex dump of 8 or 16 bytes to a line, then you will appreciate the last datasheet this month which comes from Bruce Tanner of Malvern.

Bruce provided us with TOKN in November 1982 which expanded text that had been 'tokenised' with common letter groups given a single byte token for economical storage. Now he provides us with LENGTH, a routine to determine the length of Z80 instructions, and suggests three different applications in which it could be used.

The immediately obvious use for LENGTH is in formatting hex dump for easier examination of machine code during debugging or, as implied above, filching ideas for Sub Set from your monitor (please don't send anything that may be copyright).

Bruce has sent the following piece of code which uses LENGTH to get the number of bytes of the instruction pointed to by HL and then print out the address and instruction bytes. It is not system specific but does require routines 'BYTE', 'SPACE' and 'CRLF' which will print the two hex digits in A, print a space, and perform carriage return line feed respectively. Routines to perform these three tasks are to be found in most monitors but before using them make sure that they do not alter any important register contents.

```
FRMTZ:  LD      B,NN        :desired no. of lines to output
LOOP1:  PUSH    HL          ;save HL and BC which get altered
        PUSH    BC          ;in LENGTH
        CALL    LENGTH      ;get E= no. of bytes in instruction
        POP     BC          ;
        POP     HL          ;
        LD      A,H         ;print 4 hex digit
        CALL    BYTE        ;address
        LD      A.L         ;in
        CALL    BYTE        ;HL
        CALL    SPACE       ;followed by a space
LOOP2:  LD      A,(HL)      ;get instruction byte
        INC     HL          ;point to next
        CALL    BYTE        ;print 2 hex digits of byte
        CALL    SPACE       ;followed by a space
        DEC     E           ;repeat for all bytes
        JR      NZ,LOOP2    ;in instruction
        CALL    CRLF        ;new line
        DJNZ    LOOP1       ;repeat for no. of lines
        RET                 ;or JP MONITOR or whatever
```

The second use suggested by Bruce is really an up-market version of this first use: LENGTH is a handy routine for a dissasembler.

It is Bruce's third use of LENGTH that is really exciting. As his Sharp MZ-80K does not have the necessary hardware to cause an interrupt after every instruction, he has to use a software method of single-stepping through a program when testing. LENGTH provides the information which enables his single step program to set a software breakpoint after each instruction in turn.

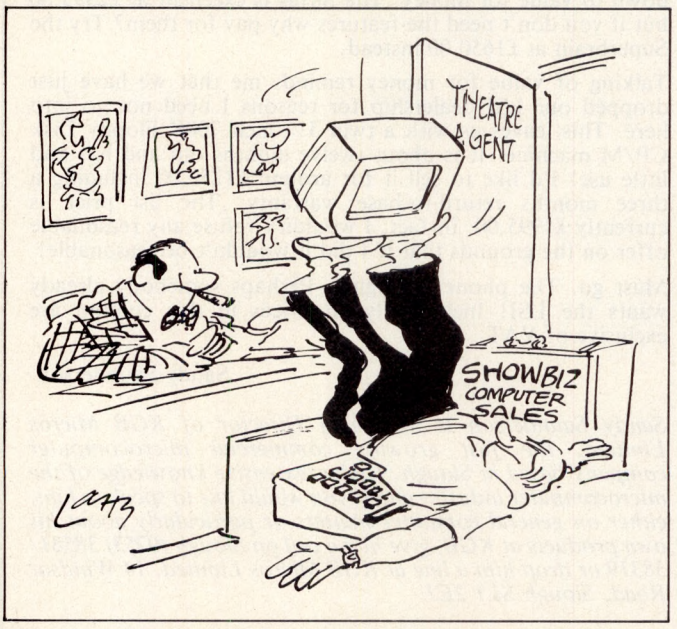
Single-stepping is not just a matter of determining the length of the next instruction to be executed and then substituting a RST to a breakpoint routine for the first byte of the following instruction. A jump, call or return instruction may mean control passing to another part of the object program. The single step program has to test for this type of instruction and use whatever information is necessary to put the RST in the location at which the Program Counter will point.

WANTED: a routine to match LENGTH and determine what the contents of the Program Counter will be after the next instruction is executed. Any offers?

END

Datasheet

```
;= LENGTH -Instruction length calculator
;/ CLASS:  2 (not position independant, registers not saved)
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:     Returns byte length of any valid instruction
;/ ACTION:  IF instruction uses IX or IY registers THEN
;/          IF instruction includes a displacement THEN
;/             length = 2 bytes more than equivalent HL instruction
;/          ELSE length = 1 byte more than equivalent HL instruction
;/          ELSE IF instruction begins with OEDH byte THEN
;/                  length = 2 or 4 bytes
;/          ELSE length = 1, 2 or 3 bytes.
;/ SUBr DEPENDENCE:  None
;/ INTERFACES:       None
;/ INPUT:  HL points to instruction whose length is required
;/ OUTPUT:  E = byte length of instruction
;/          A BC HL altered
;/ REGs USED:  A E BC HL
;/ STACK USE: 2
;/ LENGTH:  137
;/ PROCESSOR: Z80
;
TLEN1   EQU     +14                 ;no. of bytes in tables 1,
TLEN2   EQU     +6                  ;2,
TLEN3   EQU     +25                 ;3 and
TLEN4   EQU     +26                 ;4
;
LENGTH: LD      E,+1                ;initialise length to 1          1E 01
LEN1:   LD      A,(HL)              ;get 1st byte                    7E
        INC     HL                  ;point to next                   23
        INC     E                   ;add 1 to length in case it's an 1C
        CP      ODDH                ;index instruction               FE DD
        JR      Z,LEN2              ;branch if IX                    28 04
        CP      OFDH                ;                                FE FD
        JR      NZ,LEN3             ;branch if not IY                20 10
LEN2:   PUSH    HL                  ;process index instruction       E5
        LD      A,(HL)              ;2nd byte                        7E
        LD      HL,TAB1             ;start of index table            21 YY YY
        LD      BC,TLEN1            ;size of index table             01 0E 00
        CPIR                        ;search table for 2nd byte       ED B1
        POP     HL                  ;restore pointer to instruction  E1
        JR      Z,LEN1              ;if found, length 1 more than    28 E8
        INC     E                   ;equiv. HL instr., else 2 more   1C
        JR      LEN1                ;process rest of instruction     18 E5
LEN3:   CP      OEDH                ;is it an ED instruction?        FE ED
        JR      NZ,LEN4             ;if not it's 1, s or 3           20 0E
        LD      A,(HL)              ;get 2nd byte of ED instr.       7E
        LD      HL,TAB2             ;start of ED 4-byte table        21 YY YY
        LD      BC,TLEN2            ;size of table                   01 06 00
        CPIR                        ;see if 4-byte instr.            ED B1
        LD      E,+4                ;setting E = 4 for if found      1E 04
        RET     Z                   ;exit if found                   C8
        JR      LEN5                ;else length is 2                18 10
LEN4:   LD      HL,TAB3             ;start of 2-byte table           21 YY YY
        LD      BC,TLEN3            ;size of table                   01 19 00
        CPIR                        ;search table and                ED B1
        RET     Z                   ;exit if 2-byte instr.           C8
        INC     E                   ;else set E=3 for 3-byte test    1C
        LD      BC,TLEN4            ;size of TAB4, HL already at start 01 1A 00
        CPIR                        ;search table and                ED B1
        RET     Z                   ;exit if 3 bytes long            C8
LEN5:   DEC     E                   ;otherwise it's a 1-byte         1D
        DEC     E                   ;instruction                     1D
        RET                         ;                                C9
TAB1:   DEFB    9,19H,21H,22H       ;table of index instr. which are 09 19 21 22
        DEFB    23H,29H,2AH,2BH     ;one byte longer than equiv.     23 29 2A 2B
        DEFB    39H,0E1H,0E3H,0E5H  ;Hl instruction                  39 E1 E3 E5
        DEFB    0E9H,0F9H           ;                                E9 F9
TAB2:   DEFB    43H,4BH,53H,5BH     ;table of 4-byte ED instr.       43 4B 53 5B
        DEFB    73H,7BH             ;                                73 7B
TAB3:   DEFB    6,0EH,10H,16H       ;table of 2-byte instructions    06 0E 10 16
        DEFB    18H,1EH,20H,26H     ;excluding index or ED           18 1E 20 26
        DEFB    28H,30H,36H         ;                                28 2E 30 36
        DEFB    38H,3EH,0C6H,0CBH   ;                                38 3E C6 CB
        DEFB    0CEH,0D3H,0D6H,0DBH ;                                CE D3 D6 DB
        DEFB    0DEH,0E6H,0EEH,0F6H; ;                               DE E6 EE F6
        DEFB    0FEH                ;                                FE
TAB4:   DEFB    1,11H,21H,22H       ;table of 3-byte instructions    01 11 21 22
        DEFB    2AH,31H,32H,3AH     ;excluding index or ED           2A 31 32 3A
        DEFB    0C2H,0C3H,0C4H,0CAH ;                                C2 C3 C4 CA
        DEFB    0CCH,0CDH,0D2H,0D4H ;                                CC CD D2 D4
        DEFB    0DAH,0DCH,0E2H,0E4H ;                                DA DC E2 E4
        DEFB    0EAH,0ECH,0F2H,0F4H ;                                EA EC F2 F4
        DEFB    0FAH,0FCH           ;                                FA FC
```





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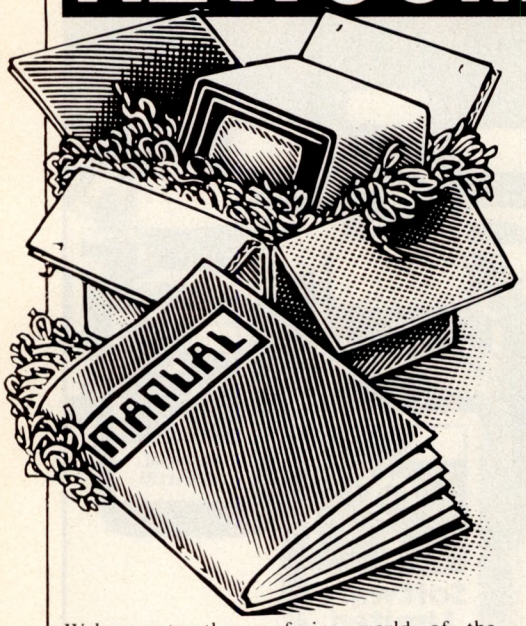

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex.** The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0 = 0000, 1 = 0001, 2 = 0010, 3 = 0011, 4 = 0100, 5 = 0101 . . . . E = 1110 and F = 1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex (**machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming language** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To **run** such a program the computer uses an **interpreter** which picks up each English-type **instruction**, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU)**, a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic;** all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU)**, which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone sytem allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.

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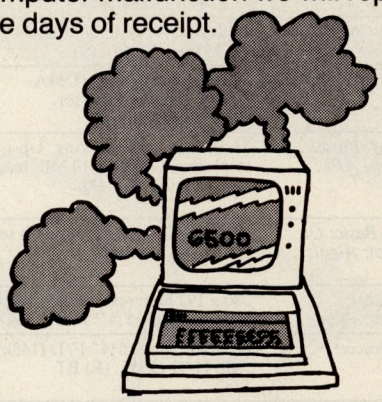

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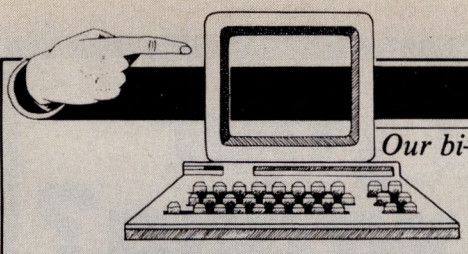

IN STORE

Our bi-monthly guide to microcomputing systems. Updates should be sent to: Dick Olney, PCW, 62 Oxford Street, London W1A 2HG.

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
ABC 26 (£4500)	AI 09237-70578(19)	64k RAM: Z80A: dual 8'' F/D (2.3Mb): 12'', 24 x 80 VDU: 2 x RS232 ports: 3 x P/P	CP/M: *MP/M Basic: Cobol: Fortran: Pascal.*	Options: 10Mb H/D £4000. BT 4/81 (S).
ABC 80 (£738)	Datormark Ltd: 97 44896	16-40k RAM: Z80A: C: 12'', 16 x 40 b&w VDU: 4680 bus: IEE 488: RS232 port.	DOS Basic (16k ROM: *Fortran: Pascal: A: Multi user Basic.*	Colour video graphics with UHF output. Viewdata compatible. Loudspeaker. Numeric keypad. Options: dual 5¼'' F/D (320k) £895: dual 8'' F/D (2 Mb). BT 1/80. (1)
Acclaim (£3650)	Country Computers 0527 29826	64k RAM: Z80: 24x80 VDU: single 5¼'' F/D (140k): 5 MB H/D: RS232 port. Option: P/P	CP/M: *Basic: Cobol: Fortran: Pascal*	Various integral H/D options up to 21MB (£4450)
ACT Sirius 1 (£2395)	ACT 021 501 2284 (50)	128-512k RAM: 8088: dual 5¼'' F/D (1.2M): 12'', 25 x 80 VDU: 2 x RS232 ports: 2 x P/P	CP/M 86: U: Basic 86 *Cobol: Fortran: Pascal*	High res graphics. Options: 10 Mb H/D: dual 5¼'' F/D (2.4 M) BT 2/82.(S)
Adler Alphatronic (£1895)	Adler 01-250 1717	48-64k RAM: 8085A: dual 5¼'' F/D (1Mb): 12'', 24 x 80 VDU: S/P: P/P	CP/M: *Basic: CBasic: Fortran: Cobol*	With 80 cps printer and dual F/D £2345 (inc CP/M). (S)
Altos ACS 800-2 £2995)	logitek: 0257 426644 (33)	64k RAM; Z80A; dual 8'' F/D (1 Mb): 2 x RS232 ports: 2 P/P.	CP/M: *Basic: CBasic: Cobol.*	Single user. Options: DMA. Floating point processor. Phototyping board.
Altos ACS 8000-10 (£6675)	As above.	280k RAM: Z80A: single 8'' F/D (500k): 10 Mb H/D: 6 x RS232 ports: P/P: network RS422 port: DMA	CP/M: *MP/M: Basic: Cobal: Fortran: APL: Pascal.*	Multi-user/multi tasking. Up to 4 users. Options: 10 Mb: mag tape backup (S + H).
APL Signet (£1750 or £130pm)	Micro APL: 01-834 2687	64k RAM: Z80A: dual 5¼'' F/D (380k): 2 x RS232 ports.	CP/M: APL: *Basic: U: Fortran: Cobol: Algol: Forth*	Desktop APL computer with self teaching course. (S)
Apple II (£695)	Apple (UK) 0442 48151 (200+)	16-48k, RAM: 6502: 8 I/O slots.	OS: Basic: *Pascal: Fortran: Cobol: Pilot*	280 x 192 high resolution graphics: Option: single 5¼'' F/D (116k) £349.
Apple III (£2496)	As above	128-256k RAM: 6502B: dual 5¼" F/D (286k): 12", 24x80 VDU: RS232 port: P/P.	SOS: *Basic: Pascal:*	Options: single 5¼" F/D (143k) £384: 5Mb H/D £2256. (E) BT 5/82
Atari 400 (£200 inc VAT)	Atari UK: Slough 33344	16k RAM: 6502: C int: cartridge slot: 24 x 40 TV int: touchpad k/b: Opt: C £50	OS (10k ROM): *Basic (8k ROM). Pilot: A:*	High resolution colour graphics. 4-channel sound. Four games controller/light pen sockets. BT 10/80. (I/B).
Atari 800 (£500 inc VAT)	As above.	16-48k RAM: 6502: C int: 2 x cartridge slots: 24 x 40 TV int: Opt: single 5¼'' F/D (90k) £300: 16k RAM £65.	OS(10k ROM) Basic (8k ROM): *Pilot A: Forth: MBasic* (I/B).	As above. Software & RAM on cartridge modules. Up to 4 disk drives RS232C int £135. BT 10/80.
Atom (£120)	Acorn: 0223 245200 (160)	2-12k RAM: 8-16k ROM 6502: Full K/B: C int: TV int: 20 I/O lines: 1 P/P. Options: 80 col printer £199, Prestel adaptor £120.	Basic in 8k ROM: A Cass O/S: *Lisp: Forth*	High resolution graphics on bigger model: Single 5¼'' F/D £297 B/ 7/80 (B)
BASF 7120 (£4400)	BASF: 01-388 4200 (12)	88k RAM: 2xZ80A: 3 x 5¼'' F/D (480k): 12'', 24 x 80 VDU: RS232 port: P/P	DOS: (OASIS) *Ex Basic: Cobol U. A: CP/M*	H/D available. Also 7125 with *960k* F/D £4900 and 7130 with single F/D (430k) & 5Mb H/D £6300. Disk controller has own Z80A. BT 9/80
BBC Micro (£299 inc VAT)	BBC Micro Systems 0933 79300	16-32k RAM: 32k ROM 6502: C int: TV int: RS423 port: P/P: Option: single 5¼'' F/D (100k) £230	MOS: Basic A: *Pascal Logo: Forth: Lisp*	Video text & second processor int. 32k model with Econet and disk interface £399. BT 1/82 (I)
Bonsai SM3000 (£1995)	Bonsai 01-580 0902	64k RAM: Z80: dual 5¼" F/D (700k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Pascal: Fortran*	Many floppy and hard disk options. Applications software avail. from Bonsai.
Computers Lynx (£225 inc VAT)	Computers Ltd 0223 315063 (TBA)	48-192k RAM: Z80A; 24x40 TV int: C int: RS232 port	Basic	248 x 256 colour graphics (8 colour). CP/M compatible 5¼'' F/D & printer avail soon. (B)
Canon BX-3 (£3000)	Canon 01-680-7700.	32k RAM: 6809: dual 5¼'' F/D (640k): 28 char display: 80 cps printer: 3 x RS232 port: P/P.	OS: Basic: A. *Cobol: Pascal*	Fully integral unit. Extensive applications support offered on all Cannon Machines. Options: dual dual 5¼'' F/D (640k) £1500.
Canon CX-1 (£2500)	As above.	32k RAM: 6809: dual 5¼'' F/D (640k): 12'', 24 x 80 VDU: 3 x V24 ports: P/P: light pen.	OS: Basic: A: *Cobol: Pascal*	Price includes installation & training. Extensive application support offered. Options: dual 8'' F/D (1Mb) £3300.(S)
Canon TX-25 (£1450)	As above.	16-32k RAM: 6809: C: 20 char display: 26 col, 2.4 lps printer. Option: 2 x RS232 port.	Basic: A	Fully integral unit. Cassette is Cannon's own design (8k). Can be used with communications. (S).
Clenlo Pronto (£2825)	Clenlo Computing Systems Ltd: 01-670 4202 (TBA)	64k RAM: Z80: dual 8'' F/D (1 Mb): 3 S/P: 2 P/P.	CP/M: CBasic-2: Pearl 1: *U Fortran: Cobol: Pascal*	With 2.4Mb F/D £3105. Also H/D systems with 5-20 Mb H/D & tape drive £5430.

List of Abbreviations

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E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Cleno Table Top 525 (£1750	As above	64k RAM: Z80 dual 5¼'' F/D: 2xS/P	CP/M: MBasic: W/P	Wordstar & Logicalc included in price. Many options
Colour Genie (£200 inc VAT)	Lowe Electronics 0629 2430 (100+)	16-32k RAM: Z80: 16k ROM: C int: 24x40 TV int: Audio port: RS232 port: P/P	ExBasic	160x96 colour graphics. 16k RAM £30. Many options inc joysticks and light pen. F/D avail soon. (B)
Columbia PC (£2800)	Icarus 01 485 5574 (50)	128k RAM: 8088: dual 5¼'' F/D (640k): 24x80 VDU: 2xRS232 ports: P/P: 8 expansion slots	MS-DOS: *CP/M 86: Basic: Cobol: Fortran: Pascal*	IBM PC compatible. With integral H/D (5 Mb) £4200 or (10 Mb) £4550 (S)
Comart Communicator (£1895)	Comart 0480 215005 (25)	64k RAM: Z80A: dual 5¼'' F/D (780k): 2 S/P: P/P.	CP/M: *MP/M Basic: Cobol: Fortran: Pascal*	With 1.5 Mb F/D £2195. With 4.8 Mb H/D & 790k F/D £2995. Option: 18 Mb H/D. £3895 Also CP100 range with 8086 & 128k-1Mb RAM from £2295. Expandable to multiuser/multitasking. (S).
CommodorePET 16k, & 32k (£550, £695)	Commodore: 0753 79292 (150)	16-32k RAM: 6502: C: 12'' 25x40 VDU: IEEE-488 port: Options: dual 5¼'' F/D (343k) £695: same but (1018k) £895	O/S: Basic (in 8k ROM): *Forth: Pilot: Pascal: Comal: Lisp: A*	CBM 8032 with 80-col screen (32-96k) BT 12/80. £895 Field service avail. (1).
Commodore Vic 20 (£200 inc VAT)	Commodore: 0753 79292 (150)	5-32k RAM: 6502: Cint: 22 x 23 TV int: S/P: P/P: Games int.	Basic	Graphics 3 tone sound generator. Will interface to PET. Option: single 5¼'' F/D (170k). BT 9/81(S).
Commodore 500 Series (From £659)	As above	128-896k RAM: 6509: 25x40 TV int: P/P	O/S: Basic: *CP/M: Pascal: Forth: Cobol: Fortran*	High res. 16-colour graphics. Second processor option: Prestel facility avail.
Commodore 700 Series (From £995)	As above	128-896k RAM: 6509: 24x80 VDU: Option: dual 5¼'' F/D (1Mb): IEEE-488 port: RS2332C port.	As above	8088 or 280 second processor option Tilt and swivel screen.
Commodore 64 (£299)	As above	64k RAM: 6509: 25x40 TV int: C int: RS232 port: P/P	Basic	Second processor option. 320x200 colour graphics. Option: Joystick: Light pen
Compucorp 625 (£6000)	Compucorp: 01-907 0198 (17)	48-60k RAM: Z80: dual 5¼'' F/D (630k): 9''. 16x80 VDU: 40 col printer: RS232 port, P/P.	Basic: A: *Fortran: Pascal:* U	IEEE-488 Controller and S100 int. Many applications packages avail. (E).
Compucorp 655/ 665/675/685 (from £5050)	As above	60k RAM:. Z80: Up to 4x5¼'' F/D(160k-2.4 Mb): 9'', 20x80 or 12'' 20x80 or 20'' 60x80 VDU: 40-col printer: RS232 port.	As above	Prices incl installation and training. Opt: 10-20 Mb H/D
Cromemco System Zero/DDF, System 2, System 3, System Z2H. (£1975/£3095/ £4495/£6585).	Datron: 0742 585490. Comart: 0480 215005 (25) MicroCentre: 031-556 7354 (18)	64k RAM: Z80: dual 5¼'' F/D (390k) on System Zero, System 2 & Z2H: dual 8'' F/D (1.2 Mb) on Sys 3: 10 Mb H/D on Z2H: S/P: P/P.	CDOS: *Basic: Cobol: Fortran: RPG II: Lisp: A: W/P: Multi-user Basic. Cromix. CP/M*	System 2 & 3 expandable to Multi-user (max 7) Also 'D' series with 6800/ Z80A dual processor from £3620. Options: dual 8'' F/D (996k): 11.2Mb H/D. BT 10/79 (E).
DAI (£595)	Data Applications (UK): 0285 2588 (7)	48k RAM: 8080: C int: 24x60 VDU int: RS232 port: over 20 industrial ints. option: dual 5¼'' F/D £595	Basic (ROM): U	Colour graphics up to 255 x 335: 3 notes & noise generator: PAL O/P to TV: Paddle int: H maths option. (1). BT 10/80.
Diablo 3000 (£6250)	Business Computers Ltd: 01-207 3344	32k RAM: 8085: dual 8'' F/D (1.3 Mb): 12'', 24x80 b&w VDU: 45 cps printer.	DOS: Basic: DACL: A: U.	Selection of business packages included (S).
Digital Micro-systems DMS-3 (£3530)	Digital Microsystems 0734 343885 (14)	64k RAM: Z80A: dual 8'' F/D (1.14Mb): 3xRS232 ports: 1xRS422 port: P/P.	CP/M: CBasic: *Cobol: Fortran: Pascal: PL/I*	Expandable to multi-user system with 10-28 Mb H/D. Extensive software avail. (S).
Digital Micro-systems DMS-4 (£4395)	As above	128-512k RAM: Z80A: single 8'' F/D (500k): 11 Mb H/D: 4x RS232 ports: P/P.	CP/M: Basic-E: CBasic: *Cobol: Fortran: Pascal.*	Port expander to enable up to 10 workstations under M/PM. Options: 128k RAM £1295: up to 96Mb H/D. (H).
Dragon 32 (£200 inc VAT)	Dragon Data 0792 580651 (50+)	32-64k RAM: 6809E: 16x32 TV int: C int: P/P	Basic	9 colour 256x192 high resolution graphics. Option: Joysticks BT 8/82
Durango F-85 (£4995)	Comp Ancillaries: 0784 36455 (12)	64k RAM: 8085: dual 5¼'' F/D (1 Mb): 9'', 16x64 green VDU: 132 col 165 cps printer: N/P.	O/S: D Basic: *CP/M: CBasic: Micro Cobol.*	Up to 5 work stations: fully integrated system. Options: additional dual 5¼'' F/D (1 Mb): 12-24 Mb H/D.(S).
Eagle II, III and IV (from £2350)	Mediatech Bus Syst 01 903 4372	64k RAM: Z80A: dual 5¼'' F/D (768k and 1.5Mb) or single 5¼'' F/D (784k) with 10Mb H/D: 2xRS232 ports: 2 x P/P	CP/M: CBasic: *Cobol Pascal: Fortran*	Many different configurations available. Full range of applications software
Equinox 200 (£7500)	Equinox: 01-739 2387 (N/A)	64-512k RAM: Z80: 10 Mb-1200 Mb H/D: 6xS/P: 1 P/P.	CP/M: CBasic: *Cobol: Fortran.*	Multi-user MVT/FAMOS available in place of CP/M. 16-bit version (Equinox 300) £10,000. (S&H).
Fortune 32:16 (£4375)	Fortune Systems 01 938 1721	256-512k RAM: MC 68000: dual 5¼'' F/D (800k): 12'', 25x80 VDU: S/P: P/P	FOS: *CP/M: Basic: Pascal: Cobol: Fortran: C*	Expandable to full multi-user system. High res colour graphics
Gecas 64/2 (£3305)	Grecas Micros 01 629 3758	64k RAM: Z80A: dual 8'' F/D (2.4 Mb): S100 bus.	CP/M: Cobol: *Basic Pascal Fortran*	Up to 4.8 Mb F/D. Expandable to multi-user/multitasking system.
Gemini Multiboard (£500)	Micro Value 02403 28321(7)	64k RAM: Z80: 25 x 80 VDU int (with Z80): Option: dual 5¼'' F/D £690.	CP/M: *Basic Cobol: Pascal Fortran AP/L:*	Modular system. Other options inc ROM board & EPROM programmer. BT 2/82 (H&S).

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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Gemini Galaxy 2 (£1495)	As above	64k RAM: Z80A: dual 5¼'' F/D (800k): 12", 25x80 VDU: RS232 port: P/P: C int	CPM: *Basic: Cobol: Fortran: Pascal: AP/L: A*	Options: dual 5¼'' FD (800k): dual 8" F/D (2.4Mb)
Gimix System 68 (£2000)	SEED: 05433 78151: Windrush 0692 505189	16-64k RAM: 6800/6809: dual 5¼'' F/D (500k): 2xRS232 ports.	OS-9: Flex *Basic: Pascal: A: Dis A: T/E:U*	With dual 8'' F/D (2 Mb) £2900. Designed as development system for industrial control. (H).
Genie I (£299)	Lowe Electronics: 0629 2430 (N/A)	16k RAM: Z80: 500bps C: 16 x 64 TV int: extra C int: 1 P/P	Basic (12k ROM): *Pascal: A M/A: Fortran*	Options: single 5¼" F/D (184k) £220; dual 5¼" F/D (368k) £375 (I) Also Genie II with numeric keypad and function keys but no cassette (same price as I).
Genie III (£1900)	As above (26)	64k RAM: Z80A: dual 5¼'' F/D (1.25 Mb): 24x80 VDU: RS232 port: P/P	NewDOS 80: *CP/MZ: Basic: Cobol: Fortran Pascal*	System complete with business applications software, maintenance contract and choice of printer £3250 (S).
Grundy 8200 (£1850)	M-Tech Comp Serv. 0603 870620	64-256K RAM: Z80A: dual 8'' F/D (2MB): 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: Forth: PL/1: Ada*	Various hard disk options up to 26MB
Haywood 9000 Composite (£1795)	Haywood: 01-428 0111. (TBA)	64-192k RAM: Z80A: dual 5¼'' F/D (640k): RS232 port: P/P. 15'' 28x80 VDU.	CP/M: *Basic: Cobol: Fortran: Pascal: W/P.*	Graphics avail. Expandable to 18 Mb H/D. Networking version planned (H&S)
Haywood Hinet (£7500)	As above	64k RAM: Z80A: dual 8" F/D (2Mb): 11Mb H/D: RS232 port: RS422 port: P/P. 24x80 VDU	CP/M: HiNet: *Basic: Cobol: Fortran: Pascal*	Local area network, up to 32 users. Range of H/D avail. Local disks & printers if required. Work station £2050 (H&S)
HP 75C (£728)	As above	16-24k RAM: 48k ROM: CPU: 32 char display: mag card reader	Basic	8k RAM £142. Video interface £221. Thermal printer £371. (E) BT 11/82
HP 85 (£2013)	Hewlett Packard Ltd: 0734 784774 (16)	16-32k RAM: C.P.U.: 5'', 16x32 VDU: C(200k): 64 cps printer: 4 P/P. Options: dual 5¼'' F/D (540k) £1610: fusl 8'' F/D (2.4 Mb) £4108.	Basic (ROM)	Full dot matrix graphics. Complete range of interfaces, peripherals and application packages avail. 16k RAM £142. (S).
HP86 (£1314)	As above	80k RAM: C.P.U.: 48k ROM. Options: 12'', 24x80 VDU £238: 9'', 16x80 VDU £216: 5¼'' F/D (207k) £622	ExBasic	Many expansion possibilities including CP/M module (£362), RS232 port (£289) and up to 576k user RAM. 400x240 graphics. BT 10/82 (E)
HP 125 (£2479)	As above	64k RAM: 2xZ80A: 12'', 24x80 VDU 2xRS232 ports: HP-1B port. Options: dual 5¼'' F/D (500k) £1693	CP/M: Basic: *Cobol Fortran: Pascal*	Integral thermal printer £629. Also available with dual 8'' F/D (2 Mb). (S). BT 3/82
IMS 5000 (£1500)	Equinox: 01-739 2387 (20)	16-56k RAM: Z80: dual 5¼'' F/D (320k): 2xS/P: 1 P/P:	CP/M: C/Basic: *Cobol, Fortran.*	3 drives option: (S&H).
IMS 8000 (£2500)	As above	64-256k RAM: Z80: dual 8'' F/D (1 Mb): 2xS/P: 1 P/P	CP/M: CBasic: *Cobol: Fortran: MicroCobol.*	Multi-user MVT/FAMOS available in place of CP/M. (S&H).
Jupiter Ace (£90 inc VAT)	Jupiter Contab,	3k RAM: 8k ROM: Z80A; 24x32 TV int: C int: loudspeaker.	Forth	Has 140 Forth words defined in ROM.
Kemitron K2000 E (£2300)	Kemitron 0244 21817 (3)	64k RAM: Z80A: single 5¼" F/D (150k): 12", 24x80 VDU: 2xS/P: P/P	CP/M: *Basic: Cobol: Fortran Pascal: A*	Extensive range of support cards and industrial interfaces.
Kemitron K3000 E (£3300)	As above	64k RAM: Z80A: dual 8" F/D (2Mb): 2xS/P: P/P	CP/M: MP/M: *Basic: Cobol: Fortran: Pascal: A*	Up to four screens and four printers can be attached. Options: 10Mb H/D.
LSI M-Two (£6000)	LSI Computers 04862 23411 (20)	64-128k RAM: 8085A: dual 8'' F/D (1.2 Mb): 12'', 24x80 VDU: 60 cps printer	Elsie: *CP/M: Basic: Cobol Fortran: Pascal: A: U*	Max 8 VDUs and 4 printers. Many applications packages available. Option: 10 Mb H/D £2600. (S).
LSI M-Three (£1700)	As above	64k RAM: Z80A: dual 5¼" F/D (350k): 12", 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: A*	Option: Dual 8'' F/D, 10 Mb H/D (E)
LSI M-four (£2175)	As above	128-256k RAM: Z80B: 8088: dual 5¼'' or 8'' F/D 3xRS232 ports: RS422 port: P/P 12'', 24x80 VDU	MS-DOS: *CP/M-86 Basic Cobol: Fortran: Pascal: MP/M-86*	Operates on either 8-bit or 16-bit applications software. Option: 10 Mb H/D
Macro 1 (£3950 or £294 pm).	Micro APL Ltd. 01-834 2687 (TBA)	64k RAM: Z80A: dual 8'' F/D (1 Mb): 4xRS232 ports.	CP/M: APL: U: *Basic: Fortain: Cobol: Word-2star Algo: Pascal: Forth.*	Designed as timesharing replacement. Macro 2 with 2 Mb F/D £4750 or £334 pm.
Marinchip M9900 (£4990)	Microprocessor Eng. 0703 775482	128k RAM: 9900: dual 8" F/D (2Mb): 4xRS232 ports.	NOS: Basic: Pascal: W/P: *SPL: Forth: Meta*	Multi-user/multi-tasking OS. Options: H/D up to 120 Mb.
Micro Trainer 1 (£650)	Hewart: 0625 22030 (N/A)	16-32k RAM: 6800/6809: 10'' 16x24 VDU: 2xC int: Opt: dual 5¼'' F/D (160k) £595: 8k RAM £17.	Basic: A: *Pascal: PL/M: W/P*	SS50-based system. Graphics avail. Int card with real time clock £17. (1).
Millbank Sys 10 (£2395)	Millbank: 01-891 4691(6).	65k RAM: Z80: dual 5¼'' F/D (700k): 12'', 24x80 VDU: 2x RS232 ports: RS449 port: P/P.	CP/M: *Basic: Cobol: Fortran: Pascal: PLI: W/P.*	12-month warranty. Mainframe comm. package. Maintenance contracts. Options: 1.6 Mb F/D. 5-50 Mb H/D. (S&H)
Munroe EC8800 (£2150)	Fi-Cord Int. 061 445 7716	128k RAM: Z80A: single 5¼" F/D (320k): 3xRS232 ports: P/P	Munroe Multitasking System: *CP/M: Basic: Cobol: Fortran: Pascal*	High res colour graphics. Option: single 5÷" F/D. (320k). £495
Munroe OC8820 (£2990)	As above	128k RAM: Z80A: dual 5¼" F/D (640k): 9", 24x80 VDU: 3xRS232 ports: P/P	As above	5MB H/D avail soon. BT 4/82.

