

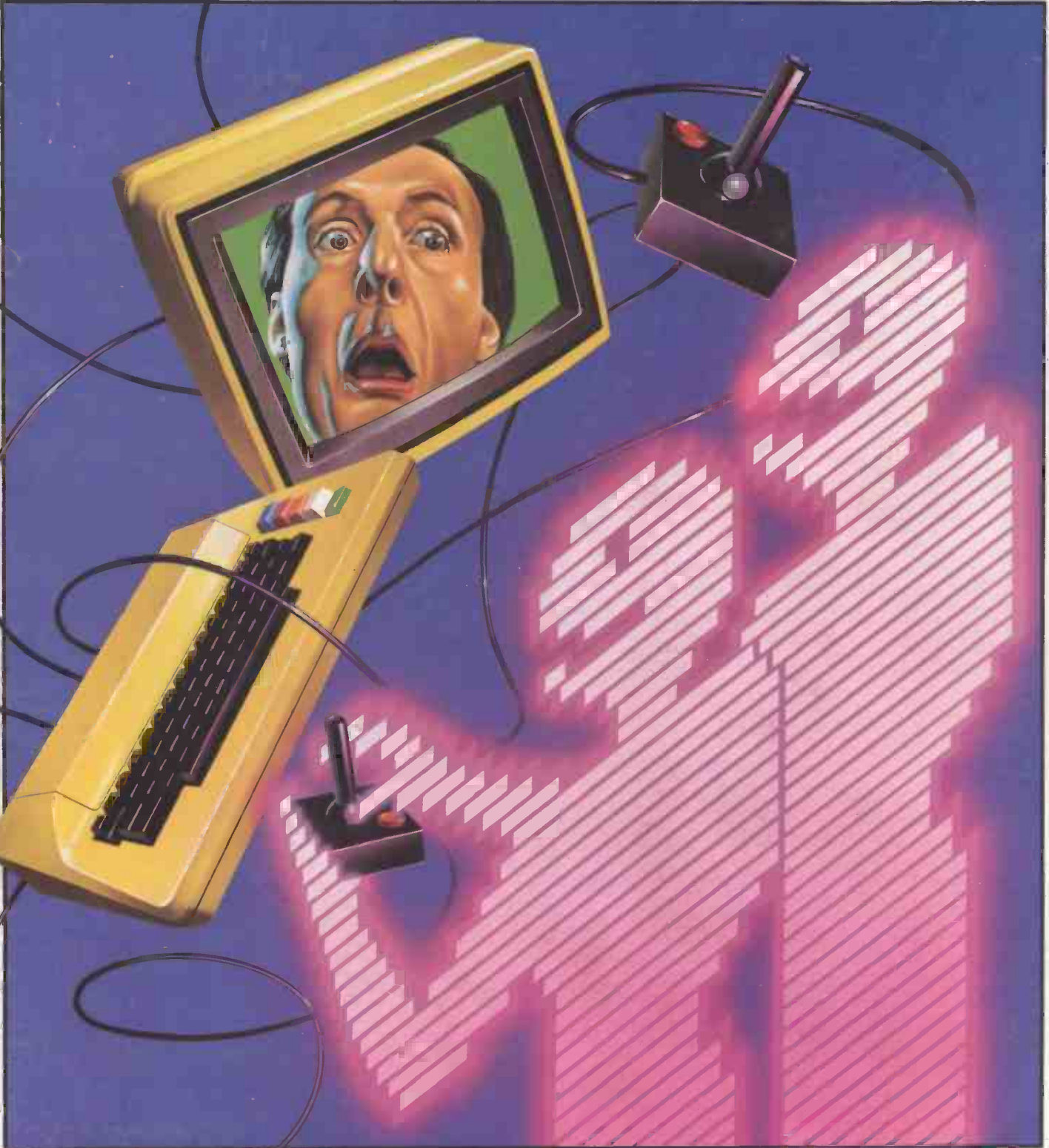
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**World** March 1982 75p

**BRITAIN'S LARGEST SELLING MICRO MAGAZINE**



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711-LS

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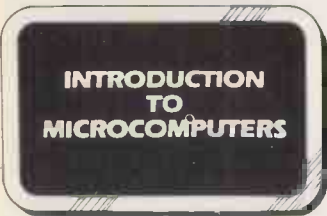
# MICRO TRAINING FOR COMPUTER USERS

# 6 Micro courses

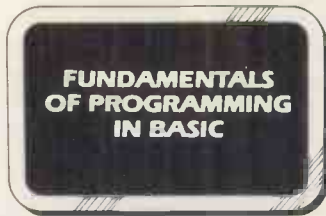


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DataStar Information Management	<input type="checkbox"