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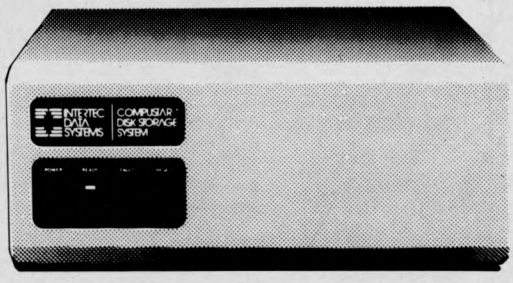

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IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Nascom 3 (£549)	Lucas Logic 0926 59411	48-60k RAM: Z80: dual 5¼" F/D (700k): RS232 port: P/P.	Basic: *Pascal: A: CP/M: Cobol Fortran*	Options dual 5¼" F/D (700k) £685: 48k RAM £130.
NEC PC 8001 (£599)	IBR 0734 664111	32k RAM: Z80A: P/P Option: dual 5¼'' F/D (326k) £699	Basic N: (24k ROM) *CP/M: Fortran: Cobol: Pascal.*	Colour monitor £359 (low res) or £579 (high res) both 12'', 25x80 many expansion units avail. (E) BT 6/81
Newbrain Model A (£199)	Grundy: 0223 350355 (TBA)	32k-2 Mb RAM: Z80A: Nat 420: 2xC int: TV int: 2xV24 ports.	CBasic (29k ROM): A.	Graphics. Battery or mains. Options: ½ Mb RAM £450. Also Model AD £299.(E).
North Star Horizon (£1975)	Comart: 0480 215005. (25) Trader Comp. 01-328 3484 (60)	32-64k RAM: Z80A: dual 5¼'' F/D (360k): 15'', 24x80 VDU: 150 cps printer: 2 S/P: 1 P/P.	DOS: Basic: CP/M: *Cobol: Fortran: Pascal.*	Options: 5-18 Mb H/D, Multi-user.
North Star Advantage (£2195)	As above	64k RAM: Z80A: dual 5¼'' F/D (720k): 12'', 24 x 80 VDU: S/P.	GDOS: CP/M: *CBasic: MBasic: Fortran: Cobol: Pascal*	Price includes business graphics & demo software.
Oki if 800 (£3000)	Encotel. 01 686 9687	64k RAM: Z80A: 2k ROM: dual 5¼'' F/D (768k): 12'', 24x80 VDU: 80 col printer: loudspeaker: RS232 port: 20k ROM cartridge.	Basic: A: *CP/M Cobol: Fortran:*	Fully integral unit. Graphics. Options: dual 5¼'' F/D (560k): RS232 port: PP. (1). BT 10/81
Olivetti M20 (£2395)	Olivetti 01 785 6666	128k-512k RAM: Z8001: 2-8k ROM: dual 5¼'' F/D (640k): RS232 port; P/P	Basic: *PCOS: A*	Alternative 8086 processor board to run CP/M86 & MS-DOS. Options: 11 Mb H/D (integral): printer £738. (S) B/T 9/82
Onyx C8000 (£6875)	Onyx Dist Ltd: 09066-5432 (TBA)	64k RAM: Z80: 12 Mb Cartridge: 10 Mb H/D: 4 S/P: P/P	CP/M: *MP/M Oasis: Unix: Fortran: Pascal: W/P*	C8001 with 128k RAM £8220. Multi-user version avail. using Oasis.(E) BT 3/81.
Oric 1 (£100 inc VAT)	Oric Products Int 0990 27641	16-48k RAM: 6502A: 28x40 TV int: C int: S/P: P/P: Loudspeaker	Basic (16k ROM): *Forth*	With 48k RAM and Forth on cassette £170 inc VAT. 240x200 colour graphics. Micro disk and modem avail soon. Viewdata compatible.
Osborne 1 (£1250)	Osborne 0908 615274(40)	64k RAM: Z80A: dual 5¼" F/D (200k): 5", 24x52 VDU: RS232 port: P/P	CP/M: W/P: *Cobol Fortran: Pascal* CBasic: MBasic: Wordstar: Mailmerge: Supercalc *Forth*	Integral system in weatherproof carrying case. Will run on battery pack. Option: dual 5¼" F/D (400k). BT11/81.
Oscar (£2560)	IDS Ltd: 0908 313997(30)	64k RAM: Z80: dual 5 ¼ F/D (800k): 12", 25x80 VDU: RS232 port: 1 P/P	CP/M: *Basic: Pascal Fortran: Cobol: W/P:A*	Also avail. with dual 5" F/D(1.6Mb) £2905 and 8'' F/D(2 Mb) £3380. Advanced video board. S&H).
Panasonic JD 800M, JD850M (£3300, £4350)	Panasonic Business Equipment: 0753 75841 (10 regional dist)	64k RAM: 8085A: 4k PROM: dual 8'' F/D JD800M (500k): JD850M (2 Mb): 12'', 24x80 VDU: 3xRS323 ports. P/P	CP/M: Basic: A *Micro-Cobol.*	Option: 8.4 Mb H/D £2725 (up two). BT3/80(S).
Pascal Microengine (£2295)	Pronto Electronic Systems Ltd: 01-554 6222	64k RAM: MCP 1600: 2x RS232 ports: 2 P/P.	Pascal.	CPU instruction set is P-code: no interpreter needed. Available with dual 8'' F/D (2 Mb) £3900.
Pasca 640 (£1900)	Westrex Ltd: 01-578 0957 (TBA)	64k RAM: Z80A: dual 8'' F/D (512k): 12'', 24x80 VDU: RS232 port: P/P	CP/M: *Basic: Cobol: Fortran: Pascal: A: W/P: U*	Maintenance contracts avail. Option: 5-20 Mb H/D. (S) BT 5/18
Philips P2000 (£2444)	Philips Data	16-48k RAM: Z80: dual 5¼'' F/D (140k): 12'', 24x80 VDU: RS232 port.	PDOS: UCSD p-system: *Pascal: Basic Fortran:A.*	With 48k RAM, Pascal and Basic £3300: BT 12/81.(S).
Position 900 (£1950)	Position Comp. 09252 29741 (10)	64-512k RAM: 6809: 4xRS232 ports: IEEE-488 port: 1200 band C: dual 5¼'' F/D (720k)	OS-9: Basic 09: *Pascal: C: A: Cobol: U FLEX O/S*	Supports 4 users, expandable to 8. Networking allows 28 users on 7 Options dual: 5¼'' F/D (1.4 Mb): 5-40 Mb H/D (E)
Position 9000 (£1536)	As above	64-512k RAM: 6809: 4xRS232 ports: IEEE-488 port: 1200 band C.	OS-9: Basic 09: *Pascal C: A: Cobol: U*	240x240 high res colour graphics. Viewdata compatible. Disk options as above. Supports 5 users. Networking allows 35 users on 7 systems (E) BT 10/82.
Prince (£3045)	Digico: 04626 78172 (50)	64k RAM: 3xZ80A: dual 5¼'' F/D (800k): 2xRS232 port: P/P 12'', 25x80 VDU	CP/M: *Basic: Pascal: Fortran: Cobol: W/P:A:* T/E:U	High res graphics. Options: single 5¼'' F/D (400k) £600: dual 8'' F/D(2 Mb) £2000 5-10Mb H/D. Rentals avail. (S).
Quantum 2000 (£2250)	Quantum Comp Sys 0532 458877	64k RAM: Z80A: dual 8" F/D (2.4Mb): 12", 24x80 VDU: C int: P/P	CP/M *Basic: Cobol: Fortran: Pascal: A*	Many expansion boards avail inc high res colour graphics. Option: 5-10Mb H/D.
Rair Black Box 3/30 (£3750)	Rair: 01-836 6921 (N/A)	64-512k RAM: 8085: dual 5¼'' F/D (500k): 6 Mb H/D: 2xRS232 ports.	CP/M: Basic: Cobol: Fortran: M/A	64k RAM expansion £500. 256k RAM £1250. Up to 16 RS232 ports.
Research Machines 380Z (£1867)	Research Machines: 0865 49866 (N/A)	16-56k RAM: Z80A: dual 5¼" F/D (300k) RS232 port. P/P.	ExBasic: A: T/E: U: *CP/M. Fortran: Cobol: Algol: Pascal.*	High res colour graphics. Many possible systems. With 56k RAM & dual 8'' 'FD (1 Mb) £3347.
Research Machines Link 480Z (£550)	As above	32-64k RAM: Z80A: C: 2xS/P: P/P	Basic: A: T/E	High res colour graphics. Network station.
SEED System 1 (£1900)	Strumech: 05433 78151 (5)	32-56k RAM: 6800: various disk options: 12'', 24 x 80 VDU: RS232 port: P/P	DOS: Basic: *M/A: CBasic: A: T/E*	Graphics. PROM programmer Also system 19 multi-user (£3000). (E)

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Sharp MZ-80K (£460-34k)	Sharp Electronics (UK) Ltd: 061-205 2333 (22)	6-48k RAM: Z80: C: 10" 24 x 40 VDU: Option: dual 5¼" F/D (289k) £695	Basic, A. *CP/M: Pascal: Fortran: Forth*	Graphics: loudspeaker. BT 10/79 (B)
Sharp MZ80A (£549)	Sharp Electronics (UK) Ltd 061 205 2333 (22)	48k RAM: Z80: 25x40 VDU: C: P/P. Options: single 5¼" F/D £400: dual 5÷" F/D £590: RS232 port	Basic: *CP/M: A: Pascal: Fortran: Cobol*	Expansion unit needed for disks (£100) Low res (80x50) graphics. Loudspeaker Numeric pad (B)
Sharp MZ-80B (£1095)	As above	64k RAM: Z80A: C: 9", 25 x 80 VDU: RS232 port: P/P.	Basic: *A: Pascal: FDOS*	High res graphics. Options: dual 5¼" F/D (560k) £800: 80 cps printer £415. (S)
Sharp PC1500 (£150)	As above	3-11k RAM: CPU: 16k ROM: 26 char LCD:	Basic	Full system with dual cassette int. and miniature four colour plotter £375. RS232 port avail. soon. (B). BT 6/82
Sharp PC3201 (£2995)	As above *CP/M: Cobol*	64k RAM: Z80A: dual 5¼" F/D (500k): C int: 12", 25 x 80 VDU: 70 1pm printer.	DOS: U: Basic: *CP/M: Cobol.*	Various expansion cards avail. BT 7/81 (I&B)
Sig/Net 100ZS (£1299)	Shelton 01 278 6273 (5)	64k RAM: Z80A: dual 5¼" F/D (400k): 2xRS232 ports	CP/M: *Basic: Cobol: Fortran: Pascal*	Various disk options, up to 16 Mb H/D
Sinclair ZX81 (£50 inc VAT)	Sinclair: 0276 66104 (300+)	1-16k RAM: Z80A: C int: TV inb: full K/B: 44-pin expansion port.	Basic (8k ROM).	Advanced 4-chip design. Printer now avail. BT 6/81
Sinclair ZX Spectrum (£125 inc VAT)	Sinclaire 0276 685311	16-48k RAM: Z80A: 16k ROM: T.V. int: C int	Basic	Options: 32k RAM £60. RS232 port and microdrive disks avail soon. BT 6/82
Smoke Signal Chieftan (£1800)	Windrush 0692 405189: (TBA)	32-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2 x RS232 port.	DOS: *68/FLEX: Basic: Fortran: Cobol: A: Disc A: Pascal: U.*	With daul 8" F/D (2 Mb) £2600. Designed as development system for industrial control. (H).
Sorcerer (£790)	EMG 0293 519211 0736 798157 (27)	48k RAM: Z80: RS232 port: 1 P/P: S100 connector: 30x64 VDU int. N/P.	O/S: Basic (ROM): *A: Algol: Fortran: MBasic: ExBasic: 80. Pascal: W/P.*	High-resolution graphics capability: user programmable character set, Option: single 5¼" F/D (316k) £600 Video disk unit (1.5Mb) £1890
Sord M100 ACE (£2339)	Midas Computer Services Ltd: 07917 64686 (10)	48k RAM: Z80: 8k ROM dual 5¼" F/D (245k): 24 x 64 green VDU: RS232 port: N/P	O/S: Basic: *A: Fortran: Pascal.*	Up to 3 drives possible. Colour graphics avail. Option S100 bus. (I)
Sord M223 Mk II-VI (£4078)	As above	64k RAM: Z80: 8k ROM: dual 5" F/D (700k): 12", 24 x 80 green VDU: RS232 ports: S100 bus: N/P	*O/S:* Ex Basic: *CBasic: Multi-User Basic: Fortran: Cobol*	Expandable to 4 Mb F/D. 32 Mb, H/D, 5 screens, 2 printers. M243 with 192k RAM & 1.4 Mb F/D £5087.
SPC/1 (£3140)	Digital Data: 01-573 8854	96-1056k RAM: 8085 A-2: dual 5¼" F/D (280k): 12", 24 x 80 VDU: 2 x RS232 ports: Option: Up to 106 Mb H/D	Mikados, Comal: Pascal: A.	Expandable to multi-user system (8 users). BT 7/80 (S).
Superbrain (£1750)	Icarus: 01-485 5574 (45)	64k RAM: 2 x Z80: dual 5¼" F/D (320k): 12" 25 x 80 VDU: 2 x RS232 port.	CP/M: A: *Basic: Cobol: Fortran: APL: Pascal*	Limited graphis, Mainframe int avail. With 676k F/D £2090, 1.5Mb £2345. With 5Mb H/D & single 338k F/D £3950. BT 8/80. (S&H)
System 10 (£2995)	Millbank 01-788 1083 (TBA)	64k RAM: Z80: dual 5¼" F/D (700k): 12", 24 x 80 VDU: 2 x RS232 port: P/P	CP/M: *Basic: Fortran: Pascal: Cobol: PL/1: W/P*	12 month warranty. Maint. contracts. Applications packages avail. Choice of high level language in price. (E)
Tandberg EC10 (£3250)	Tandberg: 0532 774844 (N/A)	64k RAM: 8080 A: single 8" F/D (250k): 12" 25 x 80 VDU: 7 x RS232 ports: printer int.	CP/M: Ex Basic (24k) *Multi-user Basic: Pascal: Cobol:* A: U:	Up to 7 terminals. Includes V28 comms port. (S&H)
Tandy PC-2 (£179 inc VAT)	As above	3-11k RAM: CPU: 16k ROM: 26 char LCD	Basic:	System with dual cassette int. and miniature four colour plotter £338 inc VAT. RS232 port aval. soon. (B)
Tandy TRS-80 Model 1 (£174)	Tandy: 0922 648181 (200)	16-48k RAM: Z80: C: 12", 16 x 64 VDU: RS232: P/P	Basic (12k ROM): A.	Fully expandable. Option: single 5¼" F/D (175k) £320 (up to 4). Many extras available. 32k RAM £260. (I)
Tandy TRS-80 Model II (£2347)	As above	64k RAM: Z80: single 8" F/D (500k) 12" 24 x 80 VDU: 2 x RS232 port: P/P	Basic *M/A Fortran: Cobol* 3-32 Mb H/D	Option: single 8" F/D (500k) £782 (subsequent £391, up to 4). 8-32Mb H/D
Tandy TRS 80 Model 3 (£434-£1477)	As above	See Model I Levels I and II		Fully integral unit. Up to 2 integral and 2 external 5¼" F/D. BT 8/81
Tandy TRS-80 Colour (£209)	As above	16-32k RAM: 6809: 8-16k ROM: C: 16 x 32 TV int: RS232 port.	Colour Basic.	With 16k RAM, 16k ROM & Extended Colour Basic £261 (I). BT 9/81.
Tandy TRS-80 Model 16 (£3651)	As above	128-512k RAM: Z80A 68000: dual 8" F/D (1-2Mb): P/P: 2xRS232 port.	TRSDOS: A: *Cobol Basic*	Will run all Model II software. System with single 5¼ F/D (600k) and 8Mb H/D £5911. Options: 8Mb H/D £2173 (up to four): 640x240 high res graphics: Multi-user system avail. soon. (S)
Tele Video TS800 (£3100)	Colt 01-577 2686	64k RAM: Z80A: dual 5¼" F/D (700k):P/P: S/P: 24x80 VDU: 80 cps printer.	CP/M: *Basic: Cobol: Fortran: Pascal*	Fully expandable to local area network with 16 users. 8 and 16 bit versions avail. and full set of application software. (S)
Terodec PBM-1000 (£4020)	Terodec: 0734 664343 (40)	80k RAM: Z80A: single 5¼" F/D (819k): 6Mb H/D:2xS/P: P/P	CP/M CP/Net CBasic: *Fortran: Pascal: Cobol*	System with Okidata 80 printer: TV1 910 VDU: W/P and various application packages £5995 (S&H)

List of Abbreviations

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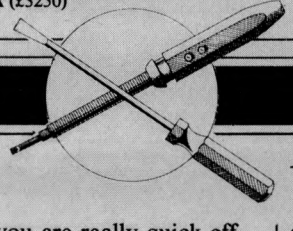
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
TI 99/4A (£199 inc VAT)	TI: 0234 67466 (TBA)	16-48k RAM: 26k ROM: 9900: 2 x C int: 24 x 32, 16 colour TV int: 3 tones & noise: P/P.	OS: Basic.	12 month guarantee. Options 32k RAM: 2 x RS232: 3 x 5¼" F/D (92k each): Speech Synthesiser.
Tuscan CP/M Starter (£999)	Transam: 01-405 5240 (N/A)	24k RAM: Z80: single 5¼" F/D (190k): Cint: TV int: RS232 port: P/P: N/P.	CP/M: *Basic: Fortran: Pascal: Cobol:*	Options: single 5¼" F/D (190k) £155: single 5¼" F/D (370k) £285: 16k RAM £162: 3 Mb H/D £1450: 20 Mb H/D £2970 (S&H)
Tuscan Starter Kit (£299)	As above	8k RAM: Z80: Cint: 56-key K/B Options: Case £110: 5 x S100 sockets £20: TV int £3.50	8k Basic	Fully assembled version £499 BT 1/81 (H&S)
Vector MZ (£2650)	Almarc: 0602 52657 (3)	56k RAM: Z80A: dual 5¼" F/D (630k): 3 S/P: 2 P/P.	CP/M: Basic: *Algol: Cobol: Pascal: Fortran: Coral: CBasic: A.*	High resolution graphics. Also system B with video board & terminal £3450. (E)
Vector System 2800 (£4600)	As above	56k RAM: Z80A: dual 8" F/D (2.4 Mb): 3 S/P: 2 P/P	As above	High-res graphics. Many Options. Fully expandable to 5005 multi-user system (max 5) £5400.
VIP (£2650)	Almarc 0602 52657 (3)	64k RAM: 3k ROM: Z80B: single 5¼" F/D (630k): 12", 24 x 80 VDU: RS232 port, 3 x P/P	CP/M: *Basic: fortran: Cobol: Pascal: A.*	Up to 3 additional F/D drives. Options: dual 8" F/D (2 Mb) £1063, 32 Mb H/D (TBA). (H&S). BT2/81
Windrush 6809 (£2418)	Windrush 0692 405189	56k non-volatile CMOS RAM: 6809: 2xRS232 ports: 2xP/P: dual 5¼" F/D (700k)	OS-9: *Flex: Uniflex Basic: A: PL9: SPLM: Cobol: Fortran: Pascal*	Designed as development system for industrial control/computer station for commercial OEM's. With dual 8" F/D (2 Mb) £2953. (E)
Xerox 820 (£1845)	Business Comp Sys 01 207 3344	64k RAM: Z80: single 5¼" F/D (162k): 12", 24 x 80 VDU: 2 x RS232 ports: P/P	Monitor: *CP/M: Basic: Cobol: Fortran: Pascal.*	With 8" F/D (500k) £2250. CP/M £95. BT 1/82 (S + H)
Zenith WH-11A (£2673)	Zenith Data Systems 0452 29451 (TBA)	LSI 11: 16-32k RAM: 25 x 80 VDU: S/P: P/P.	*O/S: Basic, Fortran:* A: U.	PDP 11-compat. Option: 2 x 8" F/D (1 Mb). £1717 (S&H).
Zenith Z89 £1570-£1710	As above	16-48k RAM: Z80: single 5¼" F/D (102k): 12" 24 x 80 b&g vdu: RS232.	*Basic: A: HDOS:* CP/M: *MBasic: CBasic: Fortran.*	3 x 5¼" F/D possible. Options: dual 8" F/D (1 Mb) £1717, 20 Mb H/D.
Zilog MCZ 1/05 (portable): MCZ 1/20A (£3250)	Thames Systems: 084421 5471 (N/A)	64k RAM: Z80: dual 8" F/D (600k): RS232 port: MCZ1/20A only 1 P/P: Option: 10 Mb H/D £7100	RIO: O/S: *Cobol: Basic: Fortran: Pascal: M/A: U.*	Available desk top or rack mounted. Debug in 3k PROM. 1/20A runs multi-user Cobol, up to 5 terminals with 40 Mb H/D. (S&H).

ACC NEWS



Rupert Steele presents his monthly round-up of news from the Amateur Computer Club.

If you are really quick off the mark, there is still time to register for the inaugural editors' conference for Club Spot 800. This, as I'm sure you know, is the chance for the hobbyist on the bus to play with the big bad system, Prestel. Not only will there be a wealth of interesting information on Club Spot 800, and generally on the Micronet 800 database, but individual hobbyists will be able to edit their own pages on Prestel (provided that they are a member of a computer club known to the ACC, as the space on Club Spot 800 will be allocated to clubs, not individuals).

Anyway, the conference is on Saturday 26 Feburary, at the Institute of Grocery Distribution, George Lane, Letchmore Heath, Watford. Admission is *free* by registration in advance (contact me on Oxford 0865 512811) or £5 on the door, subject to space being available. It kicks off at 2pm, and the provisional programme looks like this:

2pm Registration and coffee.
2:30 Introduction to Club Spot 800 — Robin Wilkinson (Editor-in-chief, Micronet 800).
3:00 Editing on Prestel: Introduction to the mechanics
4:00 Hands on session and coffee.
5:00 Organisation of Club Spot 800.
5:30 Summary and questions.

If you can't make it, or don't feel like editing yet, please look in at what's up by keying *8008# on your Prestel machine.

The North West Association of computer clubs has recently elected some officers (at least provisionally), so you have somebody to contact — namely the secretary, Clive Tallon, 27 Basnett Street, Burnley, BB10 3EQ; phone (0282) 34638. All clubs in the Manchester area (presumably Merseyside as well) should have been contacted by the Association; if your club hasn't, then you might wish to contact him. A meeting of the Association is scheduled to have taken place on 20th January, at which the detailed arrangements of the association will have been worked out.

At this meeting, they are aiming to have sorted out various forms of cooperation, including exchange of information about each other's activities, exchange of computing information, a lecturer list, attending exhibitions (it's a considerable strain on a club's active members to attend every exhibition in the area, but shared stands for the less major events may well be the answer). They may well be considering ways to help new clubs flourish in centres that are remote from existing clubs, and will be generally finding ways to support each other's activities.

This cosy little arrangement was all set up using the clubs listed on the ACC database, so if your club isn't on there, then you won't be contacted, nor will we be able to point any local clubless individuals in your direction. Get the message? To get on the database, simply write to me and tell me what you're doing — we have an information pack to help new clubs start up.

According to Robin Bradbeer, personal computing is taking off in the UK in a really big way. Plastic computers, such as those made by Uncle Clive, Commodore and others, have been very popular indeed, with predictions of at least 1.2 million sold by the end of '83. This could make the UK the country with more personal computers per capital than any other in the world. If the opportunity were taken, we could be one of the most computer literate societies in the world, which might just be important economically. But this country has a very strong record for missing opportunities; I'm sure that they'll contrive to pull it off again.

Personal computers, particularly the mass-market ones (ie, those costing less than the BBC machine), seem to be becoming the next 'train set'. Just as Daddy bought son a train set and then had at least as much fun with it as the son did, now he buys son a computer ('After all, it must be good for his school work'), and plays with it for hours. This trend is particularly noticeable at the smaller regional exhibitions, where bewildered but keen parents

ACC NEWS

are whisked from one stand to another by excited junior. I think that the decision of many major shopping chains to stock simple personal computers is a welcome one, and my spies tell me that 'own brand' plastic computers, similar to Uncle Clive's machines, may soon be appearing.

A quite extraordinary computing black hole has come to my notice. Birmingham may well be a black hole for other reasons but I would really expect to find more computer clubs in the area of the UK's second largest city (not to mention Coventry and all the places around Brum). So, if you're involved with a computer club in the Midlands, send me information and we'll put you on the database.

Down in Zomerzet, where the zyder apples grow, a Mr D G Carrington, of 2 Romsey Road, Yeovil, Somerset, BA21 5XN has had his arm twisted into becoming Secretary of the Yeovil Home Computer Users' Club. So write now to him for more information if you're a Yeovilite in need of a computer club.

Moving north, but staying west, we find the Worcester and District Computer Club: contact Mr D J Stanton, 55 Vauxhall Street, Rainbow Hill, Worcester — or pick up the dog and bone and dial (0905) 22704.

In a close scrape with Wales, we move to Hereford, to visit the Hereford Amateur Computer Club (or HACC for short: I like the acronym!). The guy who's getting this new group together goes under the totally appropriate name of Stuart Edinborough, and he lives at 3 Warwick Walk, Bobblestock, Hereford, HR4 9TG. Tel: (0432) 269700 to help him get the club together.

Even further west, you may meet Mr Thomas Moriarty, whose club appeals to hardware hackers, programming purists (alliteration addicts?) and game players; Mr Moriarty lives in Eire, at 'Tiger Bay', Rochestown Road, Douglas, Cork and his phone number is 021-293651.

Going from west to north, we find the 'Skye and Lochalsh Computer Society' (can anybody think of a catchy acronym for that?), a group operating on the Isle of Skye, with a widely scattered population in an area 80 miles (including a ferry) from end to end. Mr C J Manvell is the man to contact, living at 'Tigh na Paire', 25 Brealais Iosal, Isle of Skye, IV42 8QA.

Not quite so near the Arctic Circle is the Stockton Amateur Computer Club, or SACC for short. They have 37 members rising weekly (rising weekly to do what?), according to the letter I received from their inappropriately-named organiser, Mr P J Cheshire, of 60 Croft Road, Eaglescliffe, Stockton-on-Tees, Cleveland, TS16 0DY. They meet Mondays in Stockton YMCA at 7pm.

Back south of Watford Gap, we get to Luton, where a Mr J P Fletcher, of 1 Trowbridge Gardens, Luton, Beds, LU2 7JY is in the process of starting a computer club. So if the sound of jets overhead is boring you in Luton, why not drop Mr Fletcher a line and see how his venture is going.

Better stop plugging now; next month there will probably be an instalment from the south, yes those nasty personal computer things are beginning to penetrate the conservative fortress that is Surrey.

For more information on the ACC, or Club Spot 800, please contact me: Rupert Steele, (ACC), St John's College, Oxford, OX1 3JP; telephone Oxford (0865) 512811.

TRANSACTION FILE



Readers will be pleased to know that, due to our clever layout ideas, the Transaction File is up-to-date and waiting cut down considerably. Ads are accepted only on the form below for a flat fee of £2.50. Please don't specify issues as we can't oblige. Ads cannot be repeated unless separate forms are sent in. We will only accept entries from non-commercial readers. Thank you for cooperating.

● Green Screen Monitor, 12in Nec Audio Channel, best available, brand new boxed, list price £172, sell for £95. Hitachi Micro compatible cassette, unused, boxed £20 Burgh Heath 50318.

● Superboard II 8k RAM 32x32 display. Cegmon cased, power supply, modulator built in £75. Maidstone 678782 Eve.

● Commodore CBM 4032, wide screen, new cassette recorder, Basic and MC-Code teaching courses, manual etc. £150 of software, absolutely perfect condition, worth £1000, 9 months old. Offers? Tel 0458 42389.

● Acorn Atom 12k+ Ross toolkit 8 months old new keyboard excellent condition PSU+ leads+£100 software Acornsoft packs 1,4,8,9,11+ adventures Invaders Defender offers around £220 phone Steve (eve) 0775 840607

● MZ-80K programs. Alien attack, Fruit Machine, Music Box, PUC, Monster, Cross-words. £5.00. House accounts, gas, electric £4.00. Cheque +50p postage to Phelps, 5 Sinclair Drive, Hampton Dene, Hereford.

● 8032 Software Word Pro 4+ £185.00. Visicalc £75.00, Petaid £145.00. Quick sale — buying house. Simon, Redhill 0737 60986.

● Offers for Surplus Pertec 9 track tape transporters model T7840/9/12.5 C/W Formatter Interface +PSU one unit cabinet mounted. One set of 4 items boxed. Tel 06076 66539 day 0602 392802 Eve

● IC Logic Tutor, large plugboard, patch leads, many logic modules, 2 manuals. By Feedback Ltd CK356 £140 tel 0438 67829 (Herts).

● Sharp MZ-80K -48k guaranteed til Nov '83. Green screen, software valued at £400 includes languages, calc 3.1, home budget and 55 games. Computer/software manuals. £350 for the lot. Tel 01-368 7197 eve.

● Apple II accessories Microsft Z-80 softcard W/manuals £120. Parallel printer card (Apple) £50, cable for card £10. Apple project manager program W/manual £80 tel: 06755 2204 eve (Hampton in Arden).

● CBM PET 32k. New ROM, as new, audio cassette with counter, toolbox & arrow chips, tons programs: Games, utilities, education, manual & PET revealed £495. — Might deliver 01-856 3477.

● TRS80 model 1 level 2 16.K CPU VDU cassette leads games, User group newsletters. other mags. all for £300 ono Stafford 0785 823499

● Billings BC-12F see 'In Store' PCW Sep '82 described "Which Computer" Aug '80. 2 Basics Fortran Cobol Assembler Screen Eidtor Document Processor, Advanced System Files, especially suitable confidential records. Decwriter IV. Offers (workdays) Dr Bevans Leeds 0532 433144.

● Sharp MZ-80 P3 printer and alternative CG ROM £275. including interface card manual. Universal interface cards fitted with 4 ports, expandable to 8. £20 tel 0706 40877 (S.Fielding)

● VIDEO GENIE 16k with Scramble Star Trek, T Bug Cosmic Fighter and many more £240 ono tel Ascot 21290 (with cassette recorder) vgc.

● Transtec 12in green screen monitor, excellent condition, little used. Cost £115, bargain at £80 Contact Keith Larkin 31 Hendley Drive, Cranbrook Kent TN17 3DY.

● Acorn ATOM, 12kRAM 16k ROM including: toolbox, RP ROM, good PSU, books, leads and much software:- Galaxians, Maths, Pack, etc, 1 year old, cost £300+ accept £125 Tel: Guildford 898438.

● ASR33 Teletype for sale. Needs slight attention, hence cheap. Will deliver in Aylesbury or Deesidfe areas. Tel: Wendover 0296 625156 eve or weekends.

● Sharp MZ80A 48k practically unused and brand new with Pascal Forth machine code, 100 programs, dust cover, + Sharp software package £500 Tel Anurag on 01-651 3642 eve only.

● For sale: "Teach Yourself Typing In 8 Hours". (Teaches correct use of letters on computer keyboard) £7.50. Wanted Sinclair SPECTRUM and printer. Tel 01-304 1946

● Sharp SP4015 Pascal with manual for MZ-80k. As new, £35 ono Tel 02816 (Fulmer) 2015 after 7pm.

● Acorn ATOM 12k + 12k, FP, PSU, connectors, manuals, games and data base tapes, Less than 1 year old, hardly used, still in manufacturers carton. Only £128. 01-449 8462 eve.

● ZX81 with 32k RAM includes leads, adaptor, manual, some software, and book on machine code. Good condition, still with origianl packaging. £70 the lot, Tel: Peebles 0721 21340

● BBC model B + cassette, leads, user guide, dust cover and BBC programming book, £370. Owner buying Kettledrum instead. Tel Mark Smith 01-855 3701 weekends or after 6pm.

● Texas TI-58 programmable, 480 program steps £60 memories + master library module containing 24 programs, + charger RRP. £65 unused, 6 months old, excellent condition only £45 Petersfield 3345 (Hants).

● VIC 20 — cassette unit, joystick, 8k RAM pack, and manual. Over £70 of games, all boxed, as new for only £135 ono. Tel: 01-907 9516,.

● Acorn ATOM 12k RAM floating joint EXT power supply. Handbook, magic book; Acornsoft games, business tapes. £140 Longfield 04747 2620 Kent.

● Sharp MZ80k -48k Sharp interface unit and P3 printer. Basic, Pascal, machine code, word processor, Arcade games, and 100's other programs. All excellent condition. £550 ono Tel Glasgow 041 956 1689.

● HP41C hand held computer complete with Quad Memory module, manuals overlays. As new only 8 weeks old. Genuine reason for sale, will accept £175 Tel eve 051-356 4790.

● Sharp MZ80k 48k. Price includes Knights Commander and 100+ programs. Manual, Basic, cojmplete with box. £300 Tel 0259 51793 after 6pm.

● Atari 400 48k Basic T Horn Jumbo Jet ROM, 410 recorder, jystick, manuals £279. 810 disc drive almost new £249. 01-680 5642.

● Osborne 1 protable computer. Little used, 64k twin disks, complete with all software, original packing and extra leads. All as new, save £500. £880 tel: Weaverham 0606 853570.

● BBC micro model B cassette recorder, Basic programming book, Ghost maze, Beebug issues £349. Tel 0378 76144 day or 0422 51263 eve.

● Teach your child to tell time, count money. SPECTRUM 16k. £5.50 for 2 fun programs on cassette, super graphics and sound. Vera Sampson, Richmond House, Ingleton, Carnforth, Lancs LA6 3AN.

● Wanted Superbrain computer; Also Dot Matrix printer, Tel Jenny Carr Kenilworth 0926 55064 eve/weekends or work 0203 418938.

● Nascam 2 computer 32k RAM 8k Microsoft Basic. PSU. Cased and ready to run, complete documentation. £195 or offer. Tel Clevedon 878238.

● TRS 80 L2 48k, VDU disc drive, system desk, all cables and manuals. Software on disc, Arcades Adventure etc: £550 for quick sale. Tel 022143176 eve or weekends Tom heydon.

● PET 4032 4.0 Basic, 12 months old, + cassette, Epson MX80F/T printer, toolkit. Software includes Chess, Wordpro, Startrek, Strathclyde, Zombie, Pools. 3 manuals. Demos given. £800 ono. Tel Stanton St John 285.

● Sharp MZ80k with Quantum Hi-Res graphics, Zen assembler, Shappsoft Forth, Reset button, green screen, dust cover, manuals, many programmes inc. Chess Cribbage Super Copy £350 Reading 0734 585565.

● Acorn ATOM fully expanded + floating point, 2 utility ROMS, and over £150 of software. Also includes power supply, leads, and manual: Worth £400 want £260. Reigate 40465 (after pm).

● Wanted Apple II Europlus with disk drives, Printer etc. Tel Boston Spa 0937 843661.

● UK101 8k RAM new monitor power supply cased and compshop built; All unused and in perfect condition with manual £150 ono Simpson 12 Station Rd Upminster Essex Tel 04022 21150 or 50615.

● Sharp MZ-80B 64k CPM dual floppy disks virtually unused complete with original packing £1400 ono Tel Newbury 35734.

● Acorn Atom 12k RAM 12k ROM 4k toolbox ROM via new style keyboard. 5V 5 Amp PSU lots of software upgradeable to BBC Basic and colour £195 tel 01-464 1031 after 5pm.

● Nascom 1 T4 monitor. Tiny Basic ROM 32k expansion board. Mounted stnadard ack, separate cased keyboard, 8k Basic tape. £125. Desk £25 Staples 39 Park View, Sedbury Chepstow Gwent. Tel 029 12 70715.

● 32k Pet must go! £300+ free software including Invaders, Super Glooper, 3D Startek, Acrobat, Extramon. Also reset key and toolkit & Rabbit ROMS. £250 ono Tel 021 360 8395 after 6pm.

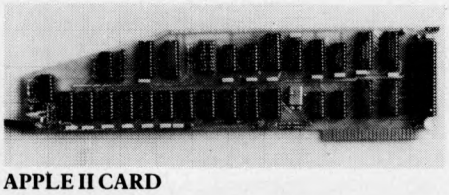
● Why wait until March for the Commodore 64 when you can buy now! Joystick, Commodore magazine, technical information sheets all for £370. Tel D Scott 01-673 0219.

512 x 512 GRAPHICS

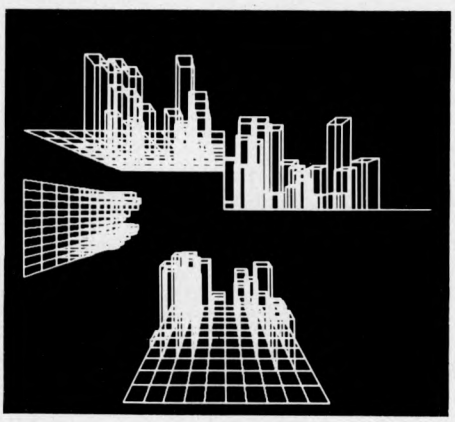
Digisolve offer you a way to increase your graphics speed and resolution. Using a high speed graphics processor our cards draw lines and characters FAST. The graphics processor works in parallel to the host machine, and gives you the power of using a co processor specifically designed for graphics. With drawing rates of up to 1,500,000 pixels per second lines appear instantly to speed up your plotting.

With the resolution, we offer new possibilities for software and systems. No longer is it necessary to consider one of the new 16 bit personal computers because of their better graphics. Digisolve offer a card designed for the Apple II to give 512 × 512 monochrome graphics. With the development of an 80 × 57 line Visicalc and Applewriter pre-boot serious business users are no longer finding 80 column cards good enough. We also offer a colour unit designed to connect to any computer and give the same resolution but with 64 colours.

Digisolve are committed to the development of graphic systems and character display equipment and have a rapidly growing soft-ware base to help you use better graphics.



APPLE II CARD



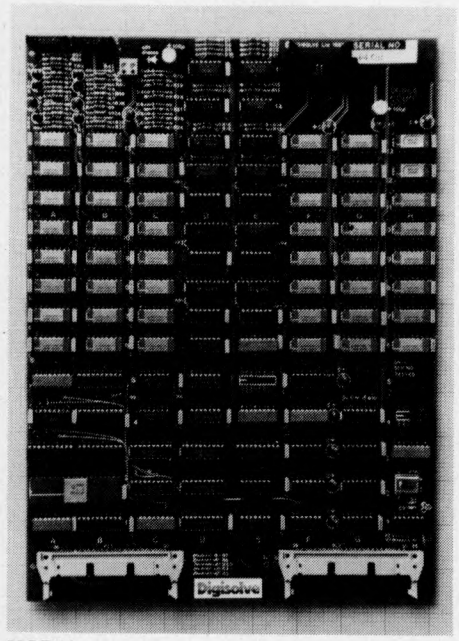
APPLE II

Digisolve's Apple II High Resolution Vector Graphic Processor Card quadruples the screen resolution and saves using up your Apple's memory space. With enhancements to Applesoft that use our card to provide powerful graphic functions software conversion is simple.

* Draws vectors at up to 1,500,000 pixels per second
* 512 × 512 pixels resolution
* Graphics and characters mixed, allows proportional spacing and up to 85 characters by 57 lines of text
* 64K bytes of on board memory will store two pictures for animation or have one text and one graphics page
* 4 different line types for clarity
* Blocks of variable sizes may be drawn to speed up area filling
* Read modify write mode for drawing cursors
* Screen read mode for dumping drawings to a printer
* £399 + VAT + P&P

SOFTWARE: Visicalc and Applewriter pre-boot. Architectural Design & Modelling. Kitchen Design. Draughting. Report Presentation.

Turtle Graphics, TASC & Apple Soft software support.



VGP64

VGP 64

Digisolve offer you high resolution colour graphics too. Designed to plug into any computer with a bus host adapter. The VGP 64 gives you 512 × 512 pixels in 64 colours. With its own vector processor and 384 K bytes of memory your computer can become a sophisticated graphics system.

* 64 colours that may be expanded with a pallette or extension video ram card
* 512 × 512 pixels resolution with fast vector processor
* 384 K bytes of video ram on board
* 2 pictures may be stored simultaneously in full colour for animation
* In monochrome 12 pictures may be stored and selected for display under software control
* Available as a boxed unit complete with power supply, or in board form to oem customers
* Will plug into Apples, IBMs, S100 systems, PDPIIs or any computer with a bus
* Available in several versions: 8 colour £799 64 colour £899

COMING SOON: Terminal emulations including TEK 4010 in monochrome and colour. Character displays 80 × 24 and A4 size.

VDU BOARD

Digisolve offer you the cheapest way to make a scrolling VDU with our intelligent 80 × 24 VDU card. With over 50 control functions the card works at up to 19.2 K band.

* 80 Characters × 24 lines of text
* Characters are properly formed with descenders
* Block graphics option
* Fully scrolling at 19.2 K band
* Keyboard and RSZ 32 data input

Digisolve

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TELEPHONE: (0977) 513141
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TRANSACTION FILE

TRANSACTION FILE ADVERTISEMENT FORM

All Transaction File ads must be submitted by readers on this form or a photo-copy of this form. Maximum 30 words. Print one word per box, very clearly. Name, address and/or telephone number must be included in the 30 words. All ads must be accompanied by a flat fee of £2.50. Make cheques or POs payable to Personal Computer World. Ads accepted from private readers only. Ads cannot be repeated (unless sent in on another form) and we cannot guarantee to print an ad in any specific issue. Please help our typesetter to help you by printing your ad very clearly. Send form to: Transaction File PCW, 62 Oxofrd Street, London W1A 2HG.

Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.

● Wanted Cromemco system 3 — Tel Mike Lawrence 0734 587661 (day) or 0784 61033 (eve).

● Atom new keyboard, expanded High Resolution modification, 12in television, GP80A printer + paper, matched cassette PSU leads, manuals, Magic book, own software, 11 games, cassettes, 40 + mags, perfect, will split, worth £740 accept £400 (0472) 48531.

● Data Dynamic RO33 Serial, 80col printer, auto motor start with stand paper tray £55.00 ono Samuel II Lower Addiscombe Road, Croydon Surrey 01-680 1010 office hours.

● Acorn ATOM 72k+16k includes FP ROM, toolkit ROM, 64k RAM board, VIA 5V/3A PSU, software: Missile Base, Snooker, etc. Complete working order, year old. £260.00p. Tel 1 Winfieldale 024610111 (work), R Alderton 074220571 (eve).

● Sharp MZ-80k -36k hardly used. Boxed. Includes games and user newsletters. £190 Tel 061-440 9882 or write/call 7 Lytham Drive, Bramhall, Stockport.

● Apple II+ 64k disc drive, DOS 3.3, Pascal system, 12in Hitachi monitor, Sound Board, software. £1100 ono Tel 01-886 5789.

● Radio Shack pcoket computer PC-2 with 4-colour printer. Extra A-k RaM and PC-2 printer carrying case cost £400 sell for £300 ono Tel weekend or eve Malvern 065-45 4930 ((VIC day).

● MZ80k +expansion unit +dual discs with controller. F Dos Basic ZEN Forth etc. almost unused. £800 ono Tel (01)-854 119 (eve).

● VIC20 with cassette unit, 16k RAM, Sargon Chess. Intro to Basic PT1, prog ref guide all boxed and in excellent condition £160 for quick sales Tel 021-360 0767.

● DRAGON software, 10 Pin Bowling, Auto Scoring, Addictive, Cassette £7. Gold, Build your own course, cassette £6 GM Newman 12 Malden park, New Malden, Surrey, KT3 6AS.

● New Prince (24 MHz) monitor £100. CCA Database manager S/W (TRS80) £50 Also unused C15 Data cassettes 20 for £10 (will split) tel (03057) 70092.

● Acorn ATOM 13kRAM +16k ROM (Acornsoft word pack), new keyboard +PSU + leads and manuals. Also 8k + 8k Acorn memory card and colour encoder £150. Tel 0223 832095 eve (8 o'clock onwards).

● VIDEO GENIE EG3003, 16k sound, built-in cassette recorder, manuals, loads of software: games, adventures, utilities, music, educational, £160 ono. David on Burntwood (near Walsall) (054 36) 3729 even.

● Rader 100 single board computer, Z80, 64k, disk interface, 80x24 VDU drive, manuals, source disk, brand new £300 also various S100 boards, monitor, PSU, KBD, cabinet £200 Mansfield 822 205 eve.

● BBC micro model B guaranteed until November 1983 £330 tel: Cleveleys (0253) 856427 weekends only.

● Wanted, computer discs, printer ect. for small business CBM. Superbrain types ideal. Please tel Cheriton Bishop 319.

● Acorn ATOM 12k + 12k 3A external power supply. Soft VDU and sales pack including Invaders. Acorn ATOM Basic book £175 tel Orpington 29127 after 7pm.

● PET to RS232C CMC non-addressable interface with ready line (DTR) £45 ono 061 792 1257 or 061 636 4296.

● GENIE I built in tape, sound, U/L case. TRS80 S/W compatible. Original manuals and leads + cover and books. 10 mnths old, hobby used hence as new. £150. Tel Slough 30563.

● CBM 3032 32k new ROm, large keyboard with power, toolkit, KRKs micetro, soundbox, 2 cassettes, over £200 games, utilities, manuals, £495 MX80/FT printerand interface £345. Tel 0865 820295 eve.

● ZX81 +16k RAM (Sinclair built) + printer + games cassettes + extra rolls printer paper. Upgrading quick sale needed. Therefore only £90. Tel 05752 3889.

● 48k Sorcerer with Basic ROM-PACK, including UHF modulator, manuals and various software £475 ono tel 0902 (Wolverhampton) 894477 (eve).

● Exidy Sorcerer 32k, S100 bus, parallel/serial I/O, Basic, Assembler development 'PAC'. Many programs, manuals, twin cassette control cables, £550 ono. ASR 33 Teletype £150 ono. Early Teletype mechanism £50 ono. Tel Northampton 710512.

● PET 8k old ROM inc. cassette, manuals, Hampshire PET revealed, Donahue and Enger CBM Guide, first two years of printout, Commodore cassettes. £175 ono. Woking 23005.

● Sharp MZ-80K 48kRAM, extended Basic Forth, systems programs, Disassembler +games manuals and User Club notes £30 ono. Tel Moulton Chapel (STD 04067) 353.

● ZX81 16k RAM Sinclair built. Complete with leads, power supply and manual. Perfectly working. Music program and Sinclair magazines. Interface included E60 ono Tel 01 767 6569.

● TRS-801,III/Genie 16k software, 8 fabulous machine/code programs, Editor — assembler, eleminator, Caterpillar, Scramble, Firebird, Galaxy Invaders, 16k copy, Super Nova. All in original tapes AND instructions £50 for 8. Tel Anil 01-570 6016 after 5.00pm.

● MZ-80B 64k, twin graphic RAMS; dual disk unit, interface, cables; MZ-80P5 matrix printer with graphics, disk Basic etc. Original packaging £1700 for everything. Tel Jeremy Turner 01 607 3325. daytime.

● Texas T199/4A micro-computer with speech synthesiser, speech emulator I, 1 game + manuals, £240. Tel 01-381 53842 Mrs Williams.

ITT 2020, 48k Applesoft and Palsoft ROMS, software, bargan £320, APple II 143k disk drive, £195 Seikosha GP80A Printer as for BBC and Genie, £140, Intellivision Mazatron cartridge, £12.00 tel Bristol 603252.

● Casio EX702P and FA2 interface £70 only 8 months old. Write, Climie, 91 Mosspark Avenue, Glasgow GS2 1LQ.

● TRS-80 Model-1 Level2 16k complete with leads, manuals, + over £40 softwar (editor/assembler; Chess). + home-made games, All for £190 or best offer. Telephone Cambridge (0223) 842238 eve.

● TRS-80 Model 1 level 2 + 48k expansion interfcace, green screen monitor, tandon disc drive and over £200's worth software and books. £550 tel 051 342 5175 Merseyside.

● TRS-80 16k LII etc and £100+ software + books, magazines CTR80. £180 ono. Epson MX70 Printer + interface cable etc £180 ono.Both above £320 ono Tel 01-303 0513.

● PET 2001 8k old ROM integral cassette deck, sound box, recently serviced, manuals, books, software dustcover £200 Tel Pudsey 0532 576921 eve.

● Sharp MZ80K — 48k memory and over a hundred pounds of software, monitor, cassette recorder. Games include Pakman, Aseroids, Space Invaders and many more. All for £300! Tel Maidenhead 74896.

● ZX81 and 16k RAM. Almost new leads, manual and mains adaptor inc. All £65 ono Steven McDonald 0360 311 341 41. Juniper Drive, Milton of Campsie. Glasgow G65 8HL.

● Acorn Atom 12k ROM 12k RAM PSU and leads under 6 mths old + over £50 of software incl. Scramble Startrek Chess Puckman Galaxians Dig-Dug £180 Tel Derby (0332) 514033.

● BBC micro, model B. Hardly used, includes all original packing, leads, manual etc. + some games and educational software, S350 ono, + £10 for Epson Printer lead. Tel 01-904 1311.

● VIC-20 + Arfon motherboard, 16k cartridge, super expander cartridge. As new all leads, manuals, etc included £225 for quick sale. Might separate. Tel: Welwyn 7667.

● Microline 80 — Reliable little printer. Can be interfaced to most computers, Friction, pin or tractor feed, Full working order £130 Buyer collects or pay delivery. Tel: 01-670 8605 eve.

● 2 Teletypes for sale. ASR33 £50 and ASR35 £20. + manuals and spares. Also Tektronix Scope £40. Tel St Albans (0727) 30305 after 6.00pm.

● Nascom 2 16k fully cased and working documentation and tape recorder £300 ono 01-485 4773.

● Open University course PT502. Self contained course comprising computer, expansion board and detailed manuals for teach yourself Z80/8085 assembler and machine code. Cost £400 new. Accept £250 A Taylordaytime 05097 2386.

● HP41C Alhpha, numeric, programmable calculator with card reader and quad RAM. Unwanted xmas present first sensible offer secures Tel Michael Cranwell (0400) 61770 eves & w/ends.

● Apple II+ 64k, disc-drive, Hitachi monitor, joystick, paddles, MX80 +graphics interface. Complete basugs, windfalls. ALl manuals inc. Pascal etc. Tons of software: games, business, Pascal etc £1500. Tel Robert on 01-455 7308.

● TRS80 LII 16k system and covers, all one year old + games, tapes and Basic instruction tapes, books, Total value over £700 offers over £300 to 0303 81 3336.

● UK101, 8k RAM + fast load/save mod. In ABS case, with leads + manual. £99 ono for quick sale. 575 3920.

● Tektronix 555 reapir or sell. Offers? Wanted: Digital Analogue and Analogue Digital Converter as shown PCW January for TV, ready assembled and working Tel Pipe Gate (063081) 312 after 6pm.

● Acorn Atom 38k RAM Basic, Lisp, Toolbox, Wordpack, Via manuals and some s/ware £189. Tel: Redhill 68327 eve.

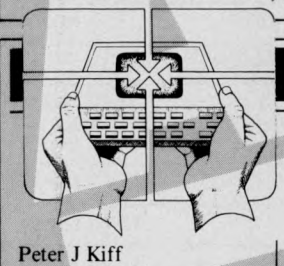
● Sharp PC-1211 with printer and cassette interface. Complete with cables and manuals. As new. £80 Tel 01-668 8541.

● Atari VCS + Binatone TV game 6 Atari cartridges inc. Missile Comand, Space Invaders, good condition with new paddles; cost £2.40. Sell £130. ono Tel London 727 3606 Adam eve weekends.

● MZ-80k Lunar Run. Adictive Basic space game. Great sound and graphics. You need skill for Asteroids, Bombs, Docking. Very fast. Send £5 inc: To Mr P Venables 29 Polsteads, Basildon, Essex SS16 4PH.

● Atari 800 (48k) disk drive, cassette recorder, Star Raiders, + loads of tape and disk software, also various magazines. Hardly usd, only 4 mnths old, £700 ono Tel Preston 734 053.

● IEEE Interface board for Epson MX80/82FT printer to connect to PET Commodore computer, Cat No 8162. + connecting lead. £64 new. As new £45ono. Can post if required.Bedford (0234) 42460.



CTUK! CONTACTS

*For further information on ComputerTown UK! see 'CTUK News' or Prestel page *800803 #*

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Broadstairs
Kent CT10 1DZ

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Tyne & Wear

Christopher Bates
Ashford Main Library
Church Road
Ashford Kent

Chris Cooper
110 Church Road
Hanwell
London W7

Bill Gibbings
2 Longholme Road
Retford
Notts DN22 6TU

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Shawfield Lane
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Rochdale OL12 7QR

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Notts

Patrick Colley
52 Queensway
Caversham Park Village
Reading
Berks RG4 0SJ

Philip Joy
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Peter Herring
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Winchmore Hill
London N21

David Sharp
5 Bridgenhall Road
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Rex Shipton
17 Woodlands Avenue
Eastcote
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Susan Kelly
Head of Reference Services
PO Box 4
Civic Centre
Harrow
Middx

Andrew Holyer
10 Masons Road
Mannings Heath
Horsham
Sussex RH13 6JP

Derek Moody
2 Victoria Terrace
Dorchester
Dorset DT1 1LS

Pam Pollicott
South Ruislip Library
Victoria Road
South Ruislip
Middx

John Stephen Bone
2 Claremont Place
Gateshead
Tyne & Wear
NE8 1TL

Derek Knight or Bob Carter
Rayners Lane Library
Imperial Drive
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Middx

Ray Skinner
62 Central Avenue
Billingham
Cleveland TS23 1LN

Brian Taylor
Tonbridge Area Library
Avebury Avenue
Tonbridge
Kent

Paul Maddison
Gardenways
Chilworth Towers
Chilworth
Southampton SO1 7JH

Peter Jarvis
c/o Health Dept
Corporation of London
Guildhall
London EC2

Vernon Gifford
111 Selhurst Road
Croydon
London SE25 6LH

Peter Stone or
Alan Strangman
Computing and Maths Dept.
The Polytechnic
Wulfruna Street
Wolverhampton WV1 1LY

Lyn Antill
1 Defoe House
Barbican
London EC2

Keith Taylor
Carter Hydraulic Works
Thornbury
Bradford BD3 8HG

Alan Hooley
21 Brammay Drive
Tottington
Bury BL8 3HS

Vernon Quaintance
50 Beatrice Avenue
Norbury
London SW16 4UN

BJ Candy
9 Oakwood Drive
Gloucester GL3 3JF

Roger Shears
18 Woodmill Lance
Bitterne Park
Southampton SO2 4PY

Chris Woodford
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Staffordshire

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or Dave Lee
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54 Foregate Street
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R L Saunders
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Herts

Brigitte Gordon
18 Purbright Crescent
New Addington
Croydon CR0 0RT

Richard Powell
22 Downham Court
South Shields
Tyne & Wear

Peter Earthy
46 High Street
Church Stretton
Shropshire SY6 6BX

Alan Sutcliffe
4 Binfield Road
Wokingham
Berks RG11 1SL

Allan Porten
14 Foxmede
Rivenhall End
Witham
Essex

E N Ryan
15 Queens Square
Eastwood
Nottingham
NG16 3BJ

NETWORK NEWS

These are all the European networks of which we're aware. Most are free — but phone them for details.

Forum-80 Hull ... (Forum-80 HQ) Tel: 0482 859169, System operator: Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours, 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10.00pm Sat/Sun 1.00pm tp 10.00pm.

Forum-80 London ... Tel: 01-747 3191. System operator: Leon Jay. Electric Mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00pm.

Forum-80 Milton ... (TRS-80 Users Group 80-Nett) Tel: 0908 566660. System operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system hours: 7 days a week 7.00pm to 10.00pm.

Forum-80 Holland ... Operator: Nico Karssemeyer, Tel: 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours; Tues-Sat 1800-0700 nightly, continuous from 1800 Sat-0700 Tues.

CBBS London ... Operator: Peter Goldman, Tel: 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

Mailbox-80 Liverpool ... 051-220 9733. System operator: Peter Toothill, Electronic mail, down-loading TRS-80 information.

ACC ... members bulletin board, Peter Whittle (0908 44262).

ABC-80 ... Stockholm (Sweden). Tel: 010-468 190522.

University Research Computer ... Sweden. Tel: 010-468 23660, guests use password "66,66" for access.

Elfa ... Sweden 010-468 7300 706.

Tree Tradet ... Sweden 010-468 190522.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

London	(Barbican Ctr) Inform'n Tech'y Office Autom'n Exbn 7 Conf — INFO — Contact BED Exbns Ltd 01-647 1001	22-25 Feb
London	(Bloomsbury Centre Hotel) Mailing Efficiency Exbn. Contact: Business Equip't Trade Ass 01-405 6233	1-3 March
London	(Royal Lancaster Hotel) Local Area Networks & Distributed Office Systems. Contact: J Street 09274 28211	8-10 March
Birmingham	(NEC) Daily Telegraph Business Enterprise Show. Contact: NEC Birmingham 021-780 4141	22-26 March
Doncaster	(Exbn Centre) Business Show. Contact: Helmar Business Services 0462 54812	3-4 March
Glasgow	(Albany Hotel & Holiday Inn) Scottish Computer Show. Contact: Clapp & Poliak Europe Ltd 01-747 3131	15-17 March
Preston	(Guildhall) Business Show. Contact: Helmar Business Services 0462 54812	15-16 March
Manchester	(Belle Vue) Computer Aided Design Exbn-CAD North. Contact: IPC Exhibitions Ltd 01-643 8040	1-3 March
Ipswich	(Gt White Horse Hotel) Computer Open day Exbn. Contact: Couchmead Communications Ltd 01-778 1102	10 March

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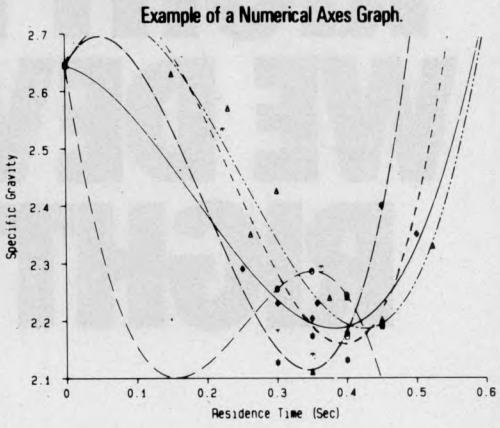

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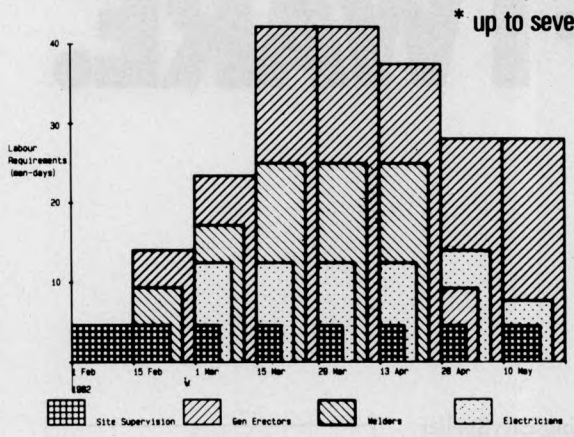

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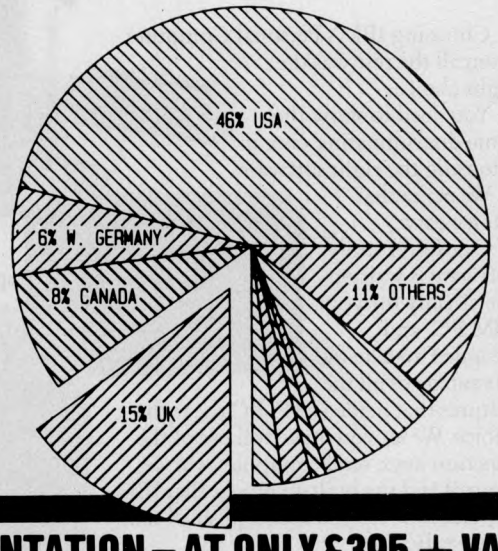

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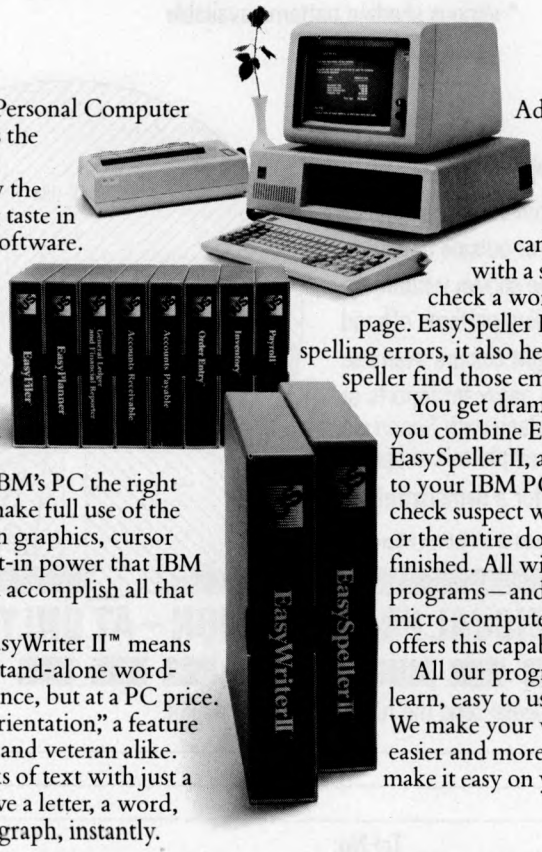

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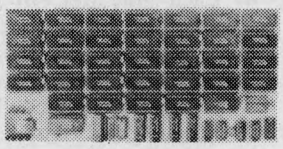

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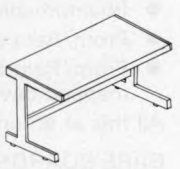

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Atari Animation

By Cliff Hatch

Program of the month this month will run (without REMs) in 16k on an Atari 400/800. I'll let the author take over here and explain his own composition.

The animation package presented here is intended to assist users of Atari Basic in the production of animated displays and games. The package sets up a machine code routine which looks after those aspects of animation requiring high speed and precise timing, leaving the user's Basic program free to concentrate on tasks such as checking joystick position, 'steering' the players, launching missiles, checking for hits, etc. Basic programmers may use the package effectively, without understanding the machine code.

In this description some background knowledge is assumed on the part of the reader, in particular an understanding of the way in which shapes may be defined using a series of bytes, and an, at least, superficial appreciation of Atari's player-missile graphics system.

The package performs the following tasks:

1) Sets up player-missile graphics in 1 or 2 line resolution and clears the player-missile table.

2) Defines a set of shapes, which may be assigned to players and missiles. The package, as listed in Table 1, defines only two 'space ships' and one, single byte, missile 'shape', but it is written in a way which allows the user to easily change these and add more definitions.

3) Sets up a machine code routine called 'MYVBI' which carries out the movement of all players and missiles. The key to the package's ability to produce smooth fast animation is the fact that this routine is tagged onto the end of the operating system's vertical blank interrupt routine (see Figure 1). This causes it to run 50 times per second, and enables it to maintain the continuous motion of all players and missiles without interfering with the operation of Atari Basic. The user's Basic program constitutes the foreground program, with MYVBI running in background. Both apparently run simultaneously and independently. A further advantage of using the vertical blank interrupt routine in this way is that all movement takes place during the blank period between television picture scans, so players and missiles move without flickering.

4) Each time MYVBI runs it picks up values for the speed, position, shape, etc, of all players and missiles from a data table. By POKEing to this data table the user's Basic program may control the motion of all players and missiles. The package initialises a set of mnemonic pointers to help the user POKE to the correct locations.

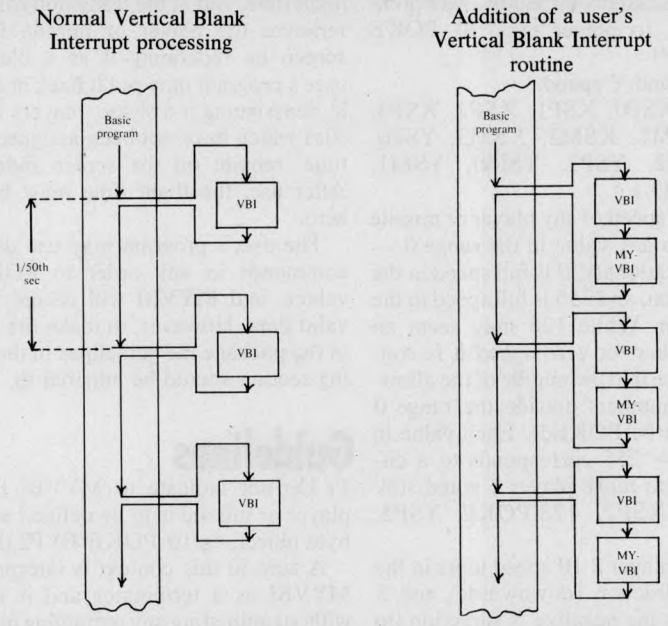

Fig 1 The system's Vertical Blank Interrupt Routine (VBI) runs every 1/50th of a second, diverting the processor from Basic program execution. By tampering with interrupt vectors we may arrange to run the user's routine (MYVBI) every 1/50th of a second as well.

5) MYVBI provides automatic wrap-around for all players and missiles; that is, a player leaving one edge of the playfield will automatically re-enter from the opposite edge.

6) MYVBI automatically performs masking operations when moving the 2-bit missiles. As far as the user is concerned missiles behave in exactly the same way as players.

7) MYVBI provides the means to launch missiles (and players) which are set to disappear from the screen after a precise time has elapsed. This is primarily intended as an efficient means to limit the range of missiles.

To use the package, firstly key in the Basic coding in Table 1 and save it on tape or disk. (Save it before attempting to run it because typing errors, particularly in the machine code data, may cause it to crash irretrievably.) Secondly, check that your version works by adding the test program in Table 2, and running it. After an initialisation period of about 20 seconds this program should make one player and one missile appear, moving, on the screen.

The test program illustrates the general procedure for using the package. The user's program first calls the package as a subroutine (by GOSUB 11228). This call (which should be made before any DIM statements) sets up player-missile graphics and starts MYVBI. MYVBI continues to run until the system is reset. The package also sets up seven mnemonic pointers for the control of each player and missile (see 4 above). The user's program may achieve control by using these pointers in POKE commands, as follows:

1) Number of bytes:
(POKE to: BYP0, BYP1, BYP2, BYP3, BYM0, BYM1, BYM2, BYM3.)
Before using any player or missile, inform MYVBI how many bytes will be used to define its shape (this should correspond to the number of bytes in the object definition you intend to use). For example, the following line informs MYVBI that player 2 is to be defined as an 8-byte object: 10 POKE BYP2,8

2) Player and missile shapes:
(POKE to: DFP0, DFP1, DFP2, DFP3, DFM0, DFM1, DFM2, DFM3.)
Each player or missile may be given a shape, chosen from the set of object definitions contained in the package. (Note that the four missiles are each two bits wide and their definitions are combined.) Shapes are assigned using pointers. For example, the

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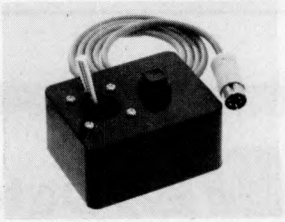

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PROGRAMS

following line assigns the shape, with pointer 'SHIP1', to player two. 20 POKE DFP2, SHIP1

3) X speed and Y speed:
(POKE to: XSP0, XSP1, XSP2, XSP3, XSM0, XSM1, XSM2, XSM3, YSP0, YSP1, YSP2, YSP3, YSM0, YSM1, YSM2, YSM3.)
The X and Y speed of any player or missile may be set to any value in the range 0 — 255. 128 is stationary, 0 is full speed in the minus direction, and 255 is full speed in the plus direction. While 128 may seem an illogical number for zero speed it is convenient to have it in the middle of the allowable range (numbers outside the range 0 —255 cannot be POKEd). Each value in the range 0 — 255 corresponds to a different speed, to make player 2 stand still: 30 POKE XSP2, 128:POKE YSP2, 128

So to give player 2 10 speed units in the positive Y direction (downwards) and 5 speed units in the negative X direction (to the left); 30 POKE XSP2, 123:POKE YSP2, 138.

4) X positions and Y positions:
(POKE to: XPP0, XPP1, XPP2, XPP3, XPM0, XPM1, XPM2, XPM3, YPP0, YPP1, YPP2, YPP3, XPP0, XPP1, XPP2, XPP3.)
The X position of any player or missile may be set to any value in the range 0 — 255 (left to right). The Y position may be set to any value in the range 0 — 255 (top to bottom) in 1 line resolution, and 0 — 127 in 2 line resolution. In 2 line resolution Y positions in excess of 127 are still valid, but are automatically wrapped around, so that 128 is the same position as 0, 138 is the same as 10, and so on. The following line would put player 2 in the middle of the screen (in 2 line resolution); 50 POKE XPP2, 128:POKE YPP2,64.

5) Flight time:
(POKE to: FTP0, FTP1, FTP2, FTP3, FTM0, FTM1, FTM2, FTM3.)
If you require a player or missile to continue flying across the screen for a limited time only (ie, to have a limited range) then you may assign it a flight time. For example, the following line would cause player 2 to disappear from the screen after exactly 2 seconds: 60 POKE FTP2, 100

The flight time may be set to any value in the range 1 — 255, and it represents the number of 1/50ths of a second for which the player or missile will remain on the screen. Each time it runs, MYVBI decrements the flight time, and at the transition from 1 to 0 removes the player or missile from the screen by redefining it as a blank. The user's program may put it back at any time by reassigning it a shape. players and missiles which have not been assigned a flight time, remain on the screen indefinitely. After use, the flight time must be set to zero.

The user's program may use the above commands in any order to POKE any values, and MYVBI will accept them as valid data. However, to make the best use of the package the guidelines in the following section should be adhered to.

Guidelines

1) Do not indicate to MYVBI that any player or missile is to be defined as a zero byte object, eg 10 POKE BYP2,0.

A zero in this context is interpreted by MYVBI as a terminator and it will exit without animating any remaining players or missiles (the order of movement is P0, P1, P2, P3, M0, M1, M2, M3).

The following line has the obscure (but possibly useful) effect of freezing all player and missile movement until repeated with a non-zero number of bytes: 10 POKE BYP0,0

2) As far as possible keep all player object definitions to the same number of bytes (even if this means padding out the definitions of small objects with blanks). Also avoid changing the number of bytes assigned to a player or missile once set. Not only will this procedure simplify your program, but it will also reduce the possibility of leaving 'stray bits' in the player missile table. For example, suppose player 2 is initially defined as an 8-byte object, and is subsequently redefined as a 3-byte object. MYVBI will then immediately cease to recognise 5 bytes of the original object, and these may be left behind as player 2 moves across the screen.

3) When launching a moving object, define its X and Y speed first and its X and Y position and shape last. This prevents the object moving to far from its intended position as a blank, before appearing on the screen. Note that all players and missiles which are not on the screen at any one time, are in fact present and being maintained by MYVBI, but are defined as blanks and so cannot be seen. Adopting this slightly primitive arrangement reduced the amount of coding required to write MYVBI.





4) Use traps to handle attempts to POKE values outside the range 0 — 255. This is much more efficient than the alternative of testing values before POKEing.
5) The control of players and missiles by POKEing to specific locations has been described. Similarly the user's program may PEEK any of these locations to determine the current position, speed, shape, etc, of any player or missile. MYVBI continuously updates X and Y positions according to each object's X and Y speed.
6) Use player missile graphics, colour, size and collision registers in the normal way. The package sets up mnemonic names for these ready for your use.
7) The package works with any graphics mode, but care must be taken to ensure that the player-missile table does not encroach on screen memory. More RAM may be made available for graphics by subtracting more pages in line 11336, Table 1. Subtract multiples of 4 pages and 2-line resolution, and multiples of 8 pages for 1-line resolution. Fortunately, if the player-missile table does overlap screen memory. The normal effect seems to be corrupted screen images rather than a system crash. In this case a suitable number of pages to subtract may be found by trial and error. Changing from 2 line to 1 line resolution doubles the size of the player-missile table, and this too may cause overlapping with screen memory. The same solution applies.
8) Faster speeds for players and missiles may be achieved by modifying lines 12201, 12202 and 12211 in the package as follows:

12201 DATA 104, 168, 76, 3, 6, 200, 177, 203, 73, 128, 16, 8, 162, 240, 142, 203

12202 DATA 6, 76, 185, 6, 162, 0, 142, 203, 6, 170, 10, 10, 10, 10, 24, 200, 113

12211 DATA 203, 145, 203, 8, 138, 74, 74, 74, 74, 9, 255, 40, 200, 113, 203

This modification may be of value to compensate for the effective halving of Y speed when changing from 2-line to 1-line resolution.
9) The package makes heavy use of variable names. It uses 108 in all which is only 20 short of the maximum. However, most of these variables are mnemonic pointers, set up specifically for use in the user's program, and the demand for additional variablers should not be high. The use of mnemonic pointers improves the readability of the user's program and enhances its speed (POKEing to named locations is faster than obtaining an address for each POKE by evaluation or array access).

If you run out of variable names (and get an 'ERROR 4') it is extremely unlikely that you will be using all the variables set up for your use by the package. In this case the problem may be overcome by the following procedure:
a) Remove references to any unused colour, size or collision registers by selectively deleting lines 11238 to 11284. Up to 25 variable names may be saved.
b) Selectively delete lines 11477 to 11492 to remove references to any unused players or missiles, saving 7 variable names apiece. For example if you are not using missile 2 then you may delete lines 11489 and 11490.
c) Remove deleted names from Basic's variable name list. This is done by saving the untokenised form of the program and reloading it. For example, using the cassette recorder: SAVE with list "C:", type NEW, and reload with enter "C;".
10) The priority for players' missiles and playing fields are not set in the program, so the user's program must set GPRIOR itself otherwise players 3 and 4 will be lost.

Limitations

The use of Basic to control animation is worthwhile because of its simplicity, popularity, and ease of use. However, it is not an ideal language for this type of application. With the assistance of machine code routines like MYVBI its capabilities can be improved, but the main factor limiting the complexity of dynamic games is still likely to be the speed of the user's Basic program.

The machine code routine MYVBI was written in a deliberately simplified and generalised form (mainly so that it would conveniently fit onto page 6 of memory, which is left free by Atari Basic). As a result the routine is not as efficient on processing time as it could be, and causes an apparent slowing down of the user's Basic program. This effect may be minimised by avoiding the use of excessively large players and missiles. Single object definitions for players and missiles may be as large as 128 bytes, but it is recommended that a working maxim;um of 16 bytes be adopted.

A further minor limitation of the package

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PROGRAMS

is that any event which disturbs normal vertical blank interrupt processing (eg, the execution of error traps) will disturb the motion of all players and missiles. Fortunately events of this type appear to be infrequent and their effects minimal.

Conclusions

The animation package enables animated games and displays to be created with Atari Basic. Players and missiles with intricately defined shapes may be moved freely around the screen in 1 or 2 line resolution. Smooth continuous movement is maintained by the machine code routine MYVBI.

Although the complexity of dynamic games is practically limited by the speed of the user's Basic program, good results should be obtained by either limiting the number of players and missiles used (eg, games like Space Duel, Moon Landing, Tanks etc) or by limiting the amount of controlled movement taking place at any one time (eg, Adventure-type games).

```
10991 REM ***********************************************
10992 REM *                                             *
10994 REM *                                             *
10995 REM *              A BASIC LANGUAGE               *
11000 REM *          ANIMATION PACKAGE FOR THE          *
11002 REM *              ATARI 400/800.                 *
11005 REM *                                             *
11010 REM *       CLIFF HATCH.      JULY 1982.          *
11020 REM ***********************************************
11021 REM
11022 REM CALLED ONCE (BY GOSUB 11228) AT START OF USER'S PROG.
11025 REM
11026 REM SETS UP PLAYER MISSILE TABLE AND ENABLES PLAYER
11028 REM MISSILE GRAPHICS IN 1 OR 2 LINE RESOLUTION.
11029 REM
11030 REM INITIATES A MACHINE CODE ROUTINE, CALLED "MYVBI",
11035 REM WHICH ANIMATES ALL PLAYERS AND MISSILES IN
11040 REM "BACKGROUND MODE". "MYVBI" IS A "USER VERTICAL BLANK
11045 REM INTERRUPT ROUTINE". READ FROM DATA STATEMENTS AND
11047 REM LOADED INTO PAGE 6 OF MEMORY. IT USES 2 DATA
11048 REM TABLES STORED IN THE STRING ARRAYS "ITAB$" AND "OB$".
11050 REM
11055 REM THE ARRAY "ITAB$" CONTAINS A TABLE OF "MOVE DATA",
11060 REM THAT IS, INFORMATION USED IN THE ANIMATION OF EACH
11065 REM PLAYER AND MISSILE. THE USER'S PROGRAM MAY CONTROL
11070 REM THE NO OF BYTES, FLIGHT TIME, X SPEED, X POSITION,
11072 REM Y SPEED, Y POSITION AND OBJECT DEFINITION OF ALL PLAYERS &
11080 REM MISSILES BY POKEING INTO ARRAY "ITAB$". POINTERS
11082 REM ARE SET UP TO ASSIST IN THIS (EG. FOR PLAYER 0: BYP0,
11084 REM FTP0, XSP0, XPP0, YSP0, YPP0 AND DFP0)
11090 REM
11095 REM THE ARRAY "OB$" CONTAINS A SET OF OBJECT DEFINITIONS.
11200 REM THESE CAN BE CHANGED BY THE USER TO PROVIDE PLAYERS
11203 REM AND MISSILES OF ANY CHOSEN SHAPE. A POINTER IS
11204 REM SET UP FOR EACH OBJECT DEFINITION.
11205 REM
11207 REM TO CHANGE FROM 2 LINE RESOLUTION TO 1 LINE RESOLUTION
11209 REM CHANGE LINES: 11349, 11360, 12183 & 12193 AS INDICATED.
11210 REM
11211 REM BASIC OCCUPIES APPROX 9K (REMS INCLUDED). "MYVBI" MACHINE
11212 REM CODE OCCUPIES PAGE 6 LOCATIONS 1536 - 1761 AND USES PAGE 0
10213 REM LOCATIONS 203 - 207 (DECIMAL). THE PACKAGE WORKS
11214 REM UNCHANGED FOR ANY MEMORY SIZE GREATER THAN 16K.
11215 REM
11218 REM ***************************
11220 REM INITIALISE PLAYER MISSILE GRAPHICS MNEMONIC NAMES
11222 REM ***************************
11228 COLR4=712:REM BCKRND COLOR
11230 COLR0=708:REM PLYFLD0 COLR
11232 COLR1=709:REM PLYFLD1 COLR
11234 COLR2=710:REM PLYFLD2 COLR
11236 COLR3=711:REM PLYFLD3 COLR
11238 PCOLR0=704:REM P0/M0 COLOR
11240 PCOLR1=705:REM P1/M1 COLOR
11242 PCOLR2=706:REM P2/M2 COLOR
11244 PCOLR3=707:REM P3/M3 COLOR
11246 SDMCTL=559:REM DMA CONTROL
11247 GRACTL=53277:REM GRPHIC CONTR
11248 P0PF=53252:REM P0,PLFLD HIT
11249 P0PL=53260:REM P0,PLYER HIT
11250 P1PF=53253:REM P1,PLFLD HIT
11252 P1PL=53261:REM P1,PLYER HIT
11254 P2PF=53254:REM P2,PLFLD HIT
```


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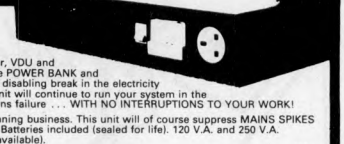

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11258 P3PF=53255:REM P3,PLFLD HIT
11260 P3PL=53263:REM P3,PLYER HIT
11262 PMBASE=54279:REM PMBASE ADDR
11264 GPRIOR=623:REM PRIORITY SELECT
11266 RAMTOP=106:REM TOP RAM POINTER
11268 SIZEM=53260:REM MISSILE SIZES
11270 SIZEP0=53256:REM P0 SIZE
11272 SIZEP1=53257:REM P1 SIZE
11274 SIZEP2=53258:REM P2 SIZE
11276 SIZEP3=53259:REM P3 SIZE
11277 M0PF=53248:REM M0,PLFLD HIT
11278 M0PL=53256:REM M0,PLYER HIT
11279 M1PF=53249:REM M1,PLFLD HIT
11280 M1PL=53257:REM M1,PLYER HIT
11281 M2PF=53250:REM M2,PLFLD HIT
11282 M2PL=53258:REM M2,PLYER HIT
11283 M3PF=53251:REM M3,PLFLD HIT
11284 M3PL=53259:REM M3,PLYER HIT
11285 HITCLR=53278:REM CLEAR HITS
11304 REM ***************************
11308 REM SET UP PLAYER MISSILE GRAPHICS & CLEAR PM TABLE.
11316 REM ***************************
11336 A=PEEK(RAMTOP)-8:REM SUBTRCT PAGES BELOW RAMTOP PM TABLE STARTS
11346 POKE PMBASE,A:ADDR=A*256
11349 DIS=128:REM 128 2 LINE RES, 256 1 LINE RES ****************
11352 REM CLEAR PM TABLE
11356 FOR I=ADDR+3*DIS TO ADDR+8*DIS-1:POKE I,0:NEXT I
11360 POKE SDMCTL,46:REM 46 2 LINE RES, 62 1 LINE RES ***********
11364 POKE GRACTL,3:REM ENABLE PM GRAPHICS
11370 REM ***************************
11372 REM SET UP ARRAYS "ITAB$" & "OB$" AND START ADDR PTRS
11374 REM ***************************
11376 DIM OB$(256),ITAB$(105)
11378 OBJ=ADR(OB$):ITABJ=ADR(ITAB$)
11471 REM ***************************
11472 REM SET UP "MOVE DATA" TABLE POINTERS
11473 REM & OBJECT DEFINITION TABLE POINTERS.
11474 REM ***************************
11477 J=ITABJ:REM *** PLAYER 0 "MOVE DATA" PTRS ***
11478 BYP0=J:FTP0=J+1:XSP0=J+6:XPP0=J+8:YSP0=J+9:YPP0=J+11:DFP0=J+12
11479 J=ITABJ+13:REM *** PLAYER 1 "MOVE DATA" PTRS ***
11480 BYP1=J:FTP1=J+1:XSP1=J+6:XPP1=J+8:YSP1=J+9:YPP1=J+11:DFP1=J+12
11481 J=ITABJ+26:REM *** PLAYER 2 "MOVE DATA" PTRS ***
11482 BYP2=J:FTP2=J+1:XSP2=J+6:XPP2=J+8:YSP2=J+9:YPP2=J+11:DFP2=J+12
11483 J=ITABJ+39:REM *** PLAYER 3 "MOVE DATA" PTRS ***
11484 BYP3=J:FTP3=J+1:XSP3=J+6:XPP3=J+8:YSP3=J+9:YPP3=J+11:DFP3=J+12
11485 J=ITABJ+52:REM *** MISSILE 0 "MOVE DATA" PTRS ***
11486 BYM0=J:FTM0=J+1:XSM0=J+6:XPM0=J+8:YSM0=J+9:YPM0=J+11:DFM0=J+12
11487 J=ITABJ+65:REM *** MISSILE 1 "MOVE DATA" PTRS ***
11488 BYM1=J:FTM1=J+1:XSM1=J+6:XPM1=J+8:YSM1=J+9:YPM1=J+11:DFM1=J+12
11489 J=ITABJ+78:REM *** MISSILE 2 "MOVE DATA" PTRS ***
11490 BYM2=J:FTM2=J+1:XSM2=J+6:XPM2=J+8:YSM2=J+9:YPM2=J+11:DFM2=J+12
11491 J=ITABJ+91:REM *** MISSILE 3 "MOVE DATA" PTRS ***
11492 BYM3=J:FTM3=J+1:XSM3=J+6:XPM3=J+8:YSM3=J+9:YPM3=J+11:DFM3=J+12
11498 GOSUB 12618:REM OBJ DEFN POINTERS
11500 REM ***************************
11505 REM POKE MACHINE CODE AND DATA TABLES.
11510 REM ***************************
11520 FOR I=1536 TO 1761:READ J:POKE I,J:NEXT I
11530 FOR I=ITABJ TO ITABJ+104:READ J:POKE I,J:NEXT I
11540 FOR I=OBJ TO OBJ+NBYTS-1:READ J:POKE I,J:NEXT I
11634 REM ***************************
11635 REM INIT PTRS TO INDIVIDUAL P&M
11636 REM PARTS OF PM TABLE. SAVE IN "ITAB$"
11637 REM ***************************
11639 ADDR=ADDR+DIS+DIS+DIS:GOSUB 12040
11640 POKE ITABJ+96,HPTR:POKE ITABJ+95,LPTR:REM MISSILE 3
11650 POKE ITABJ+83,HPTR:POKE ITABJ+82,LPTR:REM MISSILE 2
11660 POKE ITABJ+70,HPTR:POKE ITABJ+69,LPTR:REM MISSILE 1
11670 POKE ITABJ+57,HPTR:POKE ITABJ+56,LPTR:REM MISSILE 0
11680 ADDR=ADDR+DIS:GOSUB 12040
11690 POKE ITABJ+5,HPTR:POKE ITABJ+4,LPTR:REM PLAYER 0
11700 ADDR=ADDR+DIS:GOSUB 12040
11710 POKE ITABJ+18,HPTR:POKE ITABJ+17,LPTR:REM PLAYER 1
11720 ADDR=ADDR+DIS:GOSUB 12040
11730 POKE ITABJ+31,HPTR:POKE ITABJ+30,LPTR:REM PLAYER 2
11735 ADDR=ADDR+DIS:GOSUB 12040
11740 POKE ITABJ+44,HPTR:POKE ITABJ+43,LPTR:REM PLAYER 3
11749 REM ***************************
11750 REM REASSEMBLE "MYVBI" PTRS TO "ITAB$" & "OB$", & SET VBI VECT.
11762 REM ***************************
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11790 ADDR=OBJ:GOSUB 12040:POKE 1683,HPTR:POKE 1682,LPTR
11860 J=USR(1751):REM SET USER VERT BLANK INTERRUPT VECTOR.
11990 RETURN
12010 REM ****************************
12015 REM SUBROUTINE TO CALC HI & LO BYTES OF ADDRESS POINTERS.
12025 REM ****************************
12040 LPTR=ADDR-INT(ADDR/256)*256:HPTR=INT((ADDR-LPTR)/256):RETURN
12110 REM ****************************
12120 REM "MYVBI" MACHINE CODE IN DECIMAL, STORED IN MEMORY PAGE 6.
12130 REM ****************************
12151 DATA 216,160,0,177,203,208,3,76,98,228,56,233,1,133,207,200
12152 DATA 177,203,240,21,56,233,1,145,203,208,14,152,24,105,11,168
12161 DATA 169,0,145,203,152,56,233,11,168,200,177,203,141,128,6,200
12162 DATA 177,203,141,115,6,73,255,141,149,6,200,177,203,133,205,200
12171 DATA 177,203,133,206,32,165,6,141,212,6,200,200,200,177,203,141
12172 DATA 211,6,136,136,136,32,165,6,141,213,6,200,177,203,141,214
12181 DATA 6,200,152,72,166,207,172,211,6
12183 DATA 192,128,144
12184 REM LINE 12183: 192,128,144 2 LINE RES. 76,114,6 1 LINE RES*****
12185 DATA 5,152,56,233
12187 DATA 128,168,169,255,49,205,145,205,200,202,16,237,174,212,6,142
12191 DATA 255,208,172,213,6,174,214,6
12193 DATA 192,128,144
12194 REM LINE 12193: 192,128,144 2 LINE RES. 76,145,6 1 LINE RES*****
12195 DATA 5,152,56,233,128
12197 DATA 168,189,0,97,41,255,17,205,145,205,200,232,198,207,16,232
12201 DATA 104,168,76,3,6,200,177,203,73,128,16,8,162,248,142,203
12202 DATA 6,76,185,6,162,0,142,203,6,170,10,10,10,24,200,113
12211 DATA 203,145,203,8,138,74,74,74,74,74,9,255,40,200,113,203
12212 DATA 145,203,96,255,255,255,255,160,0,162,6,169,7,32,92,228
12221 DATA 104,96
12303 REM ****************************
12304 REM "MOVE DATA" TABLE, INITIAL VALUES, STORED IN "ITAB$"
12305 REM ****************************
12310 REM SOME OF THESE VALUES ARE DUMMYS, OVERWRITTEN LATER
12450 DATA 1,0,0,0,0,154,0,0,0,0,0,0,0
12452 DATA 1,0,1,0,128,154,0,0,0,0,0,0,0
12454 DATA 1,0,2,0,0,155,0,0,0,0,0,0,0
12456 DATA 1,0,3,0,128,155,0,0,0,0,0,0,0
12458 DATA 1,0,4,252,128,153,0,0,0,0,0,0,0
12460 DATA 1,0,5,243,128,153,0,0,0,0,0,0,0
12462 DATA 1,0,6,207,128,153,238,0,0,0,0,0,0
12464 DATA 1,0,7,63,128,153,0,0,0,0,0,0,0
12466 REM TERMINATOR
12468 DATA 0
12482 REM ****************************
12484 REM OBJECT DEFINITION TABLE, STORED IN "OB$"
12486 REM ****************************
12490 REM 1ST OBJ SHOULD BE A BLANK, AS MANY BYTES AS LARGEST OBJ
12491 REM BLANK
12492 DATA 0,0,0,0,0,0,0,0
12493 REM SHIP1
12494 DATA 24,60,102,255,219,153,129,129
12495 REM SHIP2
12496 DATA 0,24,60,102,60,255,153,24
12500 REM MISSILES
12502 DATA 255
12612 REM ****************************
12614 REM SUBROUTINE TO SET POINTERS TO OBJECT DEFINITIONS
12616 REM ****************************
12618 BLANK=0
12620 SHIP1=BLANK+8:SHIP2=SHIP1+8:MISL=SHIP2+8
12630 NBYTS=25:REM TOTAL BYTES IN OBJ DEFINITIONS, MAXIMUM 256
12650 RETURN
```

TABLE 2. TEST PROGRAM.

```
5 PRINT "INITIALISING"
10 GOSUB 11228:REM CALL PACKAGE
15 PRINT "OK"
20 REM START PLAYER 0
40 POKE BYP0,8:POKE XSP0,150:POKE YSP0,128
50 POKE XPP0,128:POKE YPP0,64:POKE DFP0,SHIP1
60 REM START MISSILE 3
70 POKE PCOLR3,140:POKE BYM3,1:POKE XSM3,120:POKE YSM3,255
80 POKE XPM3,128:POKE YPM3,64:POKE DFM3,MISL
90 GOTO 90
```


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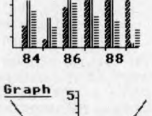

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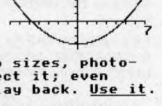

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PROGRAMS

Chinese Horoscope

by Richard Lee

Are you a Goat or a Pig? This program for the MZ-80K will tell you, and give you a run-down on the derivation of Oriental astrology. To add to the complexity, the date of the Chinese New Year changes from year to year — it can start any time between mid-January and mid-February. Richard has included New Year dates for most years of this century. When you have discovered your sign, you enter the number listed for the relevant animal — eg, for a Goat, press 8. You are then presented with a list of options. You can find out the personality associated with your sign and you are given a list of famous people who supposedly share your characteristics — did you know Prince Charles was a Rat? — or find your ideal partner's sign.

Although written for the MZ-80K, there are no PEEKs, POKEs or USR statements. So there should be no problem in converting it for any micro with at least 23k RAM. If you do convert it, leave out line 30 — this is only there to make the program auto-run on loading.

```
10 REM ** CHINESE HOROSCOPE **
20 REM ** BY RICHARD J. LEE **
30 POKE10682,1
40 DATA Rat,Buffalo,Tiger,Cat,Dragon,Snake,Horse,Goat,Monkey,Rooster,Dog,Pig
50 DIMA$(12):FORI=1TO12:READA$(I):NEXT
60 DATA J31,F19,F08,J29,F16,F04,J25,F13,F02,J22,F10,J30
70 DATA F18,F06,J26,F14,F03,J23,F11,F01,F20,F08,J28,F16
80 DATA F05,J25,F13,F02,J23,F10,J30,F17,F06,J26,F14,F04
90 DATA J24,F11,J31,F19,F08,J27,F15,F05,J25,F13,F02,J22
100 DATA F10,J29,F17,F06,J27,F14,F03,J24,F12,J31,F18,F08
110 DATA J28,F15,F05,J25,F13,F02,J21,F09,J30,F17,F06,J27
120 DATA J16,F03,J23,F11,J31,F18,F07,J28,F16,F05,J25,F13
130 DATA F02,F20,F09,J29,F17,F06,J27,F15,F04,J23,F10,J31
140 DIMD$(95):FORI=0TO95:READD$(I):NEXTI
150 PRINT"■":S=53248:M=1000
160 S$="■Successful marriage combinations:■"
170 PRINT"  ▟▀▀ ▛▀▀▜ ▛▀▀▜ ▛▀▀▜ ▛▀▀▜"
180 PRINT"  ▌   ▌  ▐ ▌  ▐ ▌  ▐ ▌  ▐"
190 PRINT"  ▌ ▀▀▜ ▛▀▀▜ ▛▀▀▘ ▌  ▐ ▝▀▀▜"
200 PRINT"  ▌  ▐ ▌  ▐ ▌  ▐ ▌  ▐    ▐"
210 PRINT"  ▝▀▀▘ ▌  ▐ ▌  ▐ ▝▀▀▘ ▝▀▀▘"
220 PRINT"▛▀▀▜ ▛▀▀▜ ▛▀▀▜ ▛▀▀▜ ▛▀▀▜ ▛▀▀▜ ▛▀▀▜"
230 PRINT"▌  ▐ ▌  ▐ ▌  ▐ ▌  ▐ ▌  ▐ ▌  ▐ ▌  ▐"
240 PRINT"▙▀▀▘ ▌  ▐ ▙▀▀▘ ▌  ▐ ▝▀▀▜ ▌  ▐ ▙▀▀▘"
250 PRINT"▌  ▐ ▌  ▐ ▌  ▐ ▌  ▐    ▐ ▌  ▐ ▌  ▐"
260 PRINT"▌  ▐ ▝▀▀▘ ▌  ▐ ▝▀▀▘ ▝▀▀▘ ▝▀▀▘ ▌  ▐ ▝▀▀▘"
270 PRINT"■By Richard J. LEE
280 PRINT"■Press any key to continue."
290 GETA$:IFA$=""THEN310
300 GOTO330
310 Z=S+M*RND(1):IFPEEK(Z)THEN290
320 FORN=1TO99:NEXTN:POKEZ,107:GOTO290
330 PRINT"■■■";TAB(13);"THE HISTORY■■
340 PRINT"The Chinese Horoscope is based on the
350 PRINT"legend of how an ancient Chinese
360 PRINT"Emperor called all the animals to his
370 PRINT"palace, and the first twelve to arrive
380 PRINT"became the signs of the Chinese Horo-
390 PRINT"scope. Unlike the English horoscope
400 PRINT"the Chinese have a twelve year cycle
410 PRINT"and whichever animal was having its
420 PRINT"year when you were born is your sign.
430 PRINT"Another difference is that the years
440 PRINT"change with the Chinese New Year which
450 PRINT"can start at some date between mid-
460 PRINT"January to late February, depending
470 PRINT"on the lunar cycle."
480 PRINT"■■Press any key"
490 GETA$:IFA$=""GOTO490
500 PRINT"■■Here is a table of the 12 animals with their years.■"
510 FORI=1TO12:PRINTA$(I):NEXTI:PRINT"■■■■":YA=1912:YB=1983
520 T=1:FORI=YATOYBSTEP12
530 FORJ=1TO12:PRINTTAB(T*5+2);J+I-1:NEXTJ:PRINT"■■■■":T=T+1:NEXTI:PRINT
540 PRINT"■■■■■■■■■■■■■To obtain earlier dates,press Z and for"
550 PRINT"later dates press X.Otherwise press any"
560 PRINT"key to continue. *NB:- if your birthday"
570 PRINT"occurs in January or February your sign"
580 PRINT"may or may not be the previous year's."
590 PRINT"Press any key to check."
600 GETA$:IFA$=""GOTO600
610 IFA$="Z"THENYA=YA-12:YB=YB-12:PRINT"■■■■":GOTO520
620 IFA$="X"THENYA=YA+12:YB=YB+12:PRINT"■■■■":GOTO520
```


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PROGRAMS

```
630 PRINT"■"
640 PRINT"If you want more exact dates so that you";
650 PRINT"can  find out what  animal sign you have";
660 PRINT"then press D  otherwise  press any other";
670 PRINT"key.
680 GETA$:IFA$=""GOTO680
690 IFA$="D"GOTO710
700 GOTO800
710 PRINT"■■Enter the year  you  require without the";
720 PRINT"19; eg for 1982 just enter 82."
730 INPUT" Year ? 19";A:IF(A<0)+(A)95)THENPRINT"Sorry, not known■":GOTO730
740 PRINT"■";SPC(20):PRINT"  In 19";STR$(A);" the Chinese New Year was on
750 A$=D$(A):IFLEFT$(A$,1)="F"THENM$="February":GOTO770
760 M$="January"
770 PRINT"  ";M$;VAL(RIGHT$(A$,2));". So if your birthday is
780 PRINT"  before that date,  then your animal
790 PRINT"  is that of the previous year."
800 PRINT:PRINT"If  you wish  to see the table  of signs";
810 PRINT"again  then  press T otherwise press any";
820 PRINT"key to continue."
830 GETA$:IFA$="T"GOTO500
840 IFA$=""GOTO830
850 PRINT"■"
860 PRINT"Here are the twelve animals again :■
870 FORI=1TO12:PRINTTAB(3);I;TAB(8);A$(I):NEXT
880 PRINT"■Enter the number in front of the animal
890 PRINT"that  you would  like to  no more about.
900 INPUT"■Animal no :";N
910 IF(N<1)+(N)12)THENPRINT"Try again■";SPC(20);"■■":GOTO900
920 PRINT"■■What would you like to know about the
930 PRINTA$(N);" ? Here's a list of the options■■
940 PRINT" 1.  The ";A$(N);" personality
950 PRINT" 2.  The ";A$(N);" with other animals
960 PRINT" 3.  Famous ";A$(N);"s
970 PRINT" 4.  The ";A$(N);"'s lines"
980 PRINT"■Enter the number corresponding to the
990 PRINT"details of what you want. Or else       press:
1000 PRINT"■   C to Change animal
1010 PRINT"    T to go to table of animals & dates
1020 PRINT"    E to End program ■
1030 GETA$:IFA$=""GOTO1030
1040 IFA$="E"THEN7550
1050 IFA$="C"GOTO850
1060 IFA$="T"GOTO500
1070 IF(ASC(A$)<49)+(ASC(A$)>52)THEN1030
1080 S=VAL(A$):ONSGOTO1100,1110,1120,1130
1090 GOTO1030
1100 ONNGOTO1150,1270,1350,1430,1530,1620,1690,1810,1890,2000,2110,2190
1110 ONNGOTO2270,2440,2590,2740,2910,3060,3220,3380,3540,3690,3850,4010
1120 ONNGOTO4170,4330,4510,4670,4810,4970,5140,5300,5430,5570,5690,5830
1130 ONNGOTO5960,6100,6240,6380,6510,6640,6770,6900,7020,7160,7300,7430
1140 REM ** PERSONALITIES **
1150 PRINT"■++          THE RESOURCEFUL RAT          ++
1160 PRINT"■■The Rat appears calm on the surface,but■"
1170 PRINT"underneath is anxious, nervous and even■
1180 PRINT"quick-tempered.  Rats are  charming and■
1190 PRINT"honest,  imaginative  and  opportunist.■
1200 PRINT"Mr. Rat is a  gambler and a drinker and■
1210 PRINT"he is  an excellent  sentimental lover;■
1220 PRINT"he  may also be a  good lover and poli-■
1230 PRINT"tician.  Female  Rat is  often a career■
1240 PRINT"woman as well as a superb housewife and■
1250 PRINT"hostess.
1260 GOTO7580
1270 PRINT"■ ++        THE BLITHE BUFFALO         ++
1280 PRINT"■■ Buffaloes are quiet,  patient, with a■
1290 PRINT" gift  for inspiring  confidence.  The■
1300 PRINT" Buffalo man knows how to love a woman■
1310 PRINT" and is kind to  children.  The female■
1320 PRINT" Buffalo likes to stay at home & often■
1330 PRINT" wears the trousers.■
1340 GOTO7580
1350 PRINT"■ ++       THE TEMPESTUOUS TIGER       ++
1360 PRINT"■■ All  tigers are noble  and courageous■
1370 PRINT" and have a natural air of authourity.■
1380 PRINT" They are generous, polite, passionate■
1390 PRINT" and  sensitive but  also  can be vain■
1400 PRINT" and  argumentative. ■ Some make money■
1410 PRINT" without really trying.■
1420 GOTO7580
1430 PRINT"■ ++         THE CONVIVIAL CAT         ++
1440 PRINT"■■ Also  known as the rabbit,  Cats love■
1450 PRINT" company and are great mixers and ent-■
1460 PRINT" ertainers.  They  make  cautious and■
1470 PRINT" astute business people.  They tend to■
1480 PRINT" cry  easily,  but are quickly cheered■
1490 PRINT" up. Cat men are worldly and snobbish,■
1500 PRINT" women  like to  show  off their newly■
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PROGRAMS

```
1510 PRINT" acquired possessions.■
1520 GOTO7580
1530 PRINT"■  ++        THE DEMANDING DRAGON      ++
1540 PRINT"■■  Dragons are idealists, gifted intell-■
1550 PRINT"  igent and generous. The male is over-■
1560 PRINT"  proud, often  stubborn and irritable.■
1570 PRINT"  He shines in his  career and does not■
1580 PRINT"  usually marry young.  The Dragon lady■
1590 PRINT"  is a sophisticated, strong minded and■
1600 PRINT"  prudent person.■
1610 GOTO7580
1620 PRINT"■■■  ++        THE SEDUCTIVE SNAKE       ++
1630 PRINT"■■■  Snakes  have  powerful  personal mag-■
1640 PRINT"  netism.  They like money and are very■
1650 PRINT"  lucky but are jealous and bad losers.■
1660 PRINT"  Snake men dress well and  females are■
1670 PRINT"  beautiful.■
1680 GOTO7580
1690 PRINT"■  ++       THE HOT-BLOODED HORSE      ++
1700 PRINT"■■  Quick - witted,  charming, extremely■
1710 PRINT"  popular and hard working. Horses are■
1720 PRINT"  capable of  saying a  complement and■
1730 PRINT"  turning a pretty phrase and love the■
1740 PRINT"  arts.  They tend to be impatient and■
1750 PRINT"  yet very  ambitious.  The male makes■
1760 PRINT"  an  excellent  father and  provider.■
1770 PRINT"  The  Female is  methodical and fares■
1780 PRINT"  well in her career.  The final third■
1790 PRINT"  of their lives is tranquil & serene.
1800 GOTO7580
1810 PRINT"■  ++        THE GRACIOUS GOAT         ++
1820 PRINT"■■  Goats are elegant, charming and art-■
1830 PRINT"  istic  but  pessimistic and worriers■
1840 PRINT"  who need security.  The female  Goat■
1850 PRINT"  dreams of  marriage with a rich man,■
1860 PRINT"  the male  makes noises like a leader■
1870 PRINT"  but fools no one.■
1880 GOTO7580
1890 PRINT"■  ++          THE MERRY MONKEY         ++
1900 PRINT"■■  Monkeys in  general  are  vain,  high■
1910 PRINT"  spirited,  egotistical, inventive and■
1920 PRINT"  original.  They have a quick and ready■
1930 PRINT"  wit and can succeed in any profession■
1940 PRINT"  and may become  famous.  Male monkeys■
1950 PRINT"  fall in love easily but do not always■
1960 PRINT"  find  happiness.  Miss Monkey appeals■
1970 PRINT"  to the  protective  man.  The men are■
1980 PRINT"  jokers and  a lot of fun but devious.■
1990 GOTO7580
2000 PRINT"■  ++        THE RECKLESS ROOSTER      ++
2010 PRINT"■■  Roosters are  reckless  show offs who■
2020 PRINT"  speak their minds bluntly, but do not■
2030 PRINT"  really  care about  other's feelings.■
2040 PRINT"  While  dreaming of  being rich,  they■
2050 PRINT"  are  unable to economise.  The Female■
2060 PRINT"  rooster  likes the  company of  others■
2070 PRINT"  women.  The male  Rooster disappoints■
2080 PRINT"  his loved one  although he makes sti-■
2090 PRINT"  mulating company.■
2100 GOTO7580
2110 PRINT"■  ++          THE DEVOTED DOG          ++
2120 PRINT"■■  Worriers,  a  bit  introverted,  anti■
2130 PRINT"  social but most loyal. Dog lady needs■
2140 PRINT"  constant encouragement and is a doer.■
2150 PRINT"  Dog  men are  wary of  strangers  but■
2160 PRINT"  will do  anything for their  friends.■
2170 PRINT"  They are not too bothered with money.■
2180 GOTO7580
2190 PRINT"■  ++          THE PASSIVE PIG          ++
2200 PRINT"■■  Pigs are plagued by romantic troubles■
2210 PRINT"  and are innocent.  Pig ladies need to■
2220 PRINT"  be  comforted:  they are  leaners and■
2230 PRINT"  dependents and seek no glory and make■
2240 PRINT"  good mothers. The male pig works hard■
2250 PRINT"  and is a success.■
2260 GOTO7580
2270 REM **  COMPATIBILITY  **
2280 PRINT"■■■THE RAT AND OTHERS ...
2290 PRINT"------------------------
2300 PRINT"■■A Rat :
2310 PRINT"■ 1. Gets on well with horses
2320 PRINT" 2. Does not like other rats
2330 PRINT" 3. Cooperates mutually with dogs
2340 PRINT" 4. Matches with the dragon
2350 PRINT" 5. Is friendly with cats
2360 PRINT" 6. And is moderately happy with pigs.
2370 PRINTS$
2380 PRINT"RAT + OX (Wife)
2390 PRINT"RAT + TIGER
```


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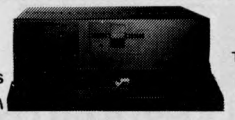

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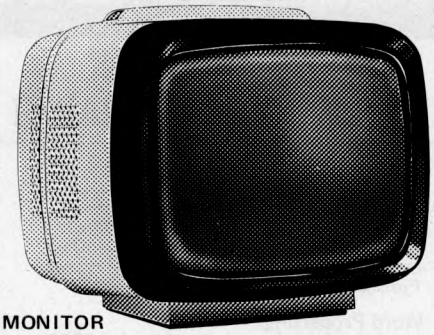

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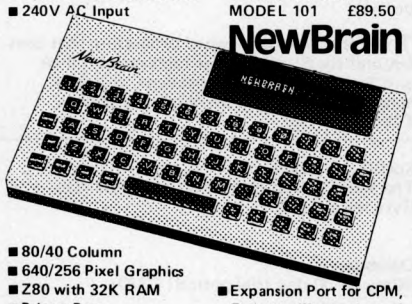

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PROGRAMS

```
2400 PRINT"RAT + DRAGON
2410 PRINT"RAT + CAT
2420 PRINT"RAT + DOG
2430 GOTO7580
2440 PRINT"■■■THE BUFFALO AND OTHERS ...
2450 PRINT"-------------------------
2460 PRINT"■■A Buffalo
2470 PRINT"■ 1. Is a good partner for a rooster
2480 PRINT" 2. Should not get involved with Tigers      or monkeys
2490 PRINT" 3. Respects dragons
2500 PRINT" 4. Just tolerates a sheep
2510 PRINT" 5. Is very compatible with rats
2520 PRINT" 6. But has no real future with horses
2530 PRINTS$
2540 PRINT"BUFFALO + SNAKE
2550 PRINT"BUFFALO + TIGER
2560 PRINT"BUFFALO + ROOSTER
2570 PRINT"BUFFALO + PIG
2580 GOTO7580
2590 PRINT"■■■THE TIGER AND OTHERS ...
2600 PRINT"-------------------------
2610 PRINT"■■A Tiger
2620 PRINT"■ 1. Trusts a horse
2630 PRINT" 2. Respects dragons
2640 PRINT" 3. Likes the company of dogs
2650 PRINT" 4. But dislikes snakes
2660 PRINT" 5. And is uncooperative with cats
2670 PRINT" 6. Although doesn't mind roosters
2680 PRINTS$
2690 PRINT"TIGER + DRAGON
2700 PRINT"TIGER + TIGER
2710 PRINT"TIGER + PIG
2720 PRINT"TIGER + HORSE
2730 GOTO7580
2740 PRINT"■■■THE CAT AND OTHERS ...
2750 PRINT"-----------------------
2760 PRINT"■■A Cat
2770 PRINT"■ 1. Settles down well with goats
2780 PRINT" 2. Enjoys the presence of pigs
2790 PRINT" 3. Distrusts dogs
2800 PRINT" 4. Hates snakes
2810 PRINT" 5. Likes to be with other cats
2820 PRINT" 6. Never goes near tigers
2830 PRINTS$
2840 PRINT"CAT + CAT
2850 PRINT"CAT + GOAT
2860 PRINT"CAT + ROOSTER
2870 PRINT"CAT + HORSE
2880 PRINT"CAT + PIG
2890 PRINT"CAT + MONKEY
2900 GOTO7580
2910 PRINT"■■■THE DRAGON AND OTHERS ...
2920 PRINT"-------------------------
2930 PRINT"■■A Dragon
2940 PRINT"■ 1. Is a good match for rats
2950 PRINT" 2. Goes well with snakes
2960 PRINT" 3. Cares for roosters
2970 PRINT" 4. Okay with monkeys
2980 PRINT" 5. Dislikes dogs
2990 PRINT" 6. Is respected by most
3000 PRINTS$
3010 PRINT"DRAGON + RAT
3020 PRINT"DRAGON + DRAGON
3030 PRINT"DRAGON + PIG
3040 PRINT"DRAGON + GOAT
3050 GOTO7580
3060 PRINT"■■■THE SNAKE AND OTHERS ...
3070 PRINT"-------------------------
3080 PRINT"■■A Snake
3090 PRINT"■ 1. Is happy with a buffalo
3100 PRINT" 2. Likes goats
3110 PRINT" 3. Prefers to be with other snakes
3120 PRINT" 4. Does not like tigers
3130 PRINT" 5. Is suspicious of dogs
3140 PRINT" 6. Is compatible with dragons
3150 PRINTS$
3160 PRINT"SNAKE + GOAT
3170 PRINT"SNAKE + PIG
3180 PRINT"SNAKE + SNAKE
3190 PRINT"SNAKE + BUFFALO
3200 PRINT"SNAKE + HORSE
3210 GOTO7580
3220 PRINT"■■■THE HORSE AND OTHERS ...
3230 PRINT"-------------------------
3240 PRINT"■■A Horse
3250 PRINT"■ 1. Goes best with a goat
3260 PRINT" 2. Is happy with dragons
3270 PRINT" 3. Likes the rat
3280 PRINT" 4. Likes female cats
```


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PROGRAMS

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3290 PRINT" 5. Avoids monkeys
3300 PRINT" 6. Likes other horses
3310 PRINTS$
3320 PRINT"HORSE + DRAGON
3330 PRINT"HORSE + GOAT
3340 PRINT"HORSE + SNAKE
3350 PRINT"HORSE + HORSE
3360 PRINT"HORSE + CAT
3370 GOTO7580
3380 PRINT"■■■THE GOAT AND OTHERS ...
3390 PRINT"------------------------
3400 PRINT"■■A Goat
3410 PRINT"■ 1. Likes horses very much
3420 PRINT" 2. Has trust in a dragon
3430 PRINT" 3. Enjoys the company of cats
3440 PRINT" 4. Is no match for the monkey
3450 PRINT" 5. Will not cooperate with pigs
3460 PRINT" 6. Is cautious of other goats
3470 PRINTS$
3480 PRINT"GOAT + DRAGON
3490 PRINT"GOAT + RAT
3500 PRINT"GOAT + HORSE
3510 PRINT"GOAT + CAT
3520 PRINT"GOAT + SNAKE
3530 GOTO7580
3540 PRINT"■■■THE MONKEY AND OTHERS ...
3550 PRINT"-------------------------
3560 PRINT"■■A Monkey
3570 PRINT"■ 1. Gets on well with dragons
3580 PRINT" 2. Is friendly to roosters
3590 PRINT" 3. Likes snakes
3600 PRINT" 4. Should avoid tigers
3610 PRINT" 5. Doesn't mix with many goats
3620 PRINT" 6. Dislikes other monkeys
3630 PRINTS$
3640 PRINT"MONKEY + DRAGON
3650 PRINT"MONKEY + PIG
3660 PRINT"MONKEY + SNAKE
3670 PRINT"MONKEY + CAT
3680 GOTO7580
3690 PRINT"■■■THE ROOSTER AND OTHERS ...
3700 PRINT"---------------------------
3710 PRINT"■■A Rooster
3720 PRINT"■ 1. If female enjoys being with other
3730 PRINT" 2. Is compatible with the horse
3740 PRINT" 3. Likes dragons
3750 PRINT" 4. If female distrusts male roosters
3760 PRINT" 5. Never mixes with pigs
3770 PRINT" 6. Is okay with buffaloes
3780 PRINTS$
3790 PRINT"ROOSTER + DRAGON
3800 PRINT"ROOSTER + DOG
3810 PRINT"ROOSTER + CAT
3820 PRINT"ROOSTER + GOAT
3830 PRINT"ROOSTER + BUFFALO
3840 GOTO7580
3850 PRINT"■■■THE DOG AND OTHERS ...
3860 PRINT"----------------------
3870 PRINT"■■A Dog
3880 PRINT"■ 1. Is blissfully happy with horses
3890 PRINT" 2. Is friendly with other dogs
3900 PRINT" 3. Makes a good companion for goats
3910 PRINT" 4. Totally distrusts cats
3920 PRINT" 5. Respects dragons
3930 PRINT" 6. Is no partner for tigers
3940 PRINTS$
3950 PRINT"DOG + BUFFALO
3960 PRINT"DOG + GOAT
3970 PRINT"DOG + DOG
3980 PRINT"DOG + HORSE
3990 PRINT"DOG + DRAGON
4000 GOTO7580
4010 PRINT"■■■THE PIG AND OTHERS.
4020 PRINT"-----------------------
4030 PRINT"■■A Pig
4040 PRINT"■ 1. Likes the company of cats
4050 PRINT" 2. Goes well with dragons
4060 PRINT" 3. Doesn't mind being with a horse
4070 PRINT" 4. Is no match for a goat
4080 PRINT" 5. Tries not to be with other pigs
4090 PRINT" 6. Never trusts a snake
4100 PRINTS$
4110 PRINT"PIG + DOG
4120 PRINT"PIG + CAT
4130 PRINT"PIG + DRAGON
4140 PRINT"PIG + HORSE
4150 PRINT"PIG + BUFFALO
4160 GOTO7580
4170 REM ** FAMOUS ANIMALS **
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4180 PRINT"■■ ##  FAMOUS RATS  ##
4190 PRINT"■■Lucrezia Borgia
4200 PRINT"James Callahan
4210 PRINT"Pope John Paul II
4220 PRINT"William Shakespeare
4230 PRINT"Jimmy Carter
4240 PRINT"Doris Day
4250 PRINT"Marlon Brando
4260 PRINT"Charlotte Bronte
4270 PRINT"Mozart
4280 PRINT"Yves St. Laurent
4290 PRINT"Leo Tolstoy
4300 PRINT"Jules Verne
4310 PRINT"Prince Charles
4320 GOTO7580
4330 PRINT"■■ ##  FAMOUS BUFFALO  ##
4340 PRINT"■■Walter Disney
4350 PRINT"Emperor Hirohito
4360 PRINT"Richard Nixon
4370 PRINT"Gerald Ford
4380 PRINT"Vincent van Gosh
4390 PRINT"Sammy Davis Jnr.
4400 PRINT"Peter Sellers
4410 PRINT"Richard Burton
4420 PRINT"Margaret Thatcher
4430 PRINT"Melina Mecouri
4440 PRINT"Robert Redford
4450 PRINT"Vanessa Redgrave
4460 PRINT"Dustin Hoffman
4470 PRINT"Adolf Hitler
4480 PRINT"Charlie Chaplin
4490 PRINT"Princess Diana
4500 GOTO7580
4510 PRINT"■■ ## FAMOUS TIGERS ##
4520 PRINT"■■Charles de Gaulle
4530 PRINT"Ludwig van Beethoven
4540 PRINT"Dwight Eisenhower
4550 PRINT"Princess Anne
4560 PRINT"Stevie Wonder
4570 PRINT"Simon Bolivar
4580 PRINT"Alec Guiness
4590 PRINT"Queen Elizabeth II
4600 PRINT"Valerie Giscard D'Estaing
4610 PRINT"St. Francis Xavier
4620 PRINT"Marilyn Monroe
4630 PRINT"Emily Bronte
4640 PRINT"Diana Rigg
4650 PRINT"Rudolf Nureyev
4660 GOTO7580
4670 PRINT"■■ ## FAMOUS CATS ##
4680 PRINT"■■Jomo Kenyatta
4690 PRINT"King Olav V of Norway
4700 PRINT"Benjamin Spock
4710 PRINT"Orson Welles
4720 PRINT"David Rockfeller
4730 PRINT"Ingrid Bergman
4740 PRINT"Fidel Castro
4750 PRINT"George Scott
4760 PRINT"Albert Einstein
4770 PRINT"Joseph Stalin
4780 PRINT"Queen Victoria
4790 PRINT"David Frost
4800 GOTO7580
4810 PRINT"■■ ## FAMOUS DRAGONS ##
4820 PRINT"■■King Constantine
4830 PRINT"John Lennon
4840 PRINT"Ringo Starr
4850 PRINT"Francisco Franco
4860 PRINT"Jimmy Connors
4870 PRINT"Joan of Arc
4880 PRINT"Salvador Dali
4890 PRINT"Frank Sinatra
4900 PRINT"Edward Heath
4910 PRINT"Yehudi Menuin
4920 PRINT"Harold Wilson
4930 PRINT"Anthony Quinn
4940 PRINT"Kirk Douglas
4950 PRINT"Walter Mondale
4960 GOTO7580
4970 PRINT"■■ ## FAMOUS SNAKES ##
4980 PRINT"■■Picasso
4990 PRINT"Mao Tse-Tung
5000 PRINT"Paul Getty
5010 PRINT"Howard Hughes
5020 PRINT"Greta Garbo
5030 PRINT"Schubert
5040 PRINT"Henry Ford II
5050 PRINT"John F Kennedy
5060 PRINT"Gamal Nasser
5070 PRINT"Indira Gandhi
5080 PRINT"Abraham Lincoln
5090 PRINT"Edgar Allan Poe
5100 PRINT"King Hassan
5110 PRINT"Jacqueline Onassis
5120 PRINT"Princess Grace of Monaco
5130 GOTO7580
5140 PRINT"■■    ##  FAMOUS HORSES  ##
5150 PRINT"■■Neil Armstrong
5160 PRINT"Lord Snowdon
5170 PRINT"F D Roosevelt
5180 PRINT"Barbra Striesand
5190 PRINT"Paul McCartney
5200 PRINT"Raquel Welsh
5210 PRINT"Rembrandt
5220 PRINT"Leonid Brezhnev
5230 PRINT"Duke of Windsor
5240 PRINT"Chris Evert-Lloyd
5250 PRINT"Theodore Roosevelt
5260 PRINT"Kurt Waldheim
5270 PRINT"Helmut Schmidt
5280 PRINT"Anwar Sadat
5290 GOTO7580
5300 PRINT"■■    ##  FAMOUS GOATS  ##
5310 PRINT"■■Andy Warhol
5320 PRINT"Muhammad Ali
5330 PRINT"Billie Jean King
5340 PRINT"King George IV
5350 PRINT"Michelangelo
5360 PRINT"James Michener
5370 PRINT"Sir Laurence Olivier
5380 PRINT"Pierre Trudeau
5390 PRINT"Ian Smith
5400 PRINT"The Shah of Iran
5410 PRINT"Ian Fleming
5420 GOTO7580
5430 PRINT"■■    ##  FAMOUS MONKEYS  ##
5440 PRINT"■■Leonardo da Vinci
5450 PRINT"Charles Dickens
5460 PRINT"Edward Kennedy
5470 PRINT"Harry Truman
5480 PRINT"Eleanor Roosevelt
5490 PRINT"Mick Jagger
5500 PRINT"Duchess of Windsor
5510 PRINT"Paul Gauguin
5520 PRINT"John Milton
5530 PRINT"Bette Davis
5540 PRINT"Federico Fellini
5550 PRINT"Mary Hemingway
5560 GOTO7580
5570 PRINT"■■    ##  FAMOUS ROOSTERS  ##
5580 PRINT"■■Prince Philip
5590 PRINT"Peter Ustinov
5600 PRINT"Alex Haley
5610 PRINT"Elton John
5620 PRINT"D K Ludwig
5630 PRINT"Paul Gallico
5640 PRINT"Baron Guy Rothschild
5650 PRINT"Andrei Gromyko
5660 PRINT"Katherine Hepburn
5670 PRINT"Errol Flynn
5680 GOTO7580
5690 PRINT"■■    ##  FAMOUS DOGS  ##
5700 PRINT"■■David Niven
5710 PRINT"Charles Bronson
5720 PRINT"Pierre Cardin
5730 PRINT"Ava Gardner
5740 PRINT"Voltaire
5750 PRINT"Sir Winston Churchill
5760 PRINT"Elvis Presley
5770 PRINT"Brigitte Bardot
5780 PRINT"Sophia Loren
5790 PRINT"Carol Burnett
5800 PRINT"Ilie Nastasie
5810 PRINT"Liza Minelli
5820 GOTO7580
5830 PRINT"■■    ##  FAMOUS PIGS  ##
5840 PRINT"■■Ronald Reagan
5850 PRINT"Henry Kissinger
5860 PRINT"King Hussein
5870 PRINT"Julie Andrews
5880 PRINT"Woody Allen
5890 PRINT"Ernest Hemingway
5900 PRINT"Humphrey Bogart
5910 PRINT"Alfred Hitchcock
5920 PRINT"John D Rockefeller
5930 PRINT"Prince Rainier of Monaco
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PROGRAMS

```
5940 PRINT"Prince William
5950 GOTO7580
5960 REM ** LINES **
5970 PRINT"■■■     THE RAT"
5980 PRINT"     ======="
5990 PRINT"■■■■I am the self proclaimed acquisitor.
6000 PRINT"I am a link yet I function as a completeunit.
6010 PRINT"I aim at encompassing heights
6020 PRINT"And strike my target
6030 PRINT"Sure and steady.
6040 PRINT"Life is one joyous journey for me.
6050 PRINT"Each search must end with a new quest.
6060 PRINT"I am progress, exploration and insight.
6070 PRINT"I am the womb of activity.■■■
6080 PRINT"  I AM THE RAT.
6090 GOTO7580
6100 PRINT"■■■     THE BUFFALO
6110 PRINT"     ==========
6120 PRINT"■■■■Mine is the stabilizing force
6130 PRINT"That perpetuates the cycle of life.
6140 PRINT"I stand immobile against the
6150 PRINT"The test of adversity,
6160 PRINT"Resolute and unimpeachable.
6170 PRINT"I seek to serve integrity,
6180 PRINT"To bear the burdens of righteousness.
6190 PRINT"I abide by the laws of nature-
6200 PRINT"Patiently pushing the wheel of Fate.
6210 PRINT"Thus I shall weave my destiny.
6220 PRINT"■■■  I AM THE BUFFALO.
6230 GOTO7580
6240 PRINT"■■■     THE TIGER
6250 PRINT"     ========="
6260 PRINT"■■■■I am the delightful Paradox.
6270 PRINT"All the world is my stage.
6280 PRINT"I set new trails ablaze;
6290 PRINT"I seek the unattainable;
6300 PRINT"And try the untried.
6310 PRINT"I dance to life's music
6320 PRINT"In gay abandon.
6330 PRINT"Come with me on my carousel rides
6340 PRINT"See the myriad of colours,
6350 PRINT"The flickering lights.
6360 PRINT"All hail me the unparalled performer."
6370 GOTO7580
6380 PRINT"■■■     THE CAT
6390 PRINT"     ======="
6400 PRINT"■■■■I am in tune with the
6410 PRINT"Pulse of the universe.
6420 PRINT"In my quiet and solitude
6430 PRINT"I hear the melodies of soul.
6440 PRINT"I float above commonplace
6450 PRINT"Dissent and decay.
6460 PRINT"I subdue by my ability to conform
6470 PRINT"In delcate pastel hues.
6480 PRINT"I epitomize harmony and inner peace."
6490 PRINT"■■■  I AM THE CAT.
6500 GOTO7580
6510 PRINT"■■■     THE DRAGON
6520 PRINT"     ==========
6530 PRINT"■■■■I am an unquenchable fire,
6540 PRINT"The centre of all energy,
6550 PRINT"The stout heroic heart.
6560 PRINT"I am the truth and light,
6570 PRINT"I hold power and glory in my sway.
6580 PRINT"My presence
6590 PRINT"Disperses dark clouds.
6600 PRINT"I have been chosen
6610 PRINT"To tame the Fates.
6620 PRINT"■■■  I AM THE DRAGON.
6630 GOTO7580
6640 PRINT"■■■     THE SNAKE
6650 PRINT"     ========="
6660 PRINT"■■■■Mine is the wisdom of the ages.
6670 PRINT"I hold the key to the mysteries of life
6680 PRINT"Casting my seeds on fertile ground
6690 PRINT"I nurture them with constancy and       purpose.
6700 PRINT"My sights are fixed.
6710 PRINT"My gaze unchanging.
6720 PRINT"unyielding, inexorable and deep
6730 PRINT"I advance with steady, unslackened gait.
6740 PRINT"The solid earth beneath me.
6750 PRINT"■■■  I AM THE SNAKE
6760 GOTO7580
6770 PRINT"■■■     THE HORSE
6780 PRINT"     ========="
6790 PRINT"■■■■I am the Kaleidoscope of the mind."
6800 PRINT"I impart light, colour and perpetual    motion.
6810 PRINT"I think, I see, I am moved by electricalfluidity.
```


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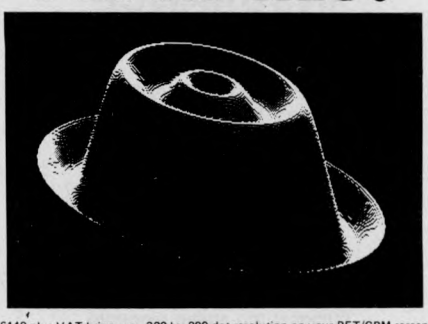

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PROGRAMS

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6820 PRINT"Constant only in my inconstancy
6830 PRINT"I am unshackled by mundane holds,
6840 PRINT"Unchecked by sturdy, binding goals.
6850 PRINT"I run unimpeded by virgin paths.
6860 PRINT"My spirit unconquered -
6870 PRINT"My soul forever free.
6880 PRINT"■■■  I AM THE HORSE
6890 GOTO7580
6900 PRINT"■■■      THE GOAT
6910 PRINT"      ========
6920 PRINT"■■■■I am nature's special child.
6930 PRINT"I trust and am rewarded by trust.
6940 PRINT"Fortune smiles upon my countenance.
6950 PRINT"All things blossom
6960 PRINT"In the gentleness of my love.
6970 PRINT"I strive to find beauty in all I behold
6980 PRINT"I am fare of face
6990 PRINT"And full of grace.
7000 PRINT"■■■  I AM THE GOAT
7010 GOTO7580
7020 PRINT"■■■      THE MONKEY
7030 PRINT"      ==========
7040 PRINT"■■■■I am the seasoned traveller
7050 PRINT"Of the labyrinth.
7060 PRINT"The genius of alacrity,
7070 PRINT"Wizard of the impossible.
7080 PRINT"My brilliance is yet unmatched
7090 PRINT"In its originality.
7100 PRINT"My heart is filled with potent magic
7110 PRINT"That could cast a hundred spells.
7120 PRINT"I am put together
7130 PRINT"For mine own pleasure.
7140 PRINT"■■■  I AM THE MONKEY
7150 GOTO7580
7160 PRINT"■■■      THE ROOSTER
7170 PRINT"      ===========
7180 PRINT"■■■■I am on hand
7190 PRINT"To herald in the day,
7200 PRINT"And to announce its exit.
7210 PRINT"I thrive by clockwork and precision.
7220 PRINT"In my unending quest for perfection
7230 PRINT"All things will be restored to their    rightful place.
7240 PRINT"I am the exacting taskmaster.
7250 PRINT"The ever watchful administrator.
7260 PRINT"I seek perfect order in my world.
7270 PRINT"I represent unfailing dedication.
7280 PRINT"■■■  I AM THE ROOSTER
7290 GOTO7580
7300 PRINT"■■■      THE DOG
7310 PRINT"      =======
7320 PRINT"■■■■The martial strains have summoned me";
7330 PRINT"To hear your sorrows,
7340 PRINT"Still your pain."
7350 PRINT"I am the protector of justice;
7360 PRINT"Equality - my sole friend.
7370 PRINT"My vision never blurred by cowardice,
7380 PRINT"My soul never chained.
7390 PRINT"Life without honour
7400 PRINT"Is life in vain.
7410 PRINT"■■■  I AM THE DOG
7420 GOTO7580
7430 PRINT"■■■      THE PIG
7440 PRINT"      =======
7450 PRINT"■■■■Of all God's children
7460 PRINT"I have the purest heart.
7470 PRINT"With innocence and faith,
7480 PRINT"I walk in Love's protective light.
7490 PRINT"By giving of myself freely
7500 PRINT"I am richer and twice blest.
7510 PRINT"Bounded to all mankind by common fellow-ship,
7520 PRINT"My goodwill is universal
7530 PRINT"And knows no bounds."
7540 GOTO7580
7550 PRINT"■■■■■■■■■■Thank you."
7560 FORI=1TO2000:NEXT
7570 RUN
7580 PRINT"■  Press any key"
7590 GETA$:IFA$=""GOTO7590
7600 GOTO920
```


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PROGRAMS

PET Patience

By Richard Still

Patience games (card games for one player) go back a long time, but new ones are still being invented, and there must by now be some hundreds known. Here is one thought to be at least a century old, but brought right up to date by being programmed for a PET 3032. It occupies about 7k and should run on old or new ROMs.

The same requires constant vigilance, and some skill in judging whether or not to move a card at a particular time. The PET gives a complete shuffle and re-deal in 8 seconds, and it moves each card of sequence with only two keystrokes. It will not countenance the slightest attempt at cheating, and it never drops the cards on the floor! When all hidden cards have been uncovered, the PET will take over automatically and complete the foundation sequences for you.

```
10    REM******STILTON PATIENCE******
20    REM*********BY R.W.STILL********
30   REM******INITIALISE******
40 POKE836,0:POKE837,0:GOTO1400
50 CLR:RESTORE:PRINT"□                    ▒                                    "
60 PRINT"        ▒  I'M SHUFFLING THE PACK   "
70 PRINT"        ▒                           "
80 DIMF$(12),P$(52),S$(4),N$(13),A$(7,20):FORN=1TO7:TP(N)=N:BP(N)=N:NEXT:L=1
90 DIMF(4),FP(4):A=RND(-TI):P=0
100 C$="▒▒▒
```

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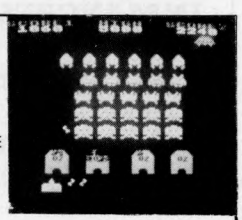

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PROGRAMS

```
660   REM******MAIN MOVE ROUTINE*******
670 GOSUB1040:F=1
680 IFPI=1THENF=2:F$(1)=H$:GOSUB1380:P=P-1:GOTO740
690 FORI=BP(X)TOTP(X):F$(F)=A$(X,I):A$(X,I)="":F=F+1
700 PRINT"  ■■■";:NEXT:XX=X:YY=Y
710 BP(X)=BP(X)-1:TP(X)=BP(X)
720 IFBP(X)>0THENG=1
730 IFTP(TT)=0THENX=TT:Y=0:GOSUB1040:GOTO750
740 X=TT:Y=TP(TT):GOSUB1040
750 PRINT"■";:FORI=1TOF-1:PRINTF$(I)"■■■";:A$(X,TP(X)+1)=F$(I)
760 IFF$(I)<>""THENTP(X)=TP(X)+1
770 NEXT
780 FORI=1TO12:F$(I)="":NEXT:F=1
790 IFG=1THENG=0:X=XX:Y=YY-1:GOSUB1040:PRINTA$(X,Y)
800 IFPI=1THEN1310
810 GOTO330
820   REM*******MOVE TO FOUNDATION*******
830 IFF(S2)>12-NU-1THEN330
840 FP(S2)=FP(S2)+1:F(S2)=NU:PRINT"■■■
```

PROGRAMS

```
1540 PRINT"□   EMPTY COLUMNS MAY BE FILLED ONLY BY
1550 PRINT"■KINGS OR BY SEQUENCES HEADED BY KINGS.
1560 PRINT"■   THE REST OF THE PACK IS DEALT, THREE
1570 PRINT"■CARDS AT A TIME, TO A WASTE PILE, THE
1580 PRINT"■TOP CARD OF WHICH IS ALWAYS AVAILABLE;
1590 PRINT"■ANY NUMBER OF RE-DEALS IS ALLOWED.
1600 PRINT"■   CARDS ARE MOVED BY SIMPLY TYPING THE
1610 PRINT"■ORIGINAL COLUMN NUMBER, OR P FOR WASTE
1620 PRINT"■PILE, FOLLOWED BY THE DESTINATION COLUMN";
1630 PRINT"■NUMBER OR F FOR FOUNDATION SEQUENCE.
1640 PRINT
1650 PRINT"   D DEALS A FRESH GROUP OF THREE CARDS,■AND E ENDS THE GAME";
1660 PRINT" AT ANY TIME."
1670 PRINT"                                        ";
1680 PRINT"          ■ PRESS SPACE TO START ■";
1690 GETA$:IFA$<>" "THEN1690
1700 GOTO50
1710   REM*****AUTOMATIC FINISH*****
1720 FORII=1TO7:IFTP(II)<>0THENII=8:NEXT:GOTO1740
1730 NEXT:GOTO1110
1740 FORII=1TO7:X=II:Y=TP(II):X$=A$(X,Y):GOSUB970
1750 IFF(S2)<>NU-1THENNEXT:GOTO1720
1760 FP(S2)=FP(S2)+1:F(S2)=NU:PRINT"■▮▮▮
```

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Continued from previous page

cribed vary in detail from the release of software which I had — in the case of MountMgr, for example — but hopefully the manuals will coincide with the release which the public eventually receives. An interesting discrepancy in the operating system manual is that reference is made to up to 10 concurrent processes being allowed in CCOS and to the action of a (non-existent) SUSPEND key. None of this is true of the version tested but presumably another version is planned which has these features (which would be very welcome).

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Concept with 256k (Includes op. system, Pascal, Assembler, Omninet Interface)	£4250
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Conclusions

I found the Concept a delight to work with in all but a few niggly details, and worthy of its description as a new generation computer. I am a little worried about how a totally inexperienced end-user would cope with an operating system more powerful and complex than CP/M but the Dispatcher labels ensure that he/she can use the applications programs without needing to know too much about the rest. For experienced computer users a network of Concepts is a much more attractive idea than a multi-user system groaning under a poor little overworked CPU, so long as sharing of data is not a major part of the job. As a stand-alone computer the Concept is a refined but rather expensive way to go, probably one for the MD to have as a status symbol, though a work-at-home Pascal programmer or word processor could find it a good investment if sufficient funds are available. As a hope for the future, I would like to see Corvus introduce a multi-tasking version of Merlin//CCOS to take full advantage of the 68000's power and allow real multi-window working along Xerox Star lines.

Thanks to Keen Computers for the loan of the review machine and particularly to Richard Scorer for his assistance in setting up the system.

Benchmark timings

magnifier	0.15
forloop	1.33
whileloop	1.51
repeatloop	1.23
literalassign	1.73
memoryaccess	1.81
realarithmetic	19.75
realalgebra	17.88
vector	11.47
equalif	2.46
unequalif	2.44
noparameters	0.95
value	1.30
reference	1.38
maths	11.93

For a full explanation and listing of the Benchmark programs see PCW *May 1982.*

Technical specifications

Processor	Motorola MC68000 8MHz
RAM	256k standard, 512k optional.
ROM	32k
Keyboard	ASCII standard with numeric keypad and 10 function keys.
Screen	Monochrome monitor, 720x560 dots. Format alterable between horizontal and vertical. User defined char. sets of variable size.
Disk	5,10 or 20 Mb winchester, 8in floppy drive optional.
Ports	2 RS232 serial ports; Apple compatible expansion bus (4 slots).
Operating system	Merlin, CP/M emulation.
Languages	SVS Pascal, Fortran, 68000 Assembler
Network interface	Corvus omninet

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by J J Clessa

Quickie

Which weighs more — a pound of feathers or a pound of gold? The answer is *not* that they both weigh the same.

Prize Puzzle

X and Y are integers. Use them to generate

A = X+Y (addition)
B = X−Y (subtraction)
C = X*Y (multiplication)
D = X/Y (division)

Then write down a single Basic expression which uses each of the values A, B, C, D once only, together with any of the following symbols.
+ ( ) − * /
which will most nearly approximate to 27.38104965.

For example, if X=2, Y=3, A=5, B=−1, C=6 and D=2/3 then A*C+B/D = 28.5, which is getting close to the required answer — but we're sure you can do better.

Answers on postcards please to arrive not later than last post 31 March 1983.
J J Clessa

December prize puzzle

Barely 100 entries this month — although I don't think that the problem was too difficult. Perhaps most readers were grappling with Xmas problems, or perhaps writing abusive letters to me about the Manhunt competition.

Anyway, the answers to the problem were 5777 and 5993. These are neither prime, nor the sum of a prime and twice a square.

The winning entry came from Mr Robert Cork of Colne in Lancashire. Congratulations Mr Cork — your prize will be with you by the time you read this.

BLUDNERS



A few errors crept into the Digital Video article in January's issue. In Figure 1 the negative line on the package diagram should have been labelled '-6v', and the IC labelled 740D should in fact have been 7400. In Figure 2 the V and H sync signals should have been shown as going to the computer along with the video. In Figure 6A it was not made clear that the output of 74LS244 is an *8-line* data bus. The CRT controller used by Clayton Abrams is 6845, not 6843 as we stated. We also omitted the value of the 'W' potentiometer (5k) and the fixed resistor at input (1k).

In 'TJ's Workshop' in the same issue, we published a routine 'PET DO-UNTIL'. Its author, J D Slodzik, writes to tell us that he made a few mistakes in the listing. The relevant lines, with corrections are:

0342	C9	3A	B0	0A	C9	20	F0	07
0352	70	00	BA	BC	01	01	C0	F9
0372	A9	F9	48	A5	78	48	A5	77
03BA	68	85	36	68	85	37	68	85
03F2	E8	E0	11	D0	F5	4C	77	C3

Also in January's 'TJ's' we made a terrible mess of David Julien-Waring's 'BBC Bad Program Fix'. The first section of code, starting A=&E00 was okay, with the exception of A=A=B, which should of course be A=A+B. The correct versions of the second and third chunks are as follows:

A=&E04: REP.A=A+1: U.? A=13: P.~ A-&E00<RETURN>
and
! &E00=&6101000D <RETURN>

In last month's User Group Index, the telephone number for the Sevenoaks School Computer Club was incorrect — proper number is 456340, and please note that this is a private club for the school only.

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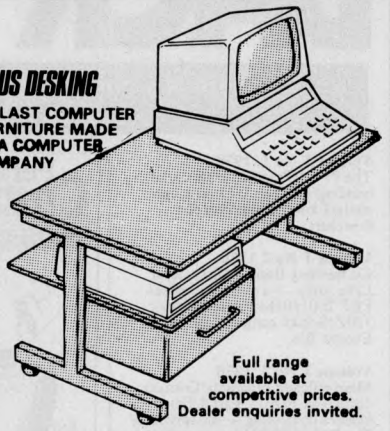

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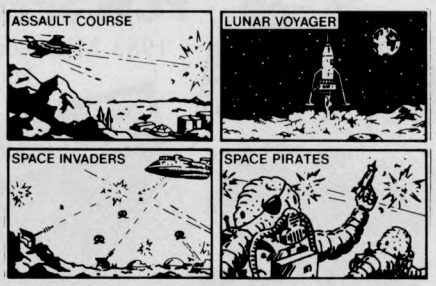

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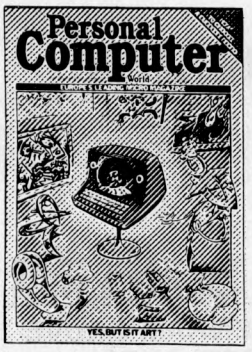
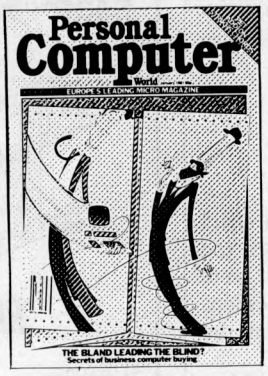
Volume 1 No 3, 1978
More efficient programs/Cosmac 1802/The PDP11 Part 1/Small busines computing — an approach/ The Z80/EPROM programmer construction.

Volume 3 No 6
June 1980
Benchtest: Tandy TRS-80 Model II/ Benchtest: Sintrom Periflex 630/48/ Staff case study/Checkout: Softy Intelligent EPROM Programmer/ Checkout: Exatron Stringy Floppy/ Practical examples of the IEEEE-48 bus use/Programs: Naming Nascom files/380Z Pictures/Fuel tank calculations — PET/PET large numerals/PET tank battle/Basic string handling.



Volume 3 No 12
December 1980
Benchtest: Microwriter/ Printerfacing: Series — Part 1/Sharp PC-1211 speed-up/Programs:TRS-80 Tarot, PET Cat & Mouse, PET Rebound, MZ-80K Alligator Swamp, PET Connect, UK101 Minefield, PET Simon Benchtest: Raannd SP1

Volume 4 No 1
January 1981
Benchtest: Transam Tuscan/Real-time control using trains — part 1/ Recover from a data tape disaster/PET Music Multi-user systems — part 1/Programs: TRS80 Four in a row, TRS80 Target Practice, PET Convoy, PET Wire, PET Maze Chase, PET Android Attack, PET Anagram





Volume 4 No 3
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Benchtest: Onyx C8002/Benchtest: Bigboard/Micro music software package/ALC circuit/Commons report/HP 43C/Programs: TRS80 Show Jumping, PET Grand Prix, PET Aircraft landing, PET Bouncy.



Volume 4 No 5
May 1981
Benchtest: Pascal 640/WP Benchtest: Magic Wand/PET colour/Low-cost digital tape system/ Using calculator printers on micros/ Apple music-making/Multi-user Benchtest: MVT-Famos/Programs: PET Grand Prix, PET Aircraft Landing, PET Bouncy.



Volume 4 No 6
June 1981
Benchtest: NEC PC-8001/Multi-user Benchtest: MP/M/Benchtest: Sinclair ZX81/West Coast Faire report/Radio Teletype/WP Benchtest: Wordpro 4 plus/Budget tape interface/Further Casio quirks/ Programs: UK101 Zor, PET Chords.



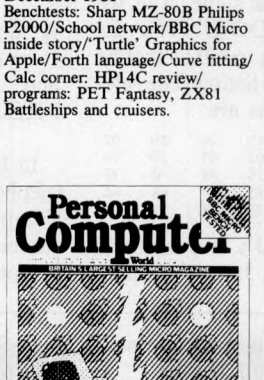
Volume 4 No 7
July 1981
Benchtest: Sharp PC-3201/Multi-user Benchtest: Acorn Econet/Case study: Accident investigation on TRS-80/Zilog Z8 family/WP Benchtest: Format-80/Pascal Benchmarks: readers letters/Quicker Casio computations/Programs: ZX80 Sliding letters, UK101 Car Rally, TRS-80 Calendar, UK101 m/c code to Basic converter, PET Exam Questions, MZ-80K Designer, ZX91 Sketch Pad.



Volume 4 No 8
August 1981
Benchtest: Tandy Model III/ Viewdata update/WP Benchtest: Spellbinder/Printer survey/ Microholism/Programs: ZX80 Othello; Easter Sunday; Apple Mondrian; MZ-80K Duck Shoot; PET Gomoku; MZ-80K Football.



Vol 4 No 12
December 1981
Benchtests: Sharp MZ-80B Philips P2000/School network/BBC Micro inside story/'Turtle' Graphics for Apple/Forth language/Curve fitting/ Calc corner: HP14C review/ programs: PET Fantasy, ZX81 Battleships and cruisers.



Vol 5 No 1
January 1982
Benchtests: BBC Micro Xerox 820/Frames of Reference (new series)/ZX81 printer Checkout/ Digital Drummer for PET/Calc Corner: benchmarks/Programs: MZ-80K Fortune, TRS-80 Reaction Timing, ZX80 Laybrinth, Apple Letters.



Vol 5 No 3
March 1982
Benchtests: Texas Instruments 99/ 4A, Hewlett-Packard 125/Choosing a Database/Compsoft DMS REVIEWED/Screenplay (new series)/Calc Corner: Hewlett-Packard Interface Loop/Programs: TRS-80 Solitaire, TRS-80 Ducks, Nascom Business Documents, MZ-80K Race Chase, ZX81 Graphplot.



Volume 5 No 4
April 1982
benchtest; Monroe OC8820/DB Benchtest: FMS-80/Checkout: Sid 1/Generating screen forms/Comal/ Logo/Brain Dump-New series/Calc Corner: Casio FP-10 printer/ Programs: TRS-80 Maths & Trig, PET Boot the Cat, ZX81 Resistor & Res code.



Vol 5 no 6
June 1982
Benchtests: Sharp MZ-80A/ZX Spectrum/Database Benchtest: DBMS2/West Coast Fire Report/ Lisp/VIC 20 games/Calc Corner: Sharp PC1500/Programs: RML Altered Basic/VIC-20 Large Characters/BBC Breakout/VIC20 Trailblazer/MZ-80K Next-to-Last-One/MZ-80K Tarot.

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Vol 5 No 8
August 1982
Benchtests: Sort M23/Dragon 32/ Database Benchtest: Cardbox/ Preview: Sony SMC-70/UCSD p-System/RS232 Interface/Sirius graphics/NCC Show report/ZX81 Speech Checkout/Calc Corner: Casio fx602p/Programs: TRS-80 Quadrangle/UK101 Conversion of units/PET Mopup/Apple Lifespan/ Apple Trees/Nascom Snail Racing/ UK101 Long Multiplication & addition.



Vol 5 No 9
September 1982
Benchtest: Olivetti M20/Word Processor Benchtest: Select for NEC/ Database Benchtest: Aquila/Checkouts: Microwriter Revisited, E40 Data Compression/ Screenplay: ZX81 Pt II/DIY Logo/ P for Perfect/Beeb Colour Hi Res/RS232/Calc Corner: HP15 and 16C reviewed/programs: Video Genie Extended Basic, ZX81 Alphabetising, PET File Comparison, BBC Music Player, PET Virus, BBC Radar, PET German Game, TRS-80 Cardshuffler.



Vol 5 No 10
October 1982
Benchtests: HP-86; Positron 9000/ Database Benchtest; Personal Pearl/ 3D Graphics for BBC Computer/Hashing Techniques/ Designing your own Database/CP/ M-86 v MSDOS/Clock-Calendar Card for Apple II/Calc Corner: hints for Sharp PC122/Programs: ZX81 Star Trek; PET Knockout; PET Trains.



Volume 6 No 1
January 1983
Benchtests: Jupiter Ace/Torch/ Database Benchtest: Superfile/ Warnier-Orr programming tecniques/Expert systems/Tokyo Data Show report/Forth Benchmarks/Digital Video/The Nearly Man — Charles Babbage/ Portable Computer World — Continued Fractions/Micro Chess/Screenplay — Spectrum/ Programs: VIC Connect-4/ VICMon/Atari character set mover/VIC UFO/PET Forth Teacher/VIC Doppler/BBC Gomoku.

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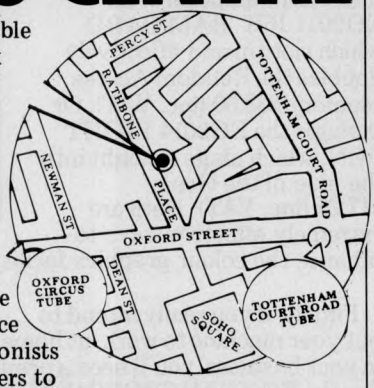



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Vol 5 No 11
November 1982
Benchtests: Canon CX-1; Hewlett Packard HP75/Database Benchtest: Condor/Apple II Clock Calendar Card Part — Algebra checking/ Benchmarks summary/Bit Stik graphics for Apple/Calc Corner — HP41C, Casio fx702p programs/ *PCW* Show report/Tiny printing on Centronics 739/Screenplay — Acorn Atom/Programs: Apple Piano; Apple Moon Module; PET Letterwriter; UK101 Logic; Atari Walls; Sharp MZ80K Area-filling; RML 380Z Restore.



Volume 6 No 2
February 1983
Benchtest: Sage/Database Benchtest: BusiPost/Which Spreadsheet — new series/Networks — new series/Expert systems/BBC graphics revealed/Logo Turtle/ Micro Chess — Fidelity's Prestige/ Portable Computer World — Sharp PC1251 Benchtested/Numbers Count/Screenplay — BBC games/ Programs — UK101 Vocabulary Test/PET Race Chase II/Apple Character Plotter/Variable Checkchart/ZX81 hex calculator/ Atom Backgammon/Video Genie Aircraft Lander/Atari Flashback/ MZ Text Analysis.

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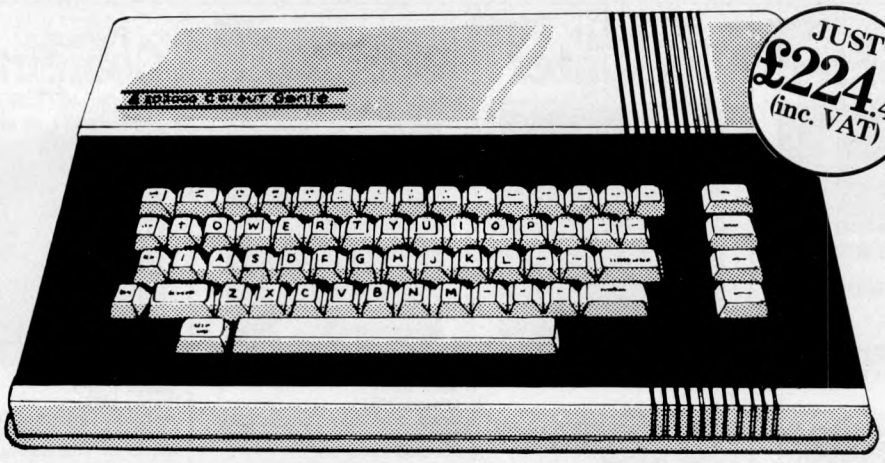

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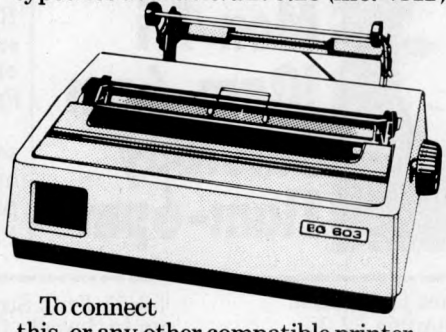

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The Brother HR-1 is an enticing addition to your system. It has a print speed of 16 cps, bi-directional, range of 8 typefaces, and a choice of two models with either parallel or RS232 interfaces. This model also enjoys a 2K PRINT BUFFER as standard.

computers
YOUR COMMAND

Reliability, durability and attractive appearance make the Brother HR-1 probably the best printer buy this year! £747.50 inc. VAT.

EG 3016 PARALLEL PRINTER INTERFACE AND CABLE

The EG 3016 is an interface allowing a Centronics parallel compatible printer such as an EG 603, EG 3085 etc to be connected directly to the Genie keyboard without the need for an expander box. £43.70 inc. VAT.

MONITORS

GENIE MONITORS

Two good performance, low priced 12″ monitors, either to match your Genie or compatible with a wide range of other systems. Good resolution and band width and, of course, they free your television set for the other type of programmes you like to watch!

The EG 100 12″ in black & white cost £77.05 inc. VAT.

The EG 101 12″ with green phospher is £90.85 inc. VAT.

A.V.T. MONITORS

Available in 9″ and 12″ sizes, with white, green or amber display, A.V.T. monitors are sturdy, attractive, easy to operate and feature an easy-view screen with smoked anti-glare display filter. Compatible with most popular micros on the market. From £98.90 inc. VAT.

NOVEX MONITORS

12″, green, metal cased, high resolution monitor with an anti-glare screen. Excellent value at £113.85 inc. VAT.

EXPANSION BOX

The updated EG 3014 expansion box allows for up to four disk drives and printer with optional double density, RS232 or S100 interface. Not bad value at £218.50 inc. VAT. (16K version) or £230 inc. VAT (32K version).

*The EG 3014 will work with TRS 80 using the EG3023 Tandy Adaptor.

EXPANSION OPTIONS

EG3020 SERIAL INTERFACE

Allows the Genie owner to communicate with other computers, use serial printers and telephone modems; in fact to talk to the world!

The EG3020 is a bidirectional RS232 serial interface for the EG3014 allowing baud rate of 110 to 19200. Word length is selectable between 5 and 8 bits. Parity and stop bit settings are switch selectable. Price £45.54 inc. VAT.

DISK DRIVES

If you want fast reliable program storage, true random access to many computer languages, we can meet your needs. The EG 400T provides storage of up to 184320 bytes per floppy disk and comes complete and tested in a stylish colour-matched cabinet. £253 inc. VAT.

The EG 401 AT offers duel disk drive with 368640 bytes of useable storage and comes complete with a power supply ready to connect to an expansion box. £425.50 inc. VAT.

DOUBLE DENSITY ADAPTOR

Allows the use of standard minidisk drives in double density, with virtually double storage capacity. The EG 3021 is equally at home in the Genie or TRS–80 expansion boxes. Double Density Adaptor £82.80 inc. VAT.

For the above, a double density disk operation system will be required. One such system is Smal-LDOS.

Powerful, yet reasonably priced, the Genie Smal-LDOS contains 21 library commands, 7 utilities, LBASIC, disk basic and bags of information, including a reference manual and 40 page beginners guide to disk usage £40.25 inc. VAT.

EG3022 BUS ADAPTOR

Gives full S100 capability to the Genie computers. The EG3022 supports any two S100 cards. Price £73.37 inc. VAT.

BUS EXTENDER

A most useful accessory, allows two bus using devices to be connected simultaneously to the Genie – when using the Hi Res and expander for instance. £24.15 inc. VAT.

EP1, EP3

Are 1.5 K additional EPROMS for Genie I & II.

EP1 Adds all Genie I software facilities to other Genies: lower case driver, machine language monitor, renumber facility, keyboard repeat and screen print.

EP3 Has HI-RES driver software with 10 extra HI-RES commands which prevent the need to load HI-RES software from tape. All at £13.80 inc. VAT. For Video Genie Systems, the LE-19 connects direct to the Genie bus and allows one of these EPROMs to be fitted externally. £30.47 inc. VAT.

TANDY BASHER

If you are a TANDY user read on! The EG 3023 is bus converted to allow Genie peripherals to be used with Tandy Model I computers. £18.40 plus VAT.

(Just in case there might be a few strange souls who want to convert in the the opposite direction there is the 50/40 converter which generates a Tandy compatible 40 way bus from a Genie. £21.16 inc. VAT.

BUSINESS SOFTWARE

Specifically written for the Genie II computer, with disks and a suite of packages from the renowned house TRIDATA. The suite includes SALES LEDGER, PURCHASE LEDGER, PAYROLL and STOCK CONTROL Each package is a very reasonable £155.25 inc. VAT. Full details on request.

TECHNICAL MANUALS

Full technical details of Genie Hardware (all you ever wanted to know about Genie).

Genie I/II Technical Manual £10 – No VAT.

Expander and accessories (EG3014). £10 – No VAT.

EQUIPMENT COVERS

Beat the dirt, coffee spills and sticky fingers when your computer and monitor are not in use with these top quality black pvc covers.

Genie CV1 £5.75 inc. VAT.
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9″ monitors CV3 4.83 inc. VAT.
Centronics Printer CV5 – £4.83 inc. VAT.

SYSTEMS DESK

Even a compact modular computer system like the Genie benefits from being used on a custom designed system desk. The SD1 system desk is designed to accommodate a complete Genie System and has a special upper shelf to support the display monitor at the best level. The desk is flat packed for easy delivery and finished in attractive teak and charcoal colours. £93.61 inc. VAT.

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I enclose 30p p&p for Genie Colour Brochure ☐

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Please send me the following items:

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All items are despatched via Securicor, please add £5 p&p and delivery to your total bill.

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PCW.3.83

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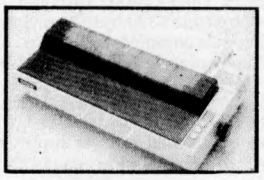

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COLUMBIA



MAIN FEATURES	CDP-MPC	IBM-PC*	OTHERS
Microprocessor	16-Bit 8088 8-Bit Z-80 (Opt)	16-Bit 8088	?
USER Memory	128K-1 Mbytes	18K-256 Kbytes	?
IBM-PC Compatible Expansions Slots Beyond Professional Configuration[1]	8 Slots	0	?
Resident Floppy Disk Storage	Dual 320K (std)	Dual 160K (Opt) Dual 320K (Opt)	?
Resident Cache Buffer Hard Disk Storage	5M/10M	–	?
OPTIONAL OPERATING SYSTEMS (Supported by Company)[2]			
MS-DOS (PC-DOS)	Yes	Yes	?
CP/M 86	Yes	Yes	?
MP/M 86	Yes	–	?
OASIS-16	Yes	–	?
XENIX	Soon	–	?
OPTIONAL HARDWARE EXPANSION BOARD (Supported by Company)			
RS-232 Communications	Yes	Yes	?
B/W and Color Display Controller	Yes	Yes	?
Expansion Memory	Yes	Yes	?
Z-80 CP/M-80 Board	Yes	–	?
Cache Buffer Hard Disk	Yes	–	?
Time/Calendar Board	Yes	–	?
IEEE Bus Controller	Yes	–	?
8" Floppy Disk System	Yes	–	?
8" Hard Disk System	Up to 40 Mbytes	–	?
Tape Cartridge System	Yes	–	?

[1]For comparison purposes, typical professional configurations consists of 16-Bit 8088 Processor, 128K RAM with Parity, Dual 320K 5-inch Floppies, DMA and Interrupt Controller, Dual RS-232 Serial Ports, Centronics Parallel Port and Dumb Computer Terminal or Equivalent.

[2]Columbia Data Products also supports CP/M 80 with an optionally available Z-80 CP/M Expansion Board.

*As advertised in BYTE Magazine, August 1982

OTHER MODELS AVAILABLE

£175	Silentype 80-Col Graphics Printer	**£460**	Paper Tiger 455
£1300	Flowriter 1600 RP	**£560**	Paper Tiger 460
£795	ET121 KFR Olivetti Daisy Wheel printer includes parallel RS232 & IEEE 488	**£725**	Paper Tiger 560
		£760	Anadex DP9500
£1050	QUME 35 KSR	**£795**	Anadex DP9001
£110	QUME Form Tractor TEC	**£900**	Annadex DP9501
£1000	Starwriter 70/40	**£1200**	Colour Prism 132 Printer

CP/M SOFTWARE – Available for both ACT Sirius 1 & Superbrain

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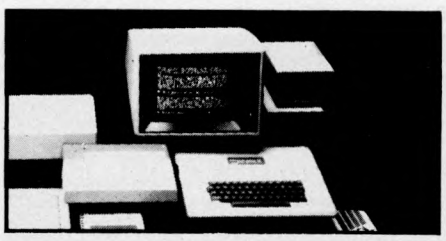
FORTRAN	MDBSIII	INTEFR ACCOUNTS
CIS-COBOL	DBII	SALES LEDGER
COBOL	MAILMERGE	PURCHASE LEDGER
FORTRAN	DATASTAR	NOMINAL LEDGER
MBASIC	SUPERSOFT 1	INVOICING
CBASIC 86	SUPERCALC	PAYROLL
APL	MULTIPLAN	STOCK CONTROL
MPM	OASIS 16	DS
C		PULSAR SOFTWARE
MS-DOS		
CPM 86 ,80		



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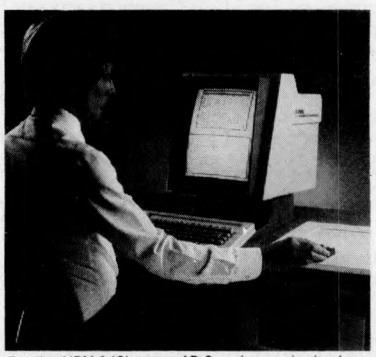

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80-COLUMN APPLEWRITER II
Pre-boot utility from PYNWON SOFTWARE, giving a beautiful display with APPLEWRITER II for the VISION-80 or SCREENMASTER 80 – the resultant display is better than an Apple III running Applewriter. **RRP £18 + VAT**

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patriarch of Constantinople (428-43[illegible])
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nĕt *(net) (n)* **1.** an openwork fabric of string, rope, wire, etc; mesh. **2.** a device made of net, used to protect or enclose things or to trap animals. **3.** a thin light mesh, fabric of cotton, nylon or other fibre.

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Calc..... Set into the form, your data fields, "££££££" and specific file-related activities,formulae and validation checks. Enter values and see the spreadsheet calculate itself.

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Here's an example of an invoice you might design for your stationery..... You could design your own spreadsheet,order form,statement, or any other kind of form that is required to fit your existing stationery.

```
INVOICE    <0>£££££££££££££

To £<1>£££££££££££          From: G.W.Ltd
   £<2>££££££££££££££££         55 Bedfrod Court Mans.
   £<3>££££££££££££££££         Bedford Avenue
   £<4>£££££££££££              London W.C.1.
   £<5>£££££££                  Tel:01-636-8210

Date <6>££.££    Tax point <7>££.££   Agent <8>£££

Quantity        Description          Cost    Tax    Total

<9>£££          <10>£££££££££££££    <11>££  <12>££ <13>£££
<14>££          <15>£££££££££££££    <16>££  <17>££ <18>£££

                    and so on.....

        Total......<19>£££££          Tax.......<20>££££
```

<??> items <1> to <5> internal command to request name input, and then search an address file for details.
<??> items <6> to <7> request date input and validate.
<??> item <8> request agent number and validate range.
<??> item <9> request quantity,validate range.
<??> item <10> request description,search file,accept,and calculate fields <11>,<12>,<13>, if finished invoice then calculate fields <19> and <20>

Now comes the more valuable facility, You can provide the 'FORM' with file-related instructions, not only to request a 'console' input for a file search against names, and stock, but after the invoice is finished the fields you have selected may be passed to related files.
EG: Send fields <0>,<1>,<6>,<7>,<11>,<12>,<13>,<19>,<20> to a sales ledger.
Then send fields <9>,<10>,<11> to product analysis file.
Then send fields <0>,<1>,<7>,<19>,<20> to V.A.T. file.
Then send fields <10>,<11>,<12>,<13> to Nominal ledger.

The program is only available from G.W.Computers Ltd <U.K.> with a system purchase at 575.00, note DBMS III comes free with system deals. or by mail order transaction at 395.00.

REFER TO PAGES 52 & 53 FOR MORE DETAILS

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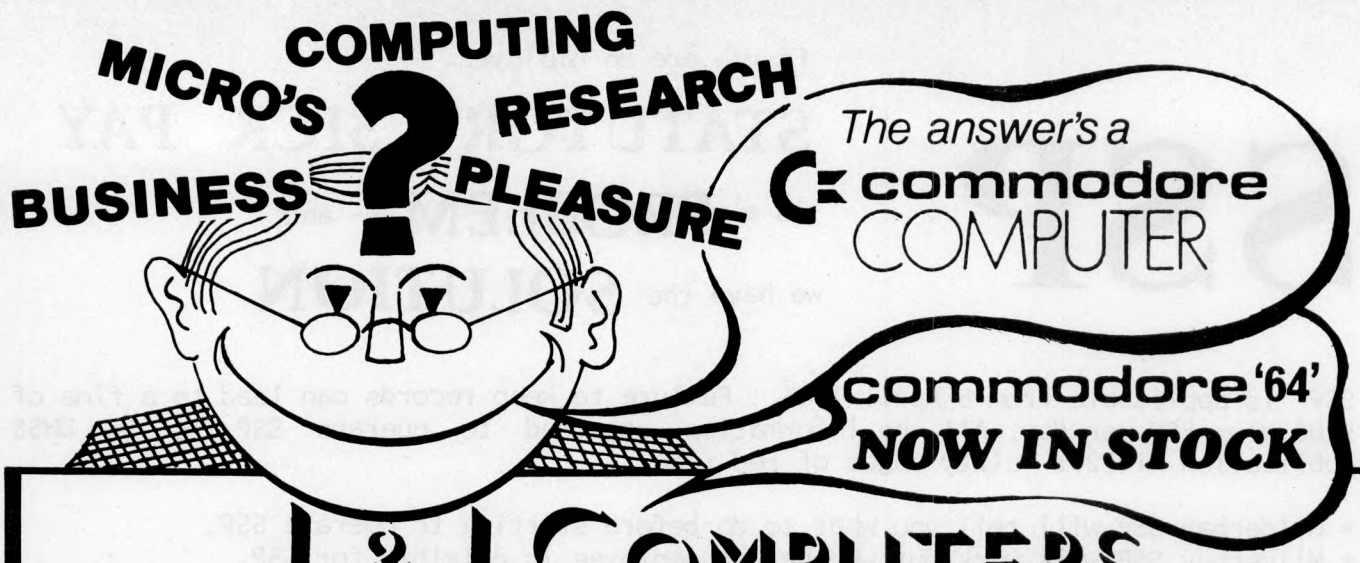
hairs on the leaves — *(vt)* irritate provoke. — **nĕt'tle rash** *(n)* skin disorder like nettle stings.

nĕt'work *(n)* **1.** chain of interconnected persons, operations, or electrical conductors, group of broadcasting stations connected for simultaneous broadcast. **2.** *electronics.* a system of interconnected components or circuits.

ASCAL DOS APPLE IBM P



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	32K	8032
	96K	8096
	SUPER-PET	9000
DISK DRIVES (5.25")	2M/B	8250
	1M/B	8050
	340K	4040
	170K	2031
HARD DISKS CBM	5 M/B	9060
	7.5M/B	9090
**MATOR 23/30/60	M/B	SHARK
**MATOR	BACK-UP	SHARKIVE
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PRINTERS (MATRIX)	CBM	4022
	CBM	8023
	CENTRONIC	150
	CENTRONIC	737
	(DAISY WHEEL) CBM	8300
	NEC	7730
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sym·biosis *(n)* **1.** living together in harmony of two organisms of different kinds *esp* to their mutual benefit.
sym·biotic *(adj)* — symbiotic computer systems manufacturers of **sym·bnet** *(n)* **sym·bfile** *(n) (see over).*

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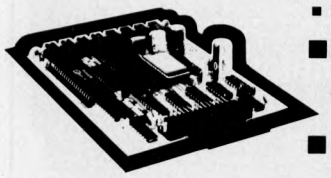

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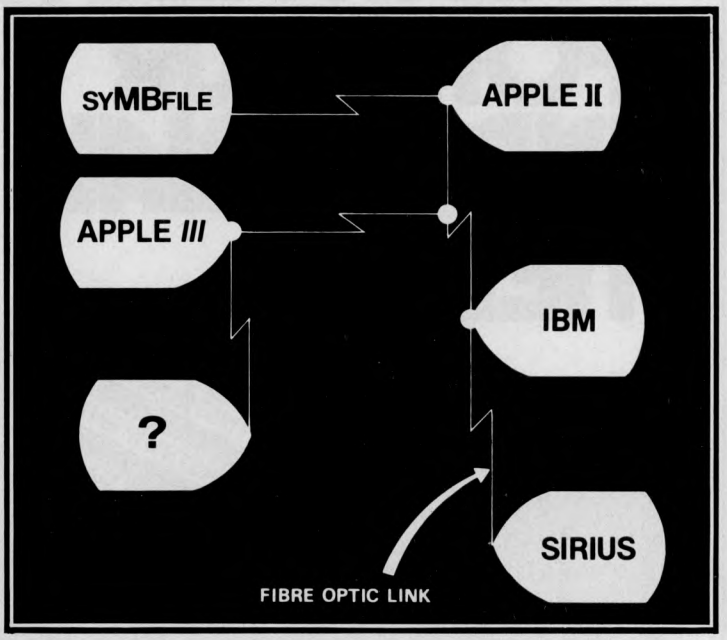

fig 1 **symb/net.**

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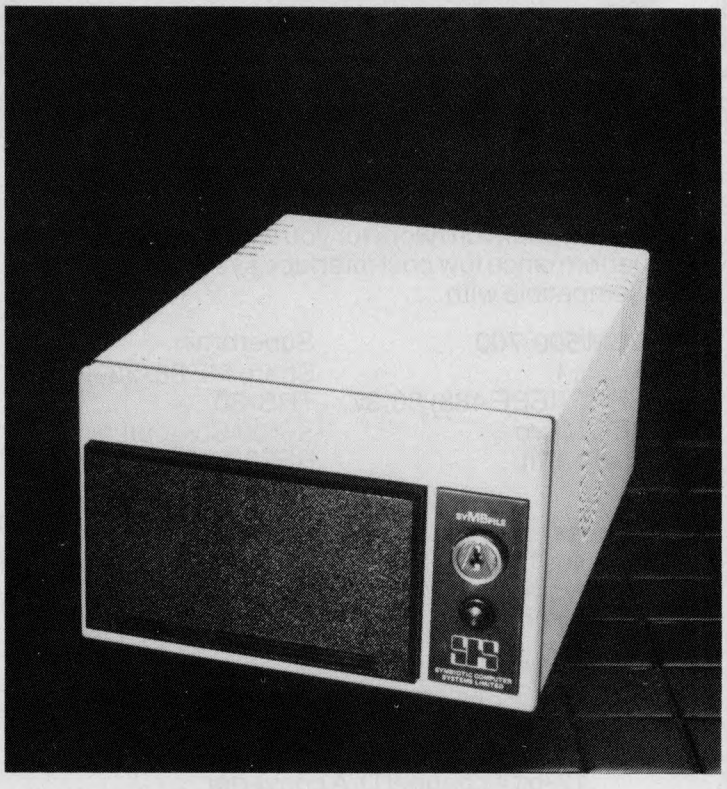

fig II **symb/file**

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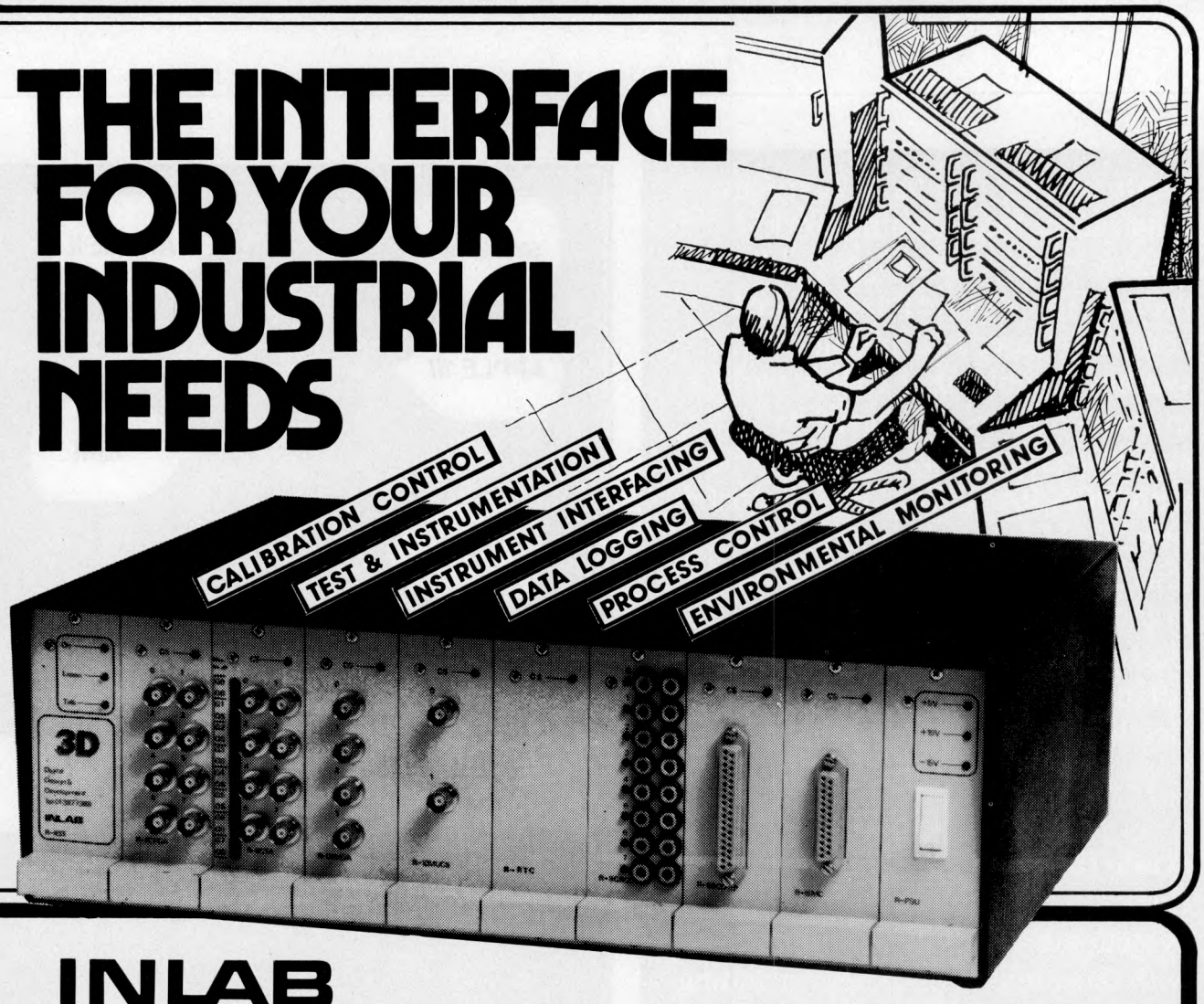

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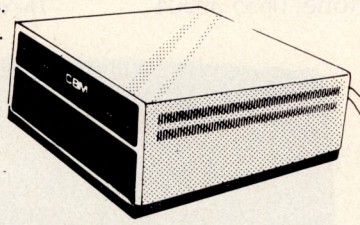

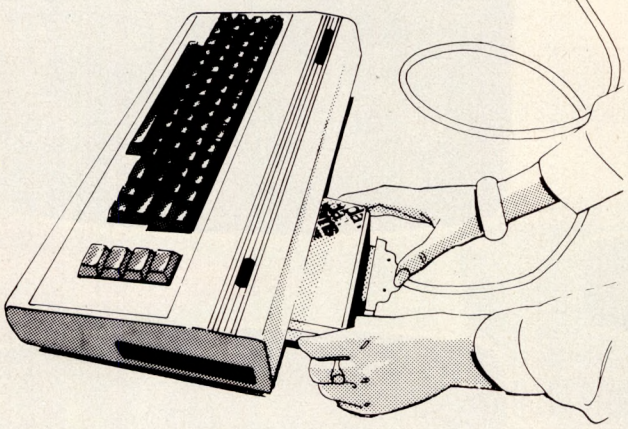

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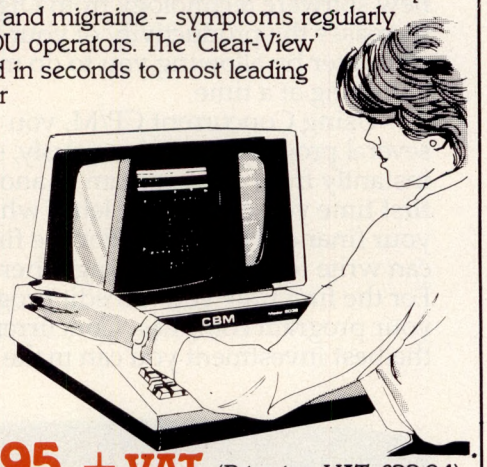

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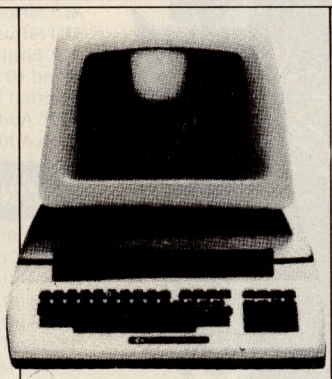

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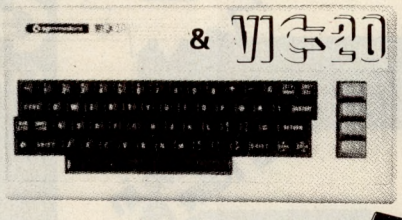

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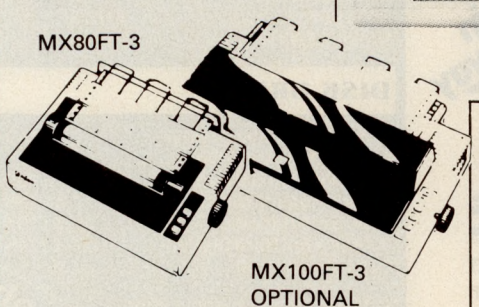

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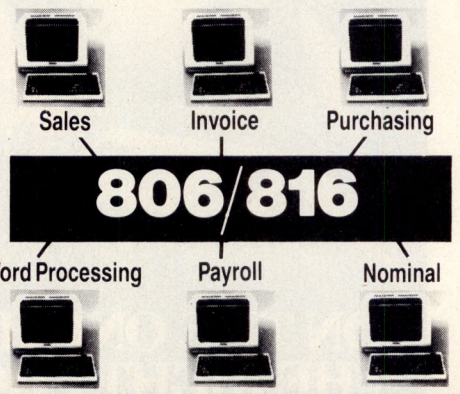

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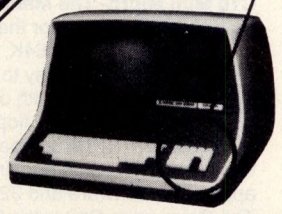

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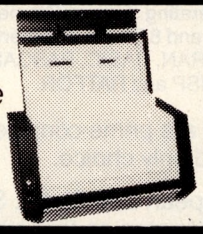

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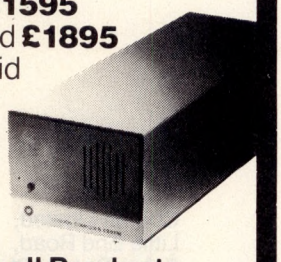

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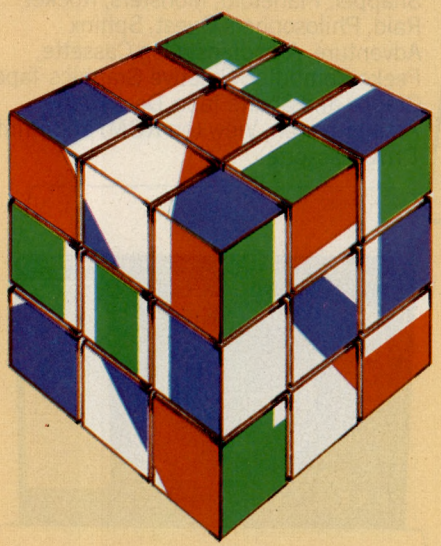

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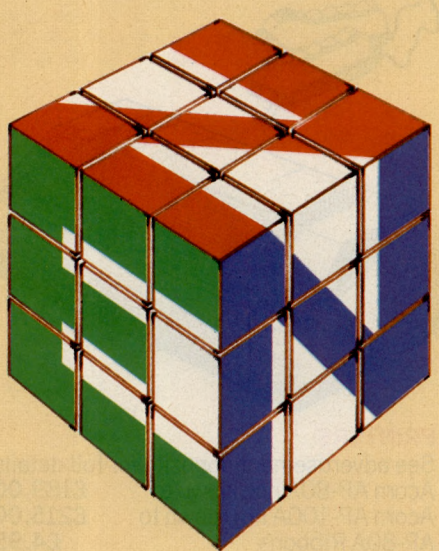

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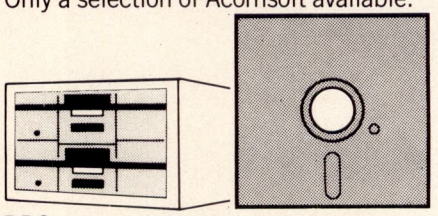

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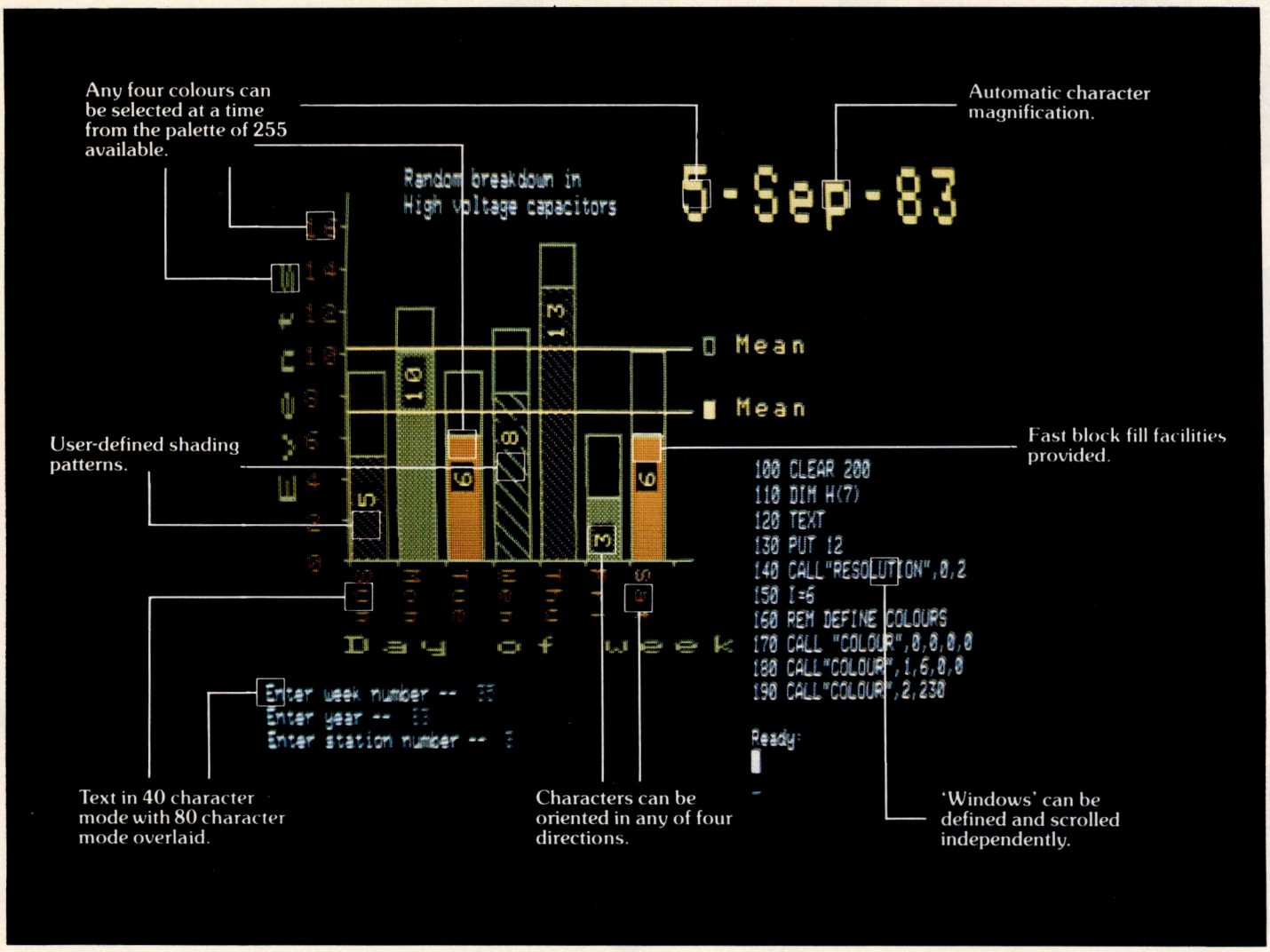

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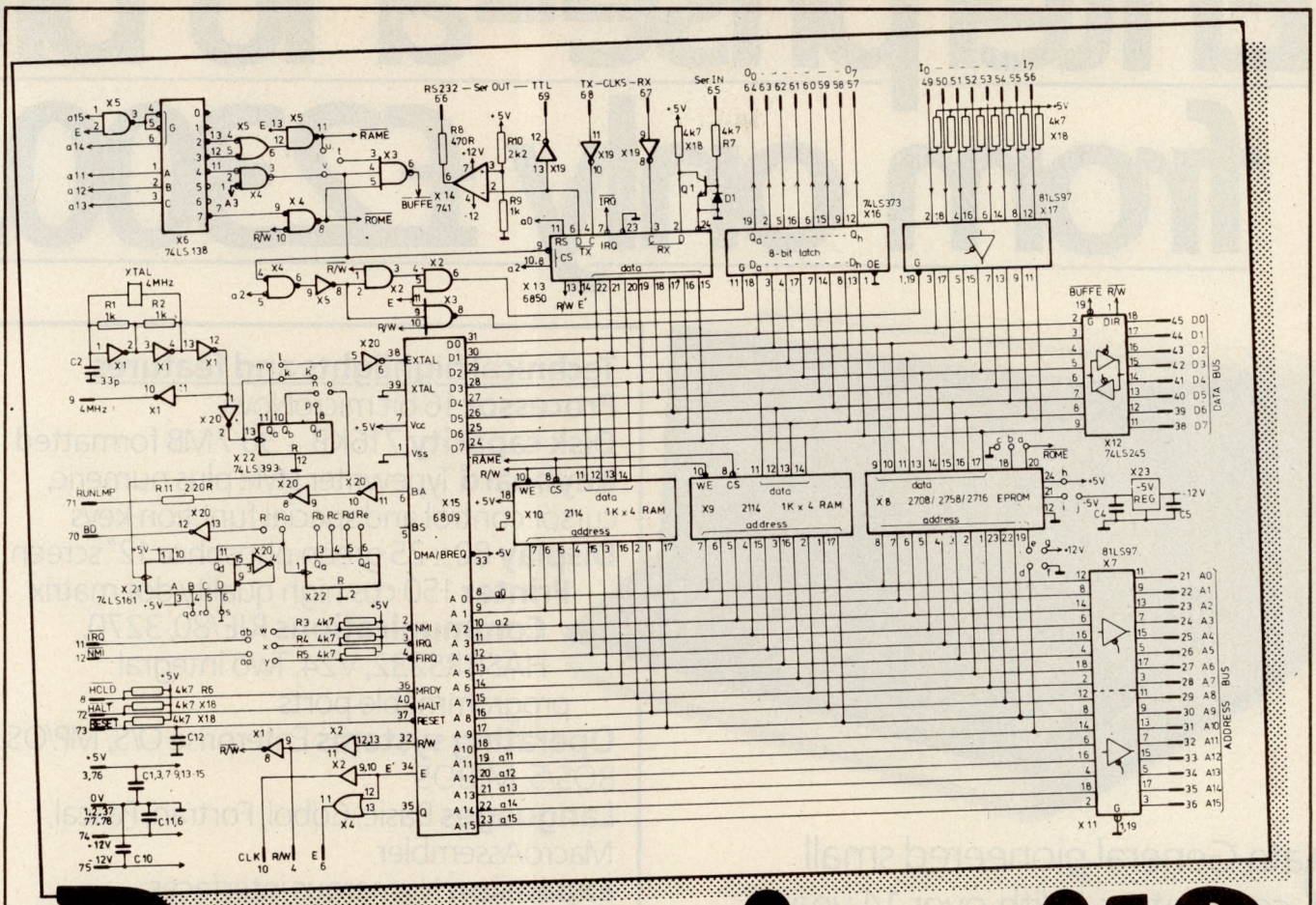

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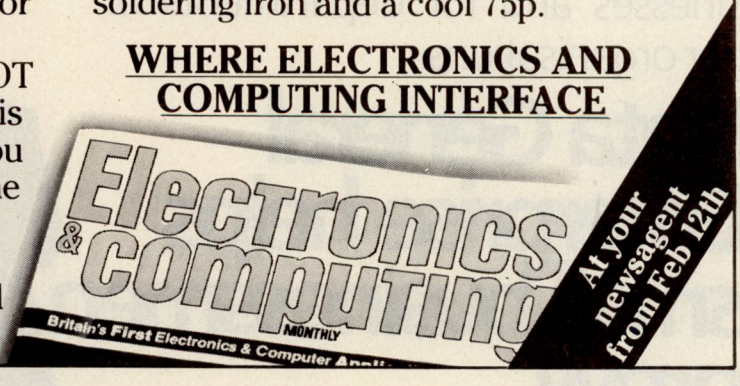

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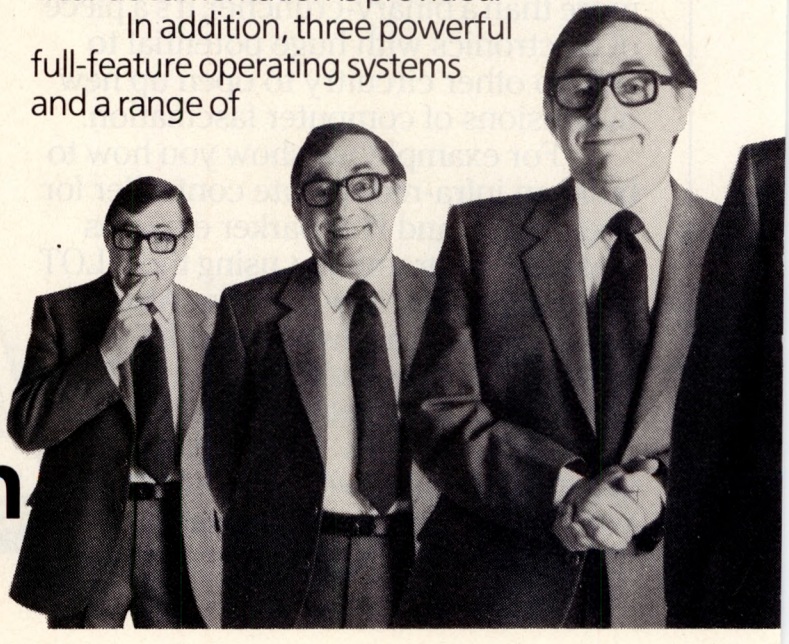

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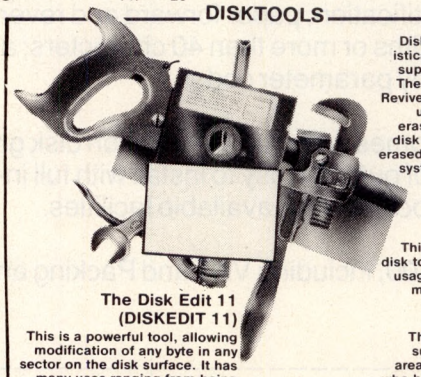

Disktools are a family of sophisticated programs designed to support CP/M based systems. The family consists of the Disk Reviver (DISKREV) * A simple to use program for recovering erased or corrupted files from disk - anyone who has had files erased or made unrecoverable by system failures will know how useful DISKREV can be!

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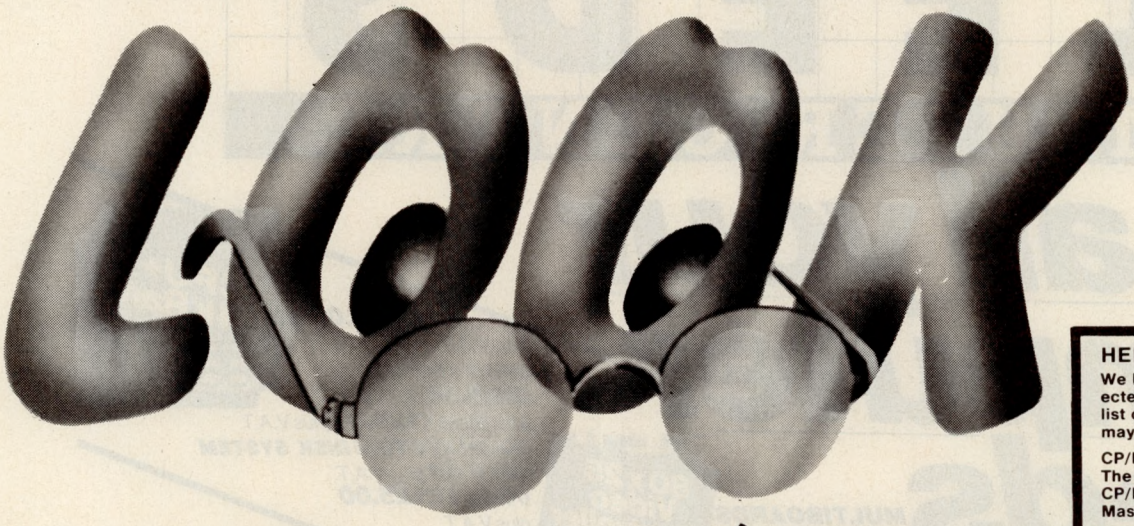

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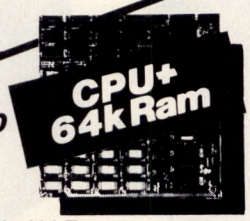

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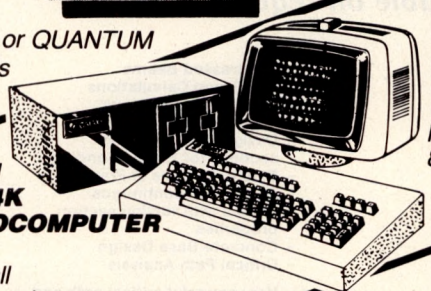

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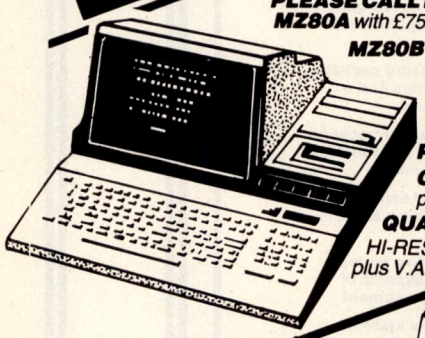

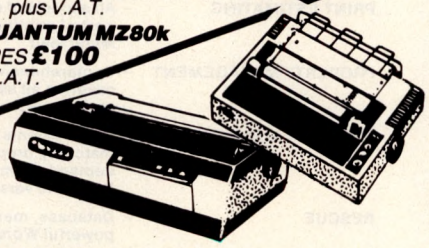

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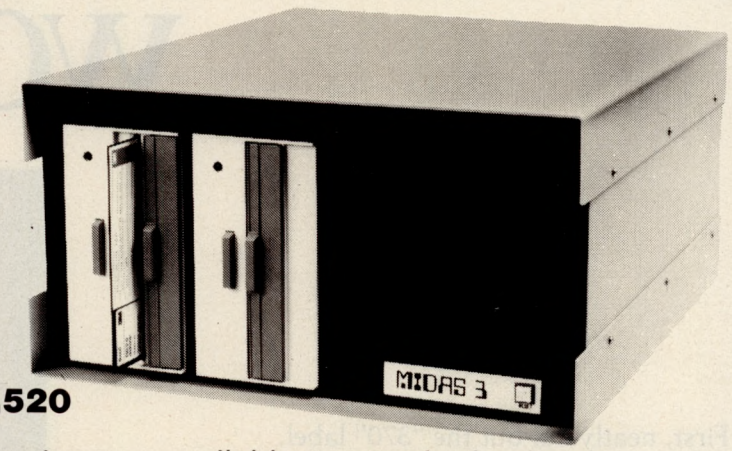

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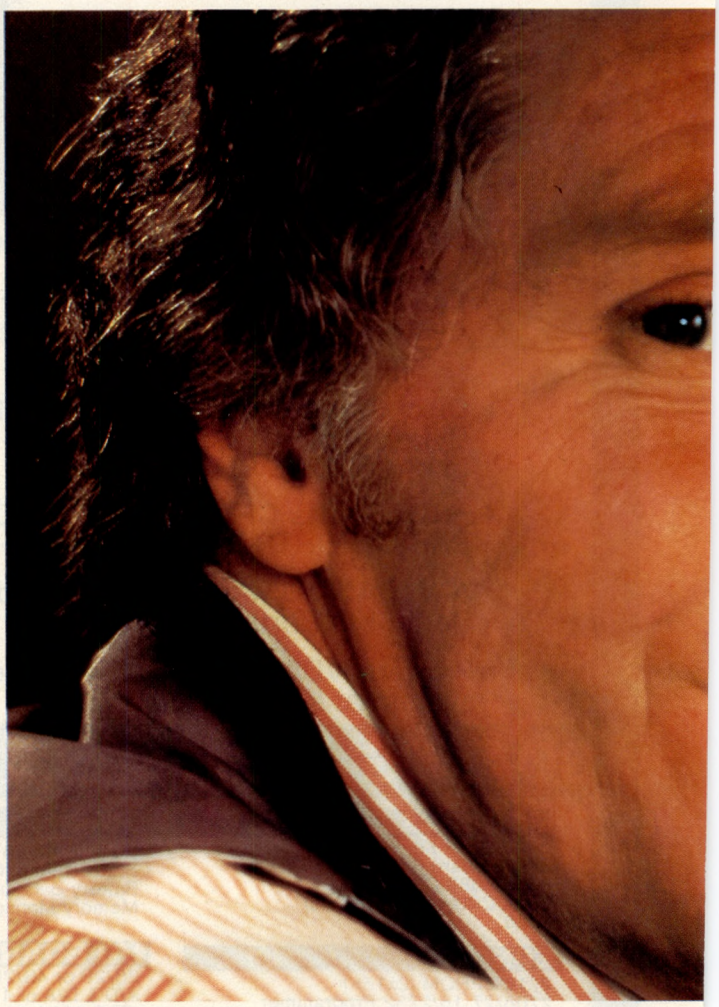

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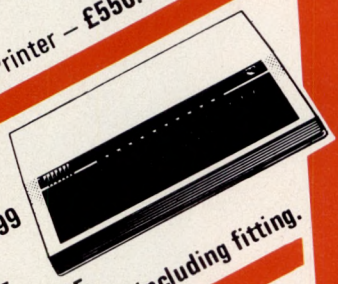

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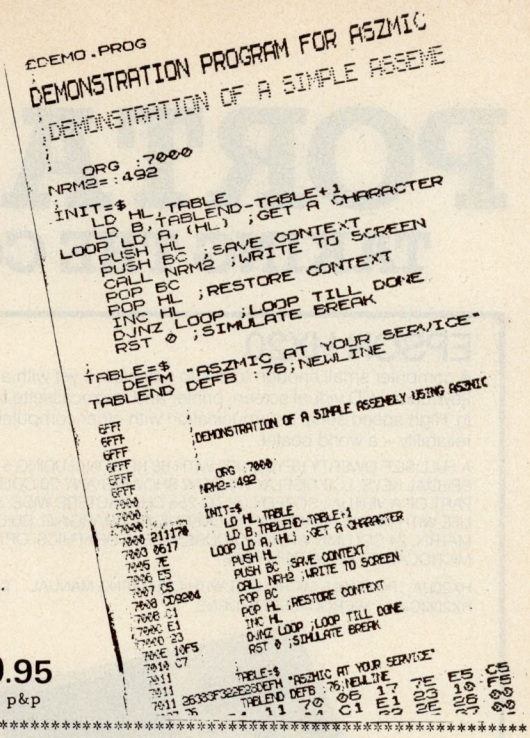

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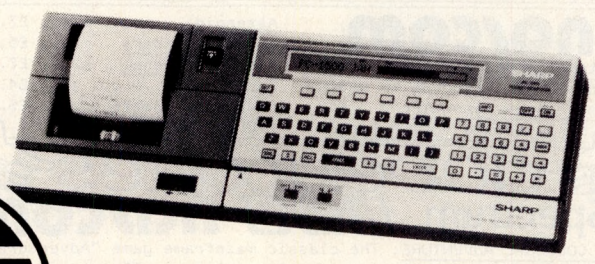

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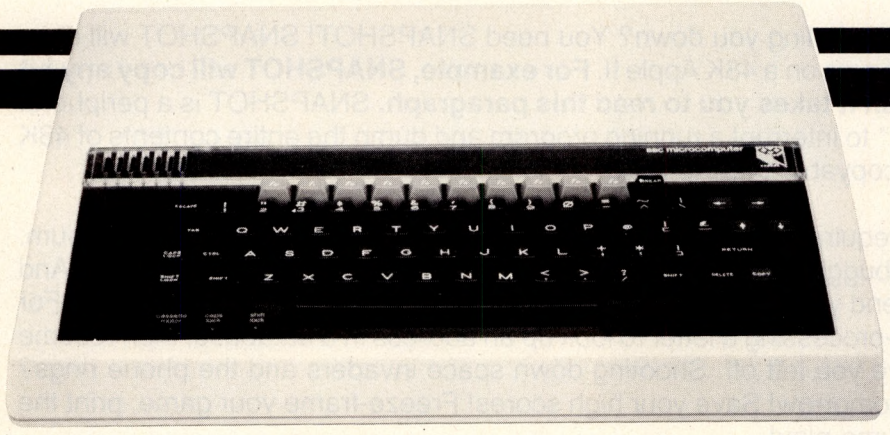

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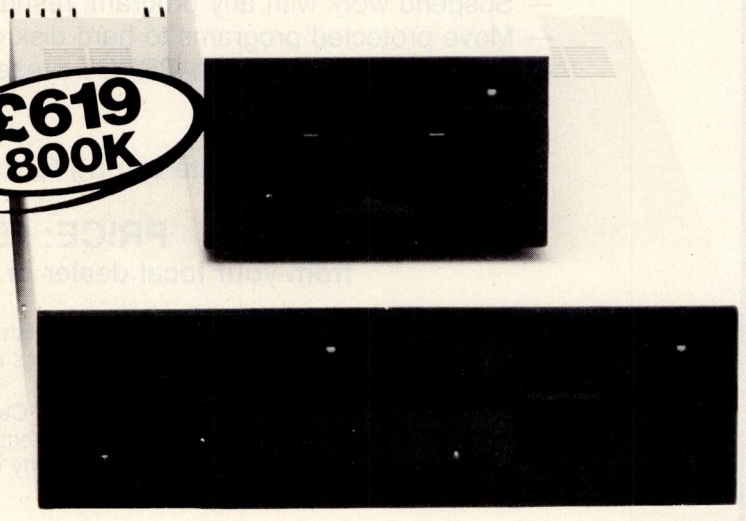

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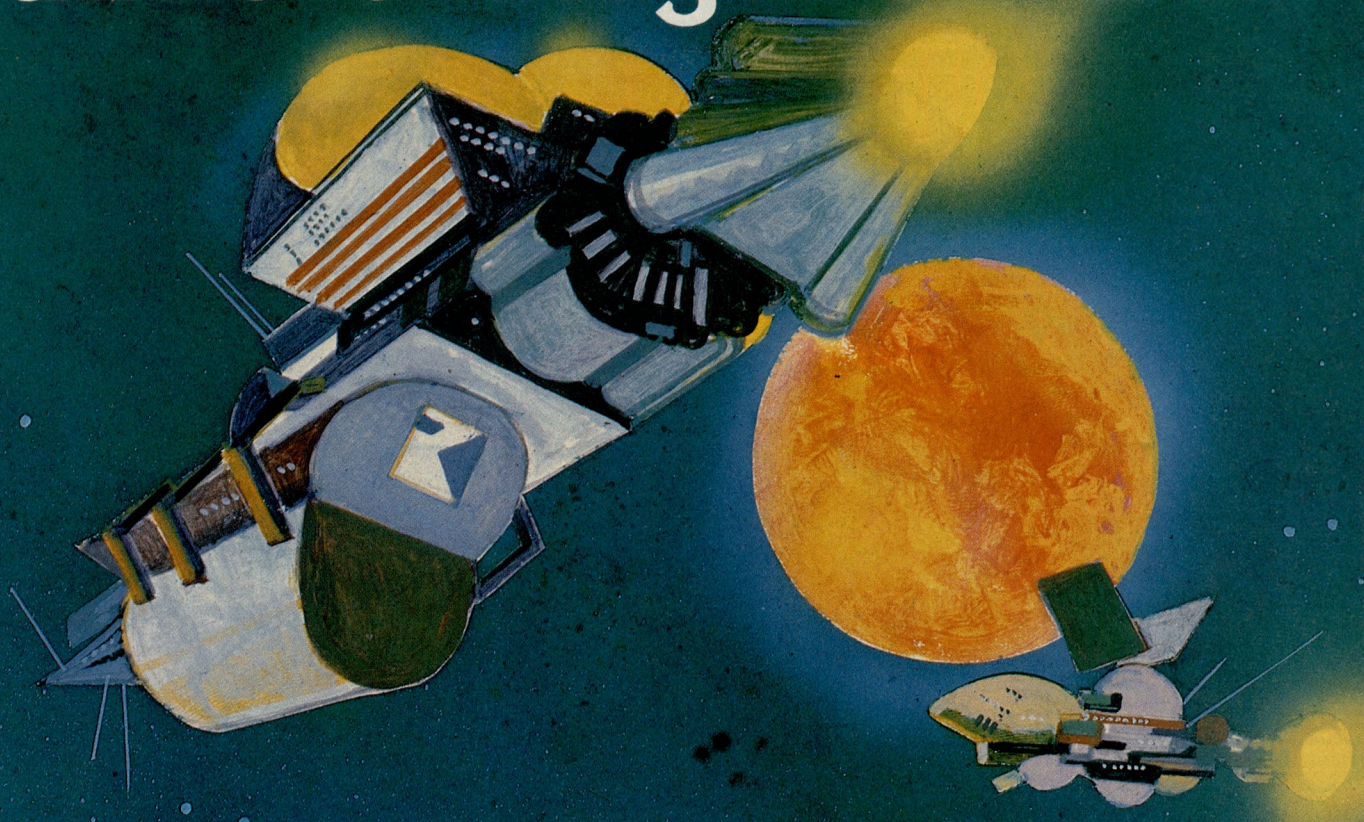

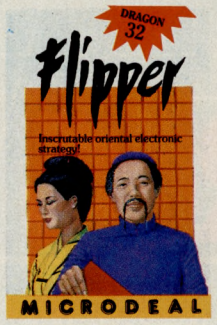

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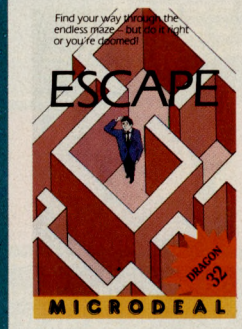

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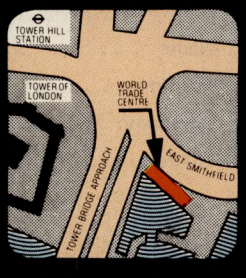

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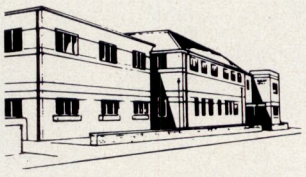

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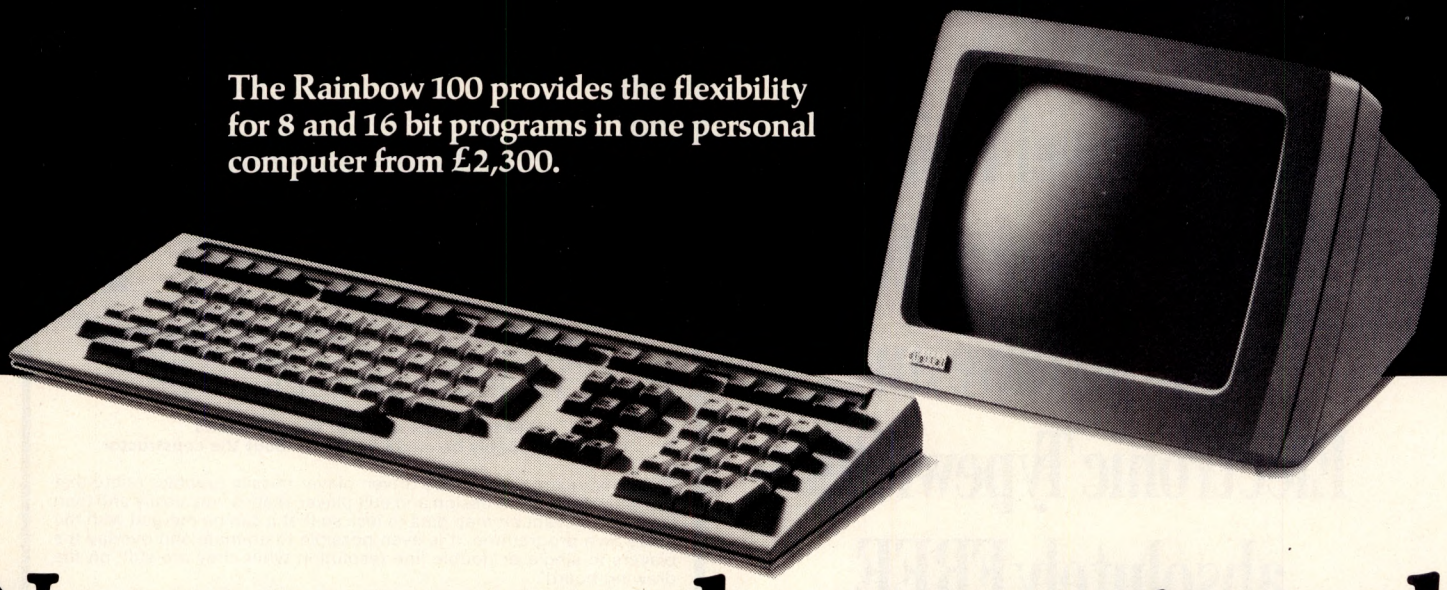

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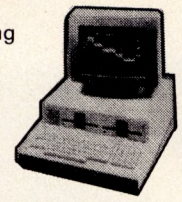

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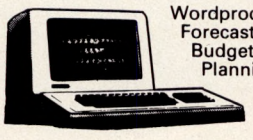

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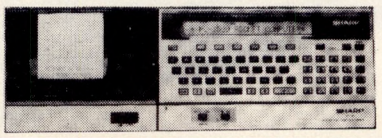

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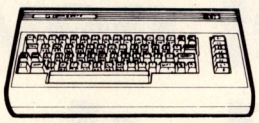

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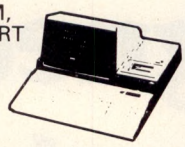

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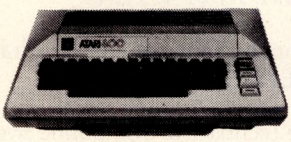

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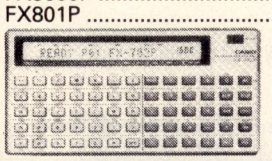

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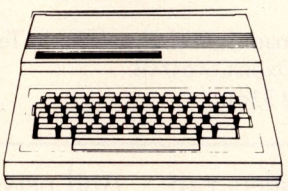

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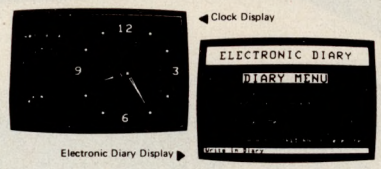

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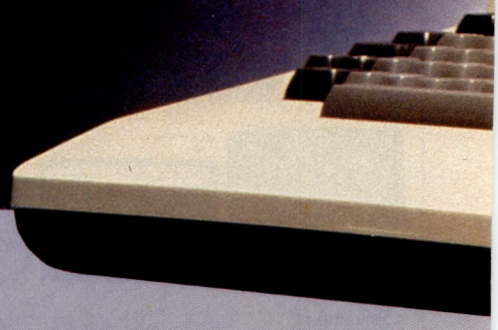

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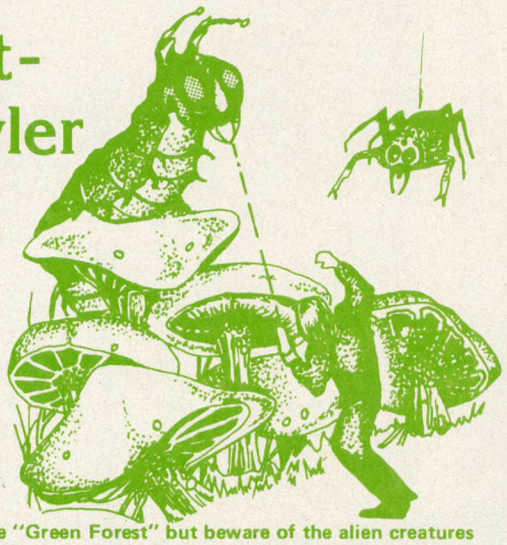

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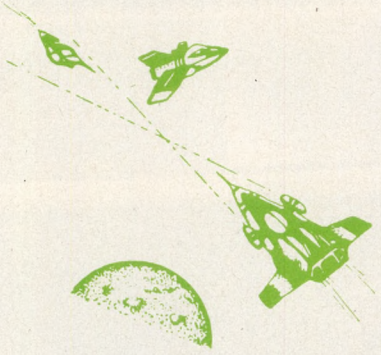

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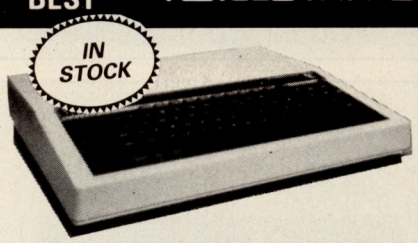

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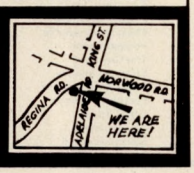



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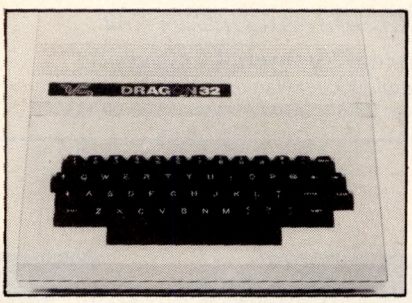

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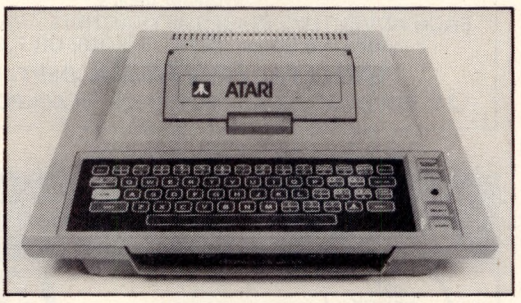



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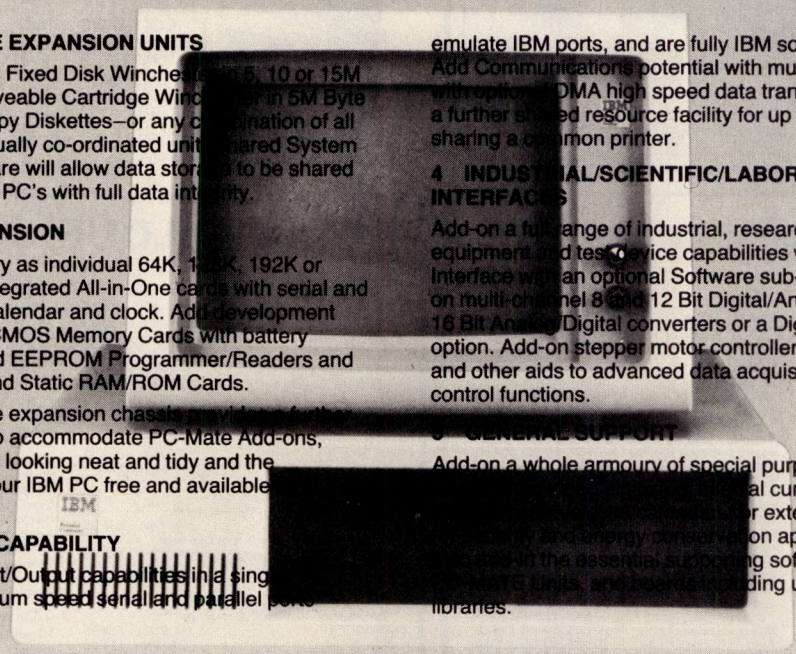

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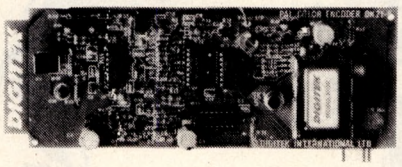

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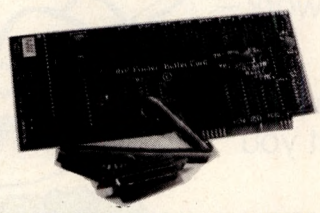

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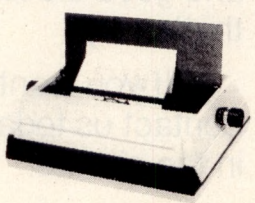

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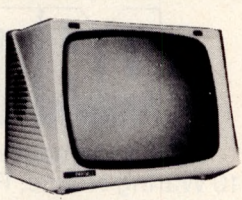

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We'll be talking about new products coming along from the Japanese and American manufacturers and spotting those who want representation in the UK and Europe. And we'll be reporting on those companies abroad which want to market British systems and software.

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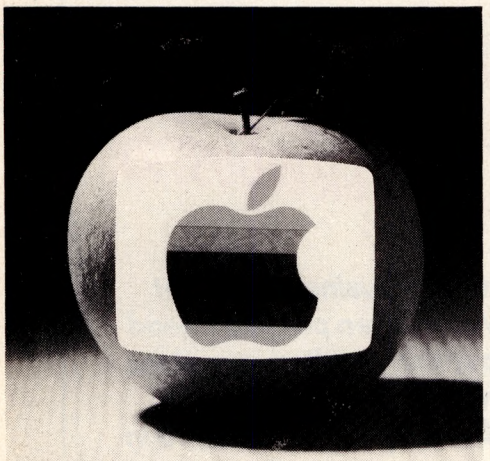

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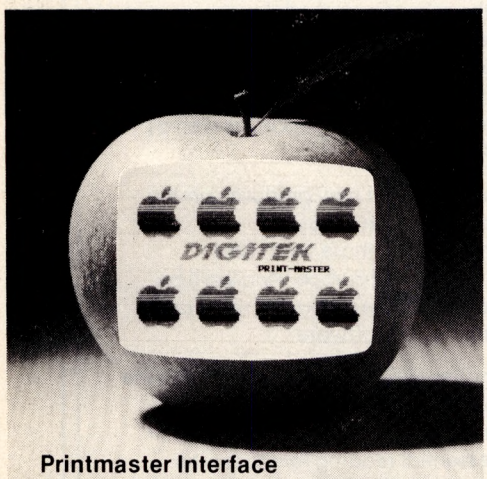

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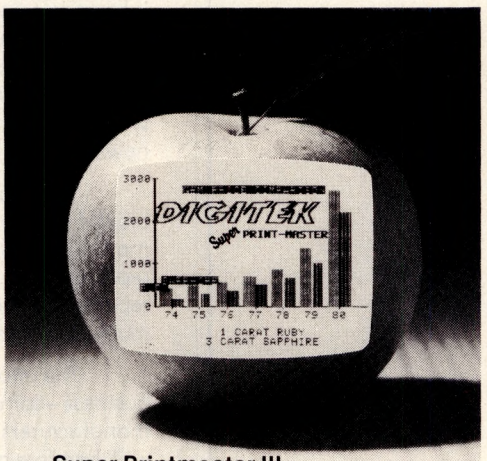

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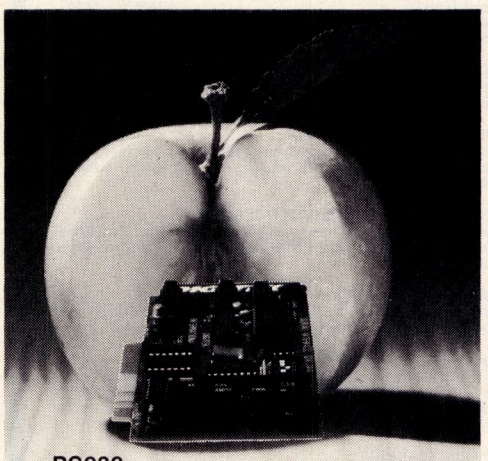

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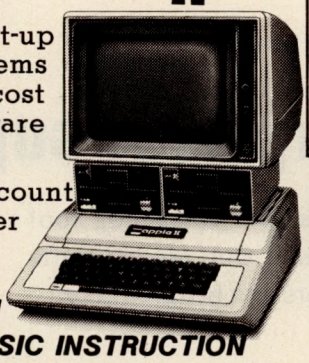

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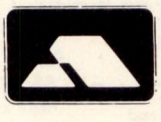

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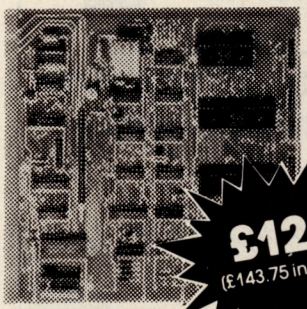
With MultiBoard an almost unlimited number of system permutations are possible. Seven of the most popular boards are shown here, but there is a range of 15 available from your MicroValue dealer; together with mother boards, frames, cables, power supplies, keyboards and compatible software if required.

Your MicroValue dealer can advise you on suitable permutations to suit your requirements, whether building a system from scratch or expanding your Galaxy or Nascom computer.

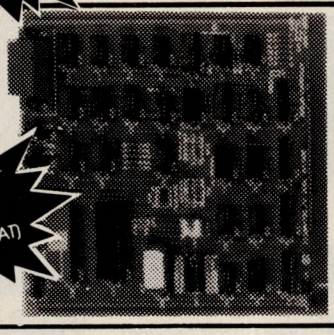


GM 816 — MULTI I/O Board

- Six 8-Bit I/O Ports
- 4 Counter/Timer Channels
- Real Time Clock
- Further expansion capability

Daughter boards also available for further expansion.

£125 (£143.75 inc. VAT)

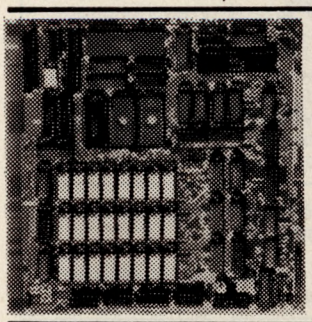


EV 814 — IEEE 488 Controller

- Cost-effective Controller
- Comprehensive software supplied

Controls equipment fitted with IEEE488 or GP1B interface.

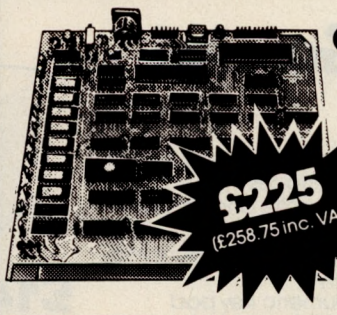
£140 (£161.00 inc. VAT)



PLUTO — Colour Graphics Processor Board

- 640 x 576 Bit mapped display
- On-board 16-Bit microprocessor
- Comprehensive on-board software

IO 828 A:	IO 828 B:
192K RAM "PLUTO" **£399**	"BABY PLUTO" 96K **£299**
(£458.85 inc. VAT)	(£343.85 inc. VAT)



GM813 — CPU/64K RAM Board

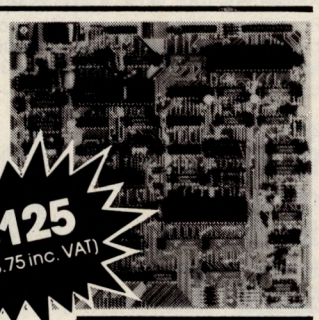
- 4 MHz Z80A CPU
- 64K Dynamic RAM
- RS232 Serial Interface
- Two 8-Bit I/O Ports
- 1200 Baud Cassette Interface
- Extended and Page Addressing Modes

£225 (£258.75 inc. VAT)

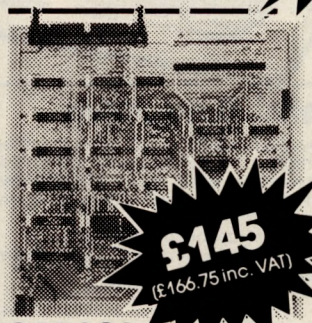
The Gemini GM813 is an 80-BUS compatible CPU card incorporating 64K dynamic RAM and utilising the powerful Z80A microprocessor running at 4MHz. Extended addressing and page mode facilities allow for future memory expansion up to 2 megabytes. Input and output capabilities include both programmable serial and parallel interfaces — RS232, 1200 baud CUTS cassette interface and the Z80A PIO. When used with the GM812 video card, the GM813's unique RP/M monitor allows the creation of cassette or EPROM based programs or files which are upwards compatible with a disk based CP/M system.

GM811 — CPU Board

- 4MHz Z80A CPU
- Four 'Bytewide' Memory Sockets
- Two 8-Bit Input/Output Ports
- 8 Bit Input Port
- RS232 Serial Interface
- 1200 Baud CUTS Cassette Interface



£125 (£143.75 inc. VAT)



GM812 — IVC Board

- 80x25 Display Format
- On-board Z80A Microprocessor
- Buffered Keyboard Input
- Programmable Character Generator
- 160x75 Pixel Graphics
- Light Pen Input

£145 (£166.75 inc. VAT)

GM 829 — FDC/SASI Board

- Single/Double density operation
- Single/Double sided drive operation
- Up to 4 mixed 3.5", 5.25" and 8" drives
- Industry Standard SASI hard-disk interface



£125 (£143.75 inc. VAT)

Other boards available in the Multiboard range include:

GM802	64K Dynamic RAM Board	**£125** (£143.75 inc. VAT)
GM803	EPROM/ROM Board	**£65** (£74.75 inc. VAT)
MP826	32K Static RAM Board	**£185** (£212.75 inc. VAT)

All MultiBoards are Nasbus* compatible
Ask for latest catalogue for full details.

*Trademark of Nascom Microcomputers Division of Lucas Logic

MicroValue

REAL value — from the Professionals

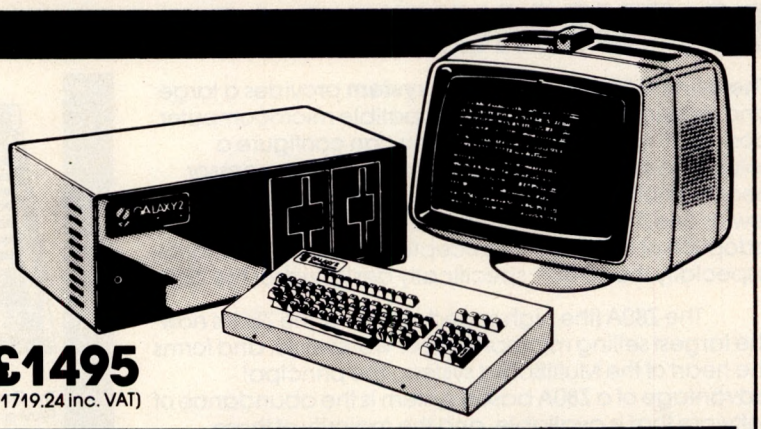
Value - MicroValue - Micro

COMPUTERS

New from Gemini

Gemini Galaxy 2

- ★Twin Z80A Processors
- ★CP/M 2.2 Operating System
- ★64K Dynamic RAM
- ★800K Disk Capacity
- ★80x25 Video Display
- ★Serial and parallel printer interfaces
- ★Cassette and light pen interfaces
- ★User definable function keys
- ★Numeric key pad
- ★12" Monitor included

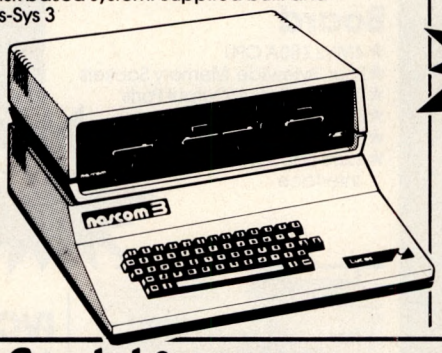


£1495
(£1719.24 inc. VAT)

Total support for Gemini & nascom Products

nascom 3 available from MicroValue

Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.



48K System
£549 (£631.35 inc. VAT)

CP/M 2.2
£100 (£115 inc. VAT)

NASCOM 2 KIT
£225 (£258.75 inc. VAT)

Built & Tested
£285 (£327.75 inc. VAT)

80x25 Video for nascom

£125 (£143.75 inc. VAT)

Nascom owners can now have a professional 80x25 Video display by using the Gemini G812 Intelligent Video Card with on-board Z80A. This card does not occupy system memory space and provides over 50 user controllable functions including prog character set, fully compatible with Gemini G805 and G815/809 Disk Systems. Software supplied on Gemini system disks. Built and tested.

Nascom 1 Printed Circuit
(inc. parts list)
£25 (£28.75 inc. VAT)

GM802 64K RAM Card **£125** (£143.75 inc. VAT)

GM802K 16K RAM Kit **£80** (£92 inc. VAT)

Disk System for Gemini & nascom

GM825 Disk Drive Unit – The GM825 floppy disk housing is supplied with either one or two 5.25" single sided, double density, 96TPI high capacity Micropolis 1015F5 disk drives. These provide 400K bytes of formatted storage per drive. (Gemini QDSS format). The CP/M2.2 package available supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers.
An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 4, it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

Single Drive System
GM825-1S
£350 (£402.50 inc. VAT)

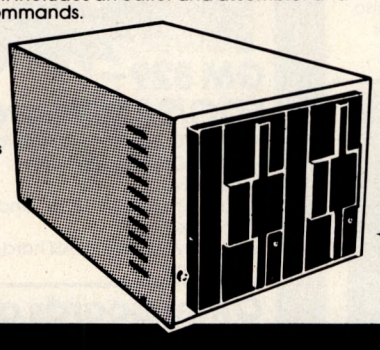
Dual Drive System
GM825-2S
£575 (£661.25 inc. VAT)

CP/M2.2 Package
(GM 5 3 2 for Gemini)
£90 (£103.50 inc. VAT)

POLYDOS 4
for Nascom
£90 (£103.50 inc. VAT)

GM809 Disk Controller Card
for 8" and 5.25" drives
£125 (£143.75 inc. VAT)

GM829
for 8", 5.25" and Winchester Drives
£145 (£166.75 inc. VAT)

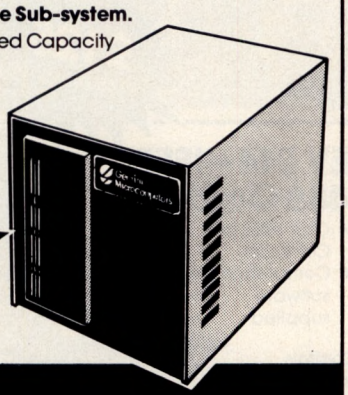


At last – a Winchester Drive for your Gemini / nascom System!

GM835 Winchester Drive Sub-system.

- ★5.4 Megabyte Formatted Capacity
- ★Rodime Drive
- ★Industry Standard SASI interface
- ★Integral Controller and power supply

£1450 (£1667.50 inc VAT)



SOFTWARE



CP/M Software Compas

is totally different from other compiler based Pascal systems, as it allows you to create, edit, run, and debug Pascal programs in a highly interactive manner.

£120
(£138 inc. VAT)

'The Last One' is used in conjunction with Microsoft's MBASIC*. No knowledge of BASIC programming is required since all input is performed using question and answer routines written in plain English.

£330 (£379.50 inc. VAT)

*MBASIC – MicroValue Price if purchased with 'The Last One' – **£178.95 inc.VAT**

VIZ:APL is a high level language system. It can be used to develop small programs faster and large programs in limited memory. The language can be enhanced almost indefinitely and the user's own operators and functions can be built up.

£255 (£293.25 inc. VAT)

Gemini Software:

GEM PEN Text Editor	**£45**	(£51.75 inc. VAT)
GEM ZAP Assembler	**£45**	(£51.75 inc. VAT)
GEM DEBUG Debugging Utility	**£30**	(£34.50 inc. VAT)
WORDSTAR Word Processor	**£215**	(£247.25 inc. VAT)
GEM GRAPHIC Links with MBASIC	**£35**	(£40.25 inc. VAT)

A wide range of software for Nascom also available.

When ordering disks, please specify format.

Value - MicroValue - Micro

LOW COST SYSTEMS

Dragon 32



A powerful colour computer for under £200.
- ★ 32K RAM
- ★ 6809E Microprocessor
- ★ Extended Microsoft Colour BASIC
- ★ 9 Colour, 5 Resolution Display
- ★ Sound through TV 5 octaves, 255 tones
- ★ Advanced Graphics

Full range of Dragon software available.

£173.47 (£199.50 inc. VAT)

Sinclair ZX81



Now available through MicroValue—a real computer for less than £50!

★ Sinclair ZX81 Computer	**£43.43**	(£49.95 inc. VAT)
★ Sinclair ZX Printer	**£52.13**	(£59.95 inc. VAT)
★ 16K ZX RAM PACK	**£26.04**	(£29.95 inc. VAT)
★ ZX81 Learning Lab	**£17.35**	(£19.95 inc. VAT)
★ Software for Sinclair	**from £3.43**	(£3.95 inc. VAT)

THE NEW SHARP MZ80A

Electronic magnificence from Sharp



Z80A C.P.U. · 48K RAM · 4K ROM · Industry standard Qwerty keyboard with numeric pad · 9" GREEN C.R.T. · 1200 baud cassette · Music and sound · Real time clock · Enhanced BASIC · Full editing facilities · Internal expansion.

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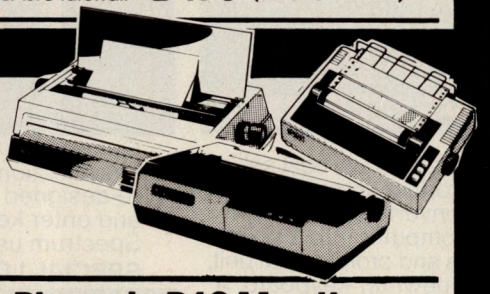
Home budget, bank reconciliation, SPACE INVADERS, STAR TREK, SCRAMBLE, bank loan calculator, mortgage calculator + 7 other games.

Educational—Geography, Maths., Spelling + 4 part BASIC tutorial.

£475 (£546.25 inc. VAT)

PRINTERS



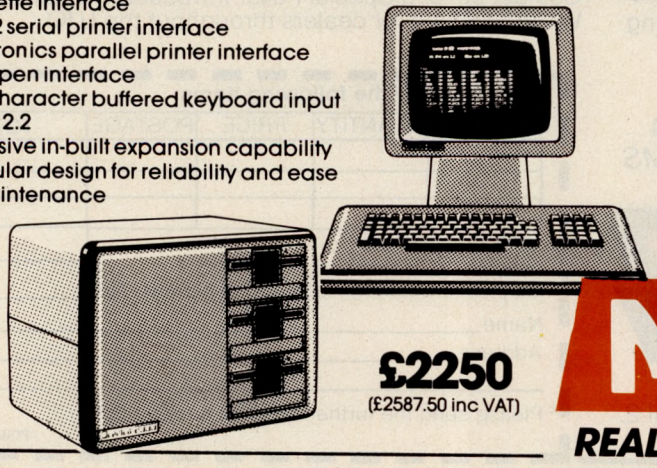
Epson MX80 Type III	**£348**	(£399.95 inc. VAT)
Epson MX80 FT Type III	**£388**	(£445.95 inc. VAT)
Epson MX100 Type III	**£496**	(£569.95 inc. VAT)
NEC 8023A	**£339**	(£389.95 inc. VAT)
SEIKOSHA GP100A	**£215**	(£246.95 inc. VAT)

Daisy Wheel Printer:

Smith-Corona TP-1	**£485**	(£557.75 inc. VAT)

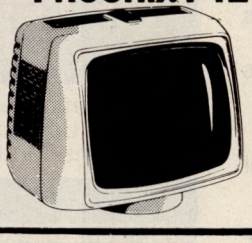
Quantum QM 2000 COMPUTER SYSTEM

- * Twin Z80A Microprocessors
- * 64K Dynamic RAM
- * 2.4 megabytes of formatted disk storage capacity
- * 80 × 25 screen format
- * 160 × 75 pixel graphics
- * Programmable character generator
- * Cassette interface
- * RS232 serial printer interface
- * Centronics parallel printer interface
- * Light pen interface
- * 128 Character buffered keyboard input
- * CP/M 2.2
- * Extensive in-built expansion capability
- * Modular design for reliability and ease of maintenance



£2250 (£2587.50 inc VAT)

Phoenix P12 Monitor



A high quality data display monitor, ideal for all Nascom and Gemini systems. 20MHz resolution. Available in amber or green phosphor.

£110 (£126.50 inc. VAT)

MICROVALUE DEALERS:

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Amersham Computer Centre, Oakfield Corner, Sycamore Road. Tel: (02403) 22307

BIRMINGHAM B5
Skytronics MBM, 80 Bristol Street, Tel: 021-622 6436

BRISTOL
Target Electronics Ltd., 16 Cherry Lane. Tel: (0272) 421196

COLCHESTER
Emprise Electronics Ltd., 58 East Street. Tel: (0206) 865926

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Electrovalue Ltd., 28 St. Judes Road, Englefield Green. Tel: (07843) 3603

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MDW (Electronics), 47/49 Woodbridge Road East. Tel: (0473) 78295

LONDON W2
Henry's Radio, 404 Edgware Road. Tel: 01-402 6822

LONDON SW11
OFF Records, Computer House, 58 Battersea Rise, Clapham Junction. Tel: 01-223 7730

MANCHESTER M19
EV Computing, 700 Burnage Lane. Tel: 061-431 4866

NOTTINGHAM
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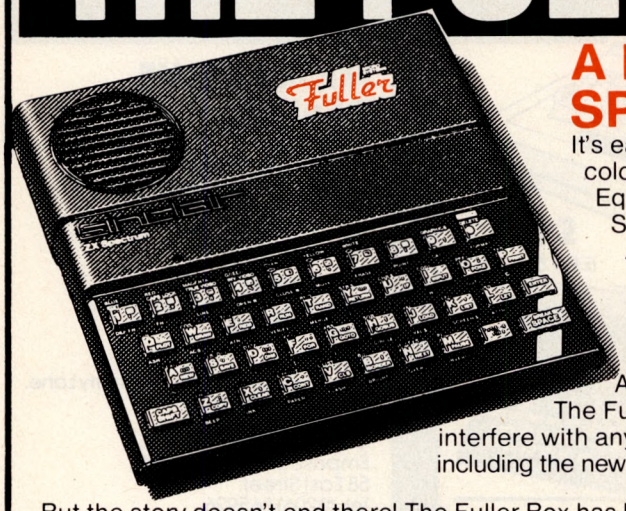
MicroValue

REAL value — from the Professionals

NOW . . . FOR ZX SPECTRUM USERS EVERYWHERE

THE FULLER BOX...



A NEW DIMENSION IN SPECTRUM CAPABILITY

It's easy to see why the ZX Spectrum is outselling all the other small colour computers, it really is a marvel of new technology.

Equally marvellous is the new 'Fuller Box' for your Spectrum.

Sound Quality is improved enormously with the built in *Audio Amplifier* which works with all Spectrum programs. *The Sound Synthesiser* will make any sound you want to design: explosions, laser blasts, trains, birds etc. It's based on the popular G1-AY-3-8912 chip, and is supplied with a demo program.

Finally, the *Joystick Port* enables you to use any low-priced Atari/Commodore joysticks with your programs.

The Fuller Box fits neatly on to the back of your ZX Spectrum,and does not interfere with any peripherals, including the new Spectrum microdrives.

PRICE (INC. VAT)

£29.95 + 80p p&p

But the story doesn't end there! The Fuller Box has been designed to perform many other functions, and extra, expanded versions are already available.

The Fuller Orator turns the Spectrum sound effects into speech! It plugs easily into the Fuller Box, and can say anything typed on the keyboard or from your programs, via the ALLOPHONE synthesiser. Complete with Demo cassette:

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Fuller Sound Amplifier Box, including Audio Amplifier (non-expandable) **£6.95 + 80p p&p**

Fuller Orator upgrade kit – to fit inside Fuller Box **£24.95** (postage free, does not include Fuller box)

Fuller 'Master Unit' – including Orator, synthesiser, amplifier and Joystick port in Fuller Box **£54.95 + 80p p&p**

Fuller FD42 System NOW FOR ZX81 or ZX SPECTRUM



This famous, best selling product immediately converts your ZX Computer into a sturdy, attractive and professional unit, with full size typewriter keyboard. A tough plastic case encloses the keyboard, P.C.B. and power supply. It has 42 keys including all the ZX81/Spectrum graphic characters printed on them. The full travel key switches have gold plated contacts and guaranteed life of 10^6 operations. IT'S SO EASY TO INSTALL! You simply unscrew the ZX PCB from its case, screw it to the FD case, and plug in the keyboard. No soldering or technical knowledge required.

NOW ALL ONE PRICE! £29.95 (inc. VAT) + £2.50 p&p

16K Expansion. Fits onto back of case or inside using a RAM Adaptor Board. **£9.75 extra.**

Fuller FDS Keyboard for the ZX81 or ZX Spectrum

Our new advanced keyboard has the same, fine specifications as the FD42 system, but with a new, re-designed case, space bar and double-sized shift and enter keys. A must for the discerning ZX81 or Spectrum user.

SPECIAL LOW PRICE £39.95 (inc. VAT) + £2.50 p&p.

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16K Spectrum owners – upgrade to 48K with a Fuller Spectrum Upgrade Pack – Complete with full assembly instructions. Model 2 or 3 only. **£34.95** (inc.VAT) p&p FREE!

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Fuller

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Telephone: 051-236 6109

Please supply the following items:

ITEM	QUANTITY	PRICE	POSTAGE	TOTAL

I enclose cheque/p.o. ☐
Or, please debit my Access/Barclaycard No. _____

Name _____

Address _____

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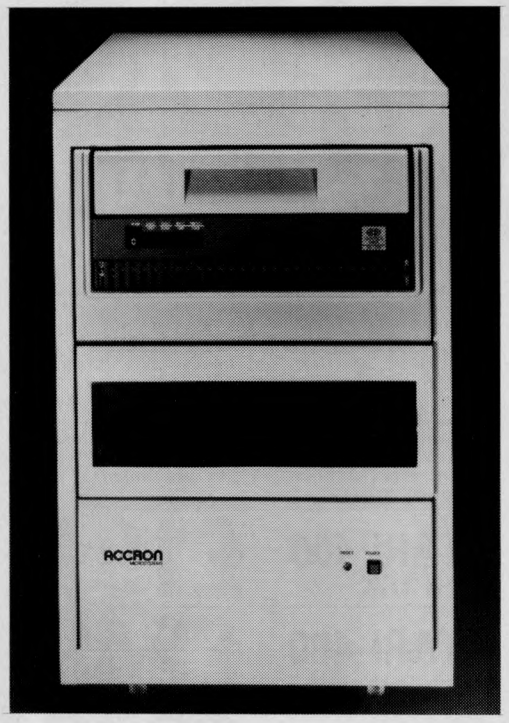
Please send me further details, I enclose S.A.E. ☐

PCW.3.83

What can sixteen CP/M* users have in common?



17 Z80s running at 4 Megahertz
1 Megabyte of 200 Nsec RAM
18 Serial Input/Output Ports
1 Centronics-type Parallel Port
90 Megabyte Shared Cartridge Disks
2 Megabyte Shared Floppy Disks
4 Shared (Spooled) Printers
Optional Private Printers
Running under Standard CP/M 2.2

All in one box!

ACCRON—Multi Processor Series—Microsystem

The ACCRON—Multi Processor Series—microsystem is a breakthrough in low cost high performance multi-user S100 micro computers. Based on the Service/User Processor principle, a single ACCRON—MPS system supports up to 16 users, where each user has its own Z80A, 64KB RAM and an RS 232 I/O Port on a single S100 board. Each User Processor runs under its own dedicated copy of the CP/M operating system. All users share the common resources such as disks, magnetic tapes and system printers. These shared resources are controlled by the Service Processor with its own dedicated Z80A and 64KB RAM running under DPC/OS*, a proprietary Distributed Processing Operating System.

Zero CPU Degradation!

Unlike single-CPU timesharing multi-user systems (e.g. MP/M, OASIS, MVT-FAMOS etc.) where system throughput degrades as additional users are added, the ACCRON-MPS system has no CPU degradation at all. Since each user has its own self-contained processor and memory you can now have minicomputer performance at micro computer prices.

It's Expandable

You can start with a single-user floppy disk system and (field) upgrade it to multi-user by simply adding a Service Processor running DPC/OS and more User Processor boards as and when required. Large capacity hard disks, magnetic tapes and more printers may be added at any time without any hardware or software redundancy.

CP/M Compatible

Use of the industry standard CP/M operating system means that a wealth of readily available, reasonably priced, system and application software will run on your ACCRON microsystem without any modification. Upgrade to multi-user, where simultaneous access of shared data files is required, is easily supported by the inclusion of simple file or record locking routines.

User Friendly DPC/OS

The Service Processor and DPC/OS provide an easy to understand and user friendly interface for common access to shared resources such as disks, magnetic tapes, up to four spooled system printers or any other peripheral that may be attached to your system (such as a telex-tape punch). Simple routines handle record and/or file locking and prevent "interleaved" or "fatal embrace" file update sequences. DPC/OS allows for both private and shared disk space. Interprocessor message communications, scheduling and batch-submit facilities are also provided.

Complete Range of Peripherals

NEWTONS Laboratories prides itself in offering you the largest choice of microsystems presently made or distributed in Britain. Three distinctive ranges, based on 5-inch, 8-inch or 14-inch magnetic media, utilizing both sealed (winchester) or removable cartridge disk techniques are supported and available NOW! In addition, the ACCRON offers a full blown, industry standard, 9-track reel-to-reel magnetic tape subsystem. So you can store, retrieve and process vast amounts of data using standard 800 or 1600 BPI magnetic tapes that can also be used to interface with most major mainframe computers.

Maintenance

Any system is only as good as its individual components. The likelihood of downtime is minimised through high quality control and testing standards at our UK manufacturing base. Each individual part goes through a rigorous testing procedure during every stage of assembly, and before shipping and installation, the completed machine will have run continuously for 72 hours or more, at temperatures much higher than the average office. However, like all good things in life, sometime or the other your machine will stop working. Our own nationwide maintenance service can, for a fixed charge provide you with a comprehensive maintenance and 24-hour repair service which includes all parts and labour, and, since we manufacture ACCRON ourselves here in Britain, there is never a delay over waiting for a replacement part.

Stability

NEWTONS Laboratories has been trading (profitably) for more than 7 years. We supply copies of our accounts on request. The computer division specialises in multi-user micro systems, developed and supported by UK based professionals. Its customers include British Telecom, the DHSS, Local Councils, small businesses and large businesses such as BTR and Plessey. NEWTONS Laboratories is involved in continuous research and development.

Dealers and OEM's, Get The Facts

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PCW1

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FROM SILICA SHOP — WITH EVERY PURCHASE OF AN
ATARI 400 800



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We at Silica Shop are pleased to announce some fantastic reductions in the prices of the Atari 400/800 personal computers. We believe that the Atari at its new price will become the U.K.'s most popular personal computer and have therefore set up the Silica Atari Users Club. This club already has a library of over 500 programs and with your purchase of a 400 or 800 computer we will give you the first 100 free of charge. There are also over 350 professionally written games and utility programs, some are listed below. Complete the reply coupon and we'll send you full details. Alternatively give us a ring on 01-301 1111 or 01-309 1111.

ATARI 400 with 16K	**£199**
ATARI 400 with 32K	**£248**
ATARI 800 with 16K	**£349**

400/800 SOFTWARE & PERIPHERALS

Don't buy a T.V. game! Buy an Atari 400 personal computer and a game cartridge and that's all you'll need. Later on you can buy the Basic Programming cartridge (£35) and try your hand at programming using the easy to learn BASIC language. Or if you are interested in business applications, you can buy the Atari 800 + Disk Drive + Printer together with a selection of business packages.

Silica Shop have put together a full catalogue and price list giving details of all the peripherals as well as the extensive range of software that is now available for the Atari 400/800. The Atari is now one of the best supported personal computers. Send NOW for Silica Shop's catalogue and price list as well as details on our users club.

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No 3 Mission Imp
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No 5 The Count
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No 8 Pyramid of D
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No 10 Sav Island 1
No 11 Sav Island 2
No 12 Golden Voy
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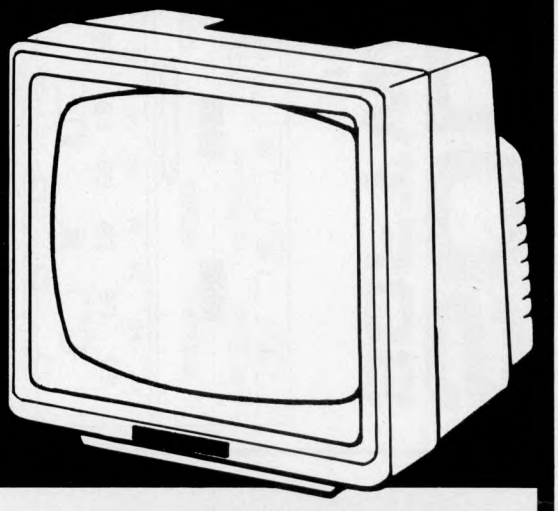

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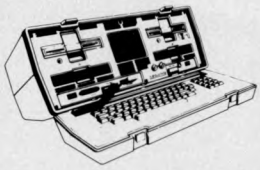

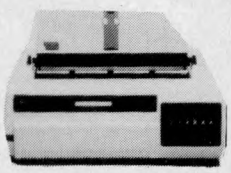

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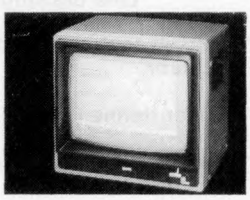

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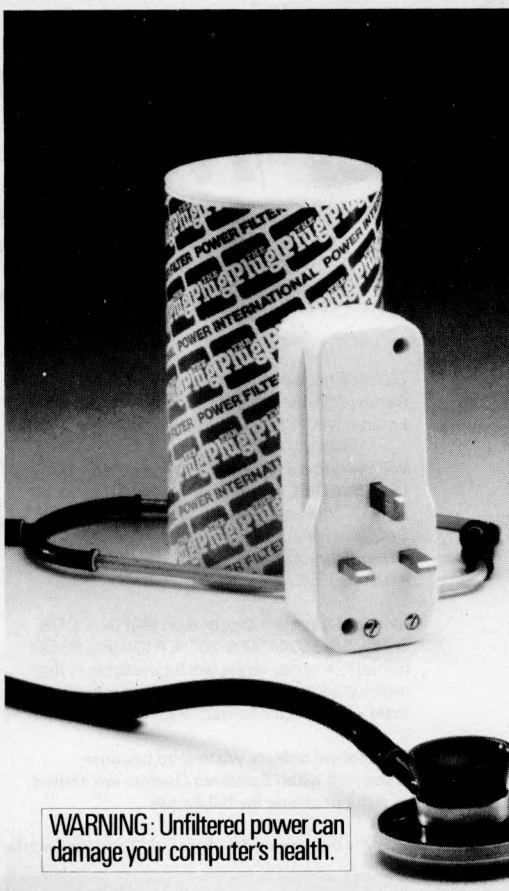

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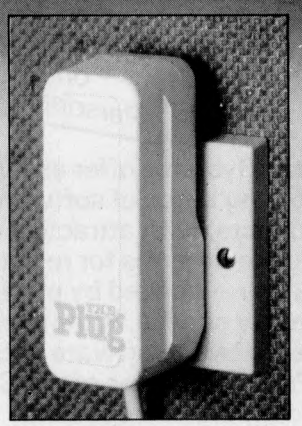

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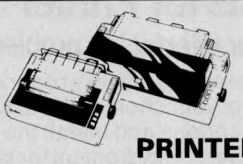

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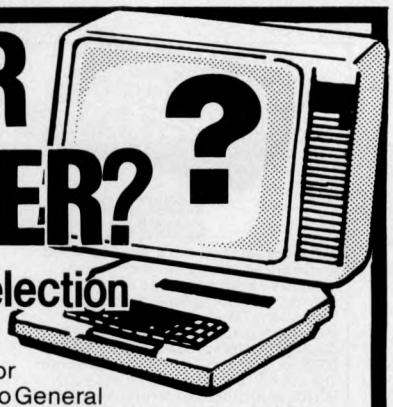

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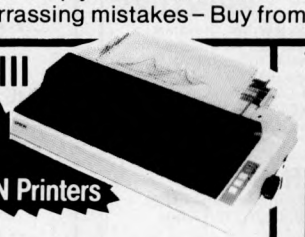

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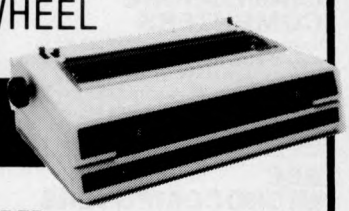

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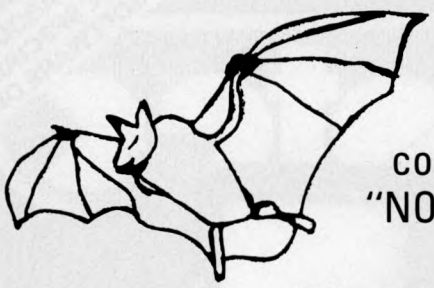

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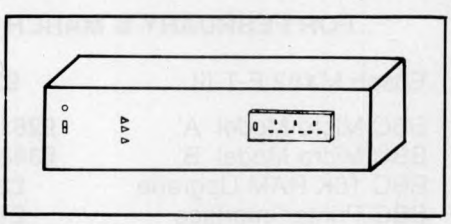

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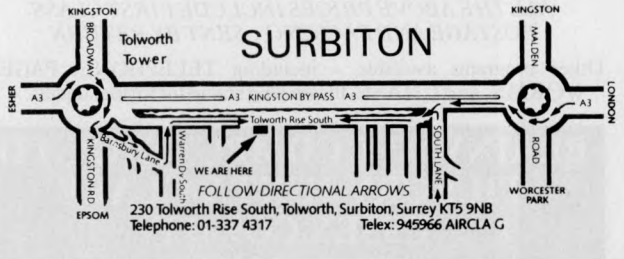

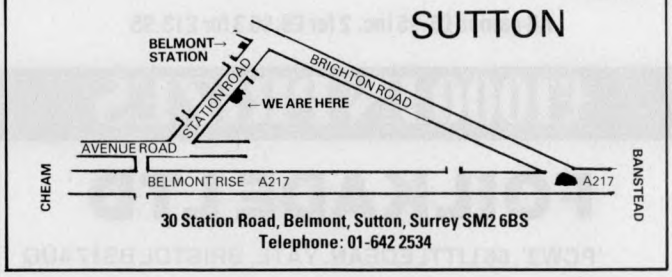

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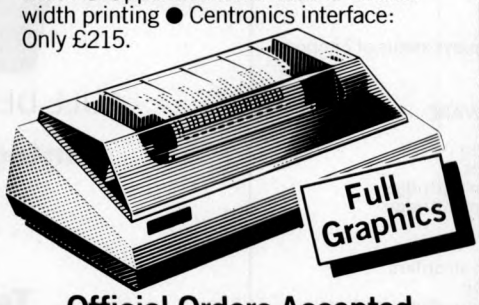

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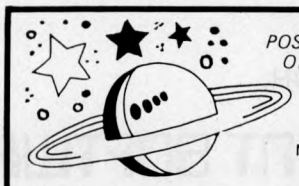

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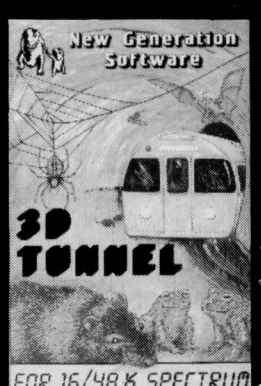

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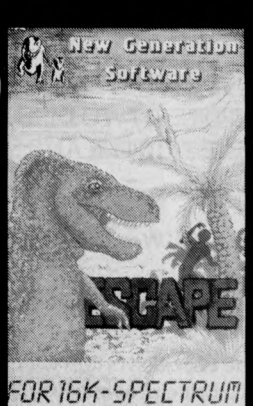

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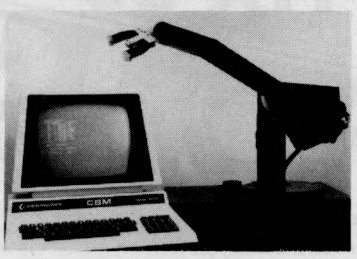

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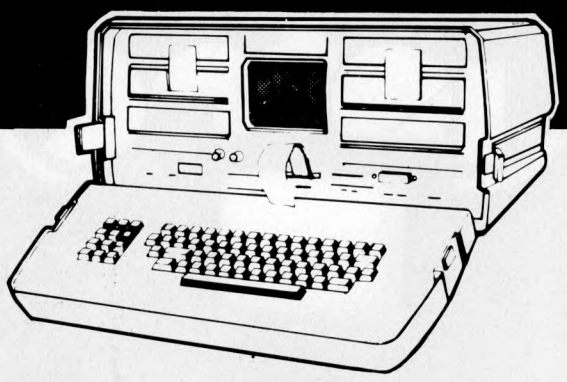

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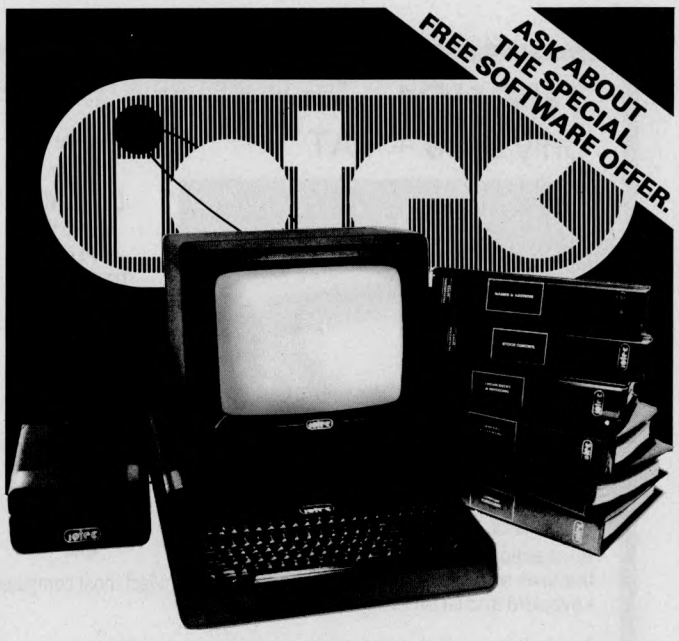

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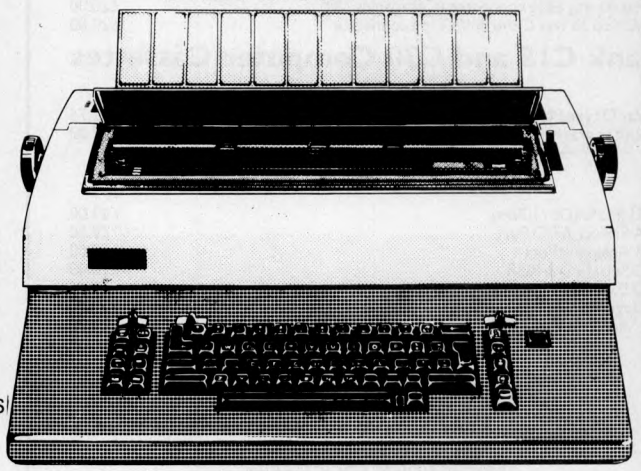

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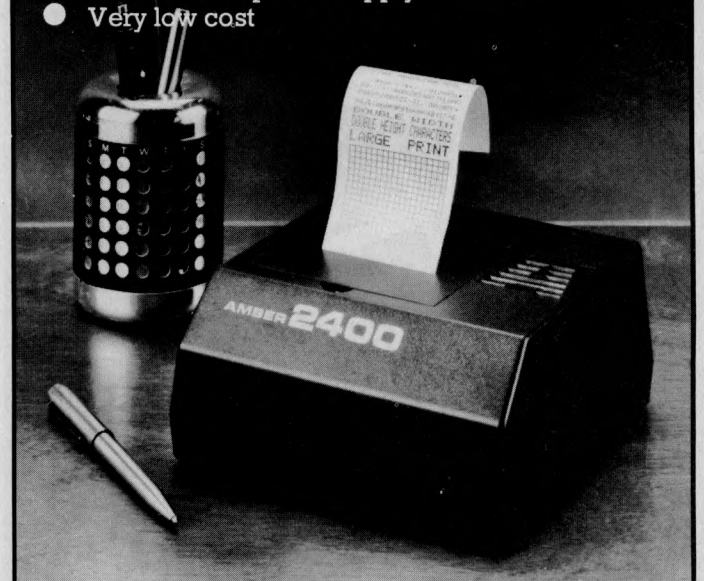

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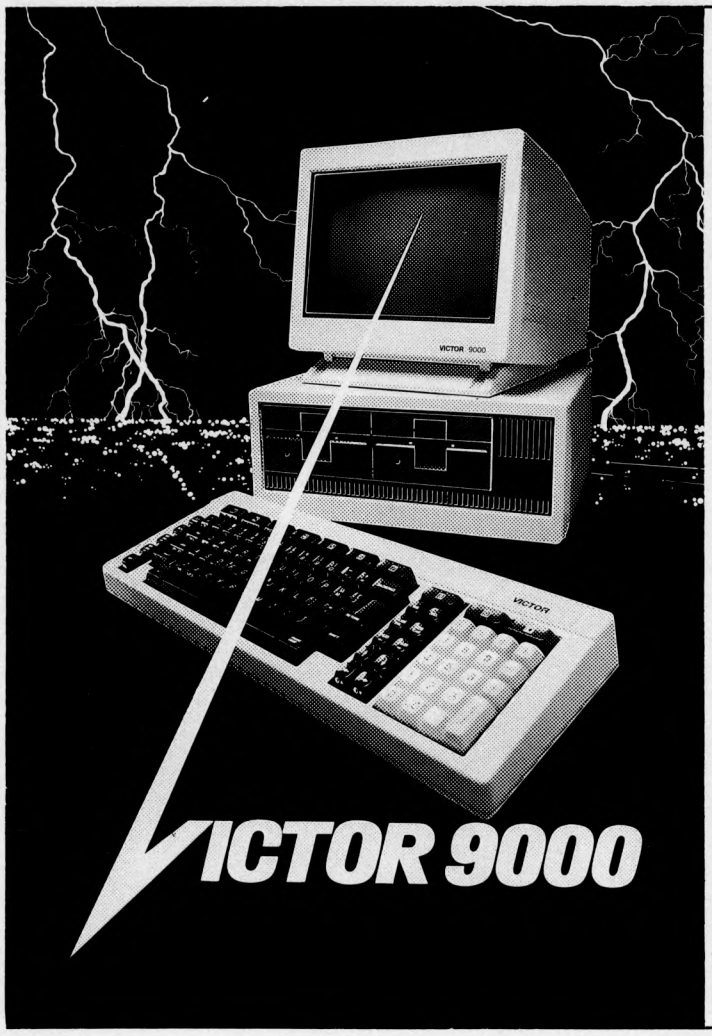

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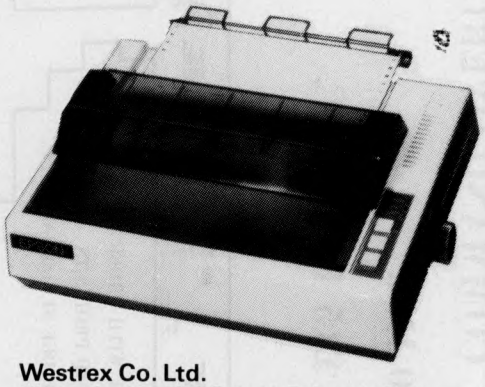

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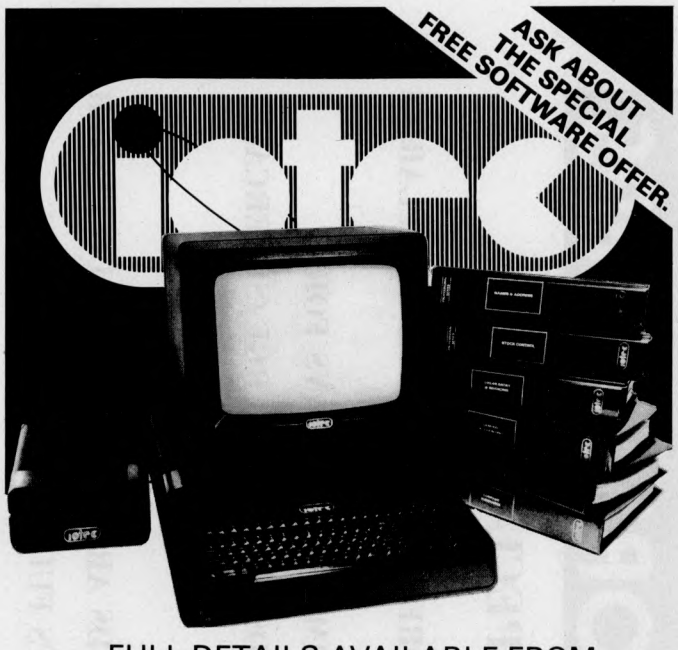

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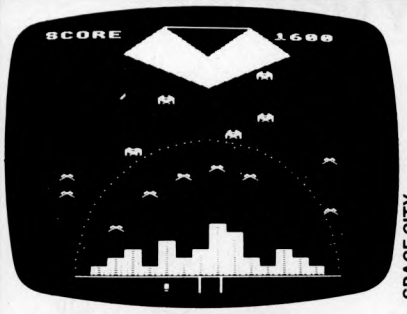

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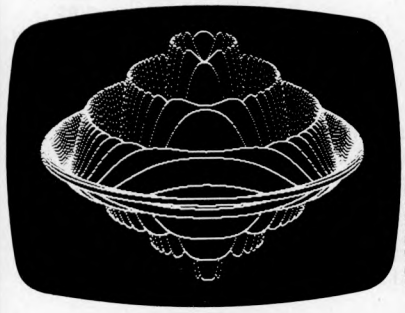
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October Issue: Program Features: Alien Attack; Calendar Generator; Union Jack; Memory display utility. Plus articles on Beebugging; Improving Key Detection; Acorn Press Release on O.S.H.2.; and Issue II Basic; The Tube and Second Processor Options; or New Series for less experienced users; and Software Reviews.

November Issue: Program Features: Racer (excellent 16K racing car game), Mini Text Editor (Mk2), Transparent Loader, Music with Memory, Harmonograph Emulator, New Character set for Modes 2 & 5; and cassette block-zero – bug retrieve. Plus articles on sound and envelope design – includes indispensable envelope editor program; Debugging Part 3, BBC Basics – Memory Maps and addressing explained; Serial Printer Port (RS423) and RGB upgrade. Plus a large number of Hints & Tips, and a guide to our past issues and their contents.

December/January Issue: Program Features: Space City (invader-type game), Breakout, Artist (Joystick painting program); Rescue (miraculously retrieves programs after bad loading or 'Bad Program' message); and Pack – a program to compact Basic programs. PLUS Disc System Review, Software reviews – including Wordwise, Book reviews, Adding Joystick interface to model A; How to access the video controller chip; and ideas for the newcomer; plus a new crop of Hints and Tips.

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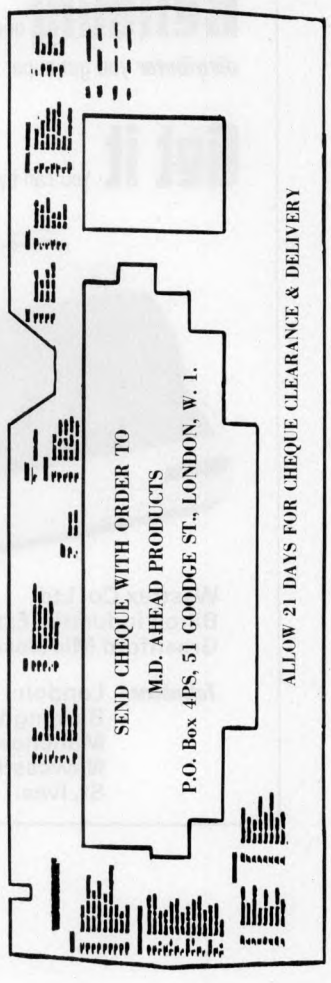

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CHIP CHAT

We receive some odd invitations from public relations companies from time to time but the one which arrived recently from Epson's ebullient Mike Cartright will take some beating. It accompanied Epson's announcement that Miss World will be promoting that company's products; 'Should you wish to meet with representatives of Epson UK or with Miss World. . . we would be delighted to cooperate in every way possible,' says the invitation. In *every* way?. . . And another press release from the delightfully named Pete and Pam Computers extolls the virtues of a new game for the IBM PC — Ulysses and The Golden Fleece. It sounds quite interesting but one thing puzzles us — wasn't it Jason who went in search of the Golden Fleece?. . . While we're in the mood for upsetting our advertisers, how about Bug Byte's latest lurid ad which shows in the foreground a person hunched over the BBC computer, playing a game? But the screen shows Mazogs which is not only unavailable for the BBC (it's for the ZX81) but isn't even in colour, as the ad shows. . . Silliest press release of the month concerns 'In Pursuit of Excellence', billed as the 'world's most unique (sic) exposition'. Promising instead to be the most pretentious exhibition in the history of human civilisation, this event 'is to be a striking-presented concentration of superlative products, creations and designs, each reflecting a state-of-the-art credibility which probably cannot be challenged.' As Ms G Slagg would say, 'Aren'tcha sick tadeath!!!??' What really reduced the *PCW* team to helpless hysterics, though, was the list of products expected to be on show, which included biscuits, bricks, clubs (?), doors, flat glass, ink, matches, mustard, polish, razor blades and soap. Oh yes, also computers and word processors, which is presumably why they sent it to us. . . In the continuing fight to put their names onto everyone's lips, computer companies are now turning to the world of sport for publicity. Sharp had one Gary Bailey, apparently a footballer, on its stand at the *Witch Computer?* Show; Torch has supplied a computer to be used during cricketer Phil Edmonds' benefit year; and one Neil Hall, a senior analyst for GEC Computers, beat the world record for inshore circuit racing recently in his frighteningly fast boat called, yes, 'GEC Computers', which is sponsored by the company. A Luddite lurking at the back of our office commented that an interest in sport is quite appropriate for computer companies as in a few years, with our jobs all taken over by boxes of chips, sport will be all that's left for us to do. . . Now here's a good way to feed middle management paranoia. Williams and Glyn's Bank has announced a competition for 16-19 year-olds, who will be asked to suggest ways to increase the efficiency of the firms which employ them, using, of course, microelectronics in some way to achieve the improvement.

THE REAL INVESTMENT

NEW:
THE X-ROMCARD

FOR YOUR ZX81



WHAT IS *SO* SPECIAL ABOUT THE SPECIAL RAMPACK?

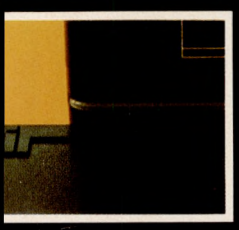

fig. 1

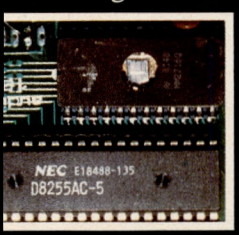

fig. 2

WHAT IS **SO** SPECIAL ABOUT AUDIO'S 16K SPECIAL RAM PACK?

THE SPECIAL RAM PACK (16K) is the latest design of its kind, following at least a dozen similar products. It has many of the good points of its predecessors, including packs manufactured by **Sinclair Research, Memotech, Bygbyte** and **Econotech** to cite a few of the best known.

With the experience we have gained with memories both for the **ZX 81** and a **wide range of other Micros**, we are also able to offer some **exclusive new features**:

THE CASE: **The SPECIAL RAM PACK** has been designed to overcome the infamous **'wobbling'** problem associated with many other packs, and does not resort to **temporary solutions** such as **Velcro, Blutak, adhesive strip** or a huge, unsightly case. It clamps positively to the ZX 81 by means of a special built in ridge aided by a **resilient spring effect** in the connection socket (see figure 1).

EXPANSIBILITY: **The SPECIAL RAM PACK** is not only compatible with all software and hardware produced for the **ZX 81**, such as the **ZX printer**, but it also has the edge over other packs with its **expansibility**. You will find it interesting that the **keyboard sounder** option is already included in the **SPECIAL RAM PACK**. It also has **expansion pins**, ready to receive — **in the same case** — the most advanced add-on ever designed for the ZX 81 — **the X ROM CARD** (see figure 2).

WHAT DOES THE X-ROM CARD OFFER?

1. **The X-ROM CARD has a built in autostart ROM.** Programs can be run automatically every time the ZX 81 is switched on. This will result in a huge increase factor for **ROM based software**, since all software houses are currently very aware of copyright piracy problems.
2. **The X-ROM CARD has a built in printer interface,** necessary if you wish to use a printer other than the XZ printer. **This is invaluable for any serious applications,** including **word processing,** where careful presentation is of the utmost importance.
3. **The X-ROM CARD has a built in EPROM burner.** This means that you can save Basic or Machine code programs onto silicon chips and play them back at any time.
4. **You may of course buy the X-ROM CARD to use with other Ram Packs** such as the **Sinclair Ram Pack.** However, when you purchase the X-ROM CARD with the SPECIAL RAM PACK, you will have the advantage of lower cost, greater reliability and neatness, since the whole system is nicely housed within a single case.

IN CONCLUSION, **The SPECIAL RAM PACK,** is the **best immediate investment** for your **ZX 81**. The availability of the **X-ROM CARD** opens the way to new software development such as **languages programming** and is the guarantee that your system will never be obsolete.

THE BEST GUARANTEE THAT YOUR ZX81 WON'T BE OBSOLETE FOR ONLY:

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including VAT

TECHNICAL SPECIFICATIONS:

- SPECIAL RAMPACK:
  - **Memory capacity:** 16K bytes.
  - **Maximum speed:** 200 ns access time.
  - **Power requirement:** Use exclusively Sinclair PSU.
- X-ROMCARD:
  - **Autostart ROM:** 4K byte, exchange for 8K bytes and software switch possible. Displays memory size, checks for byte "00" (identifies ZX basic) @ 2000H. Loads program if found, checks for byte "C3" and jumps (2000H) if found. Checks for presence of ROM in socket n.3 and ROM catalog, displays catalog if found. Contains also machine code monitor and printer utility.
  - **Preprogrammed ROM:** Catalog available on request. Use only 2732 or 2764 ROM/EPROM.
  - **Blank EPROM:** Use only 2764 — 8K bytes per device — in socket n.3. 3 × 9V, PP3 size batteries are needed to burn EPROM.
  - **Printer connection:** 16 pin DIL output, use standard IDC ribbon cable. Outputs include DO to D7, Strobe, Reset, Inputs include No-fault and Busy.
  - **Documentation:** Schematic diagram included, full listings of Autostart ROM extra (only for X-ROMCARD user, £1.50 + large SAE)

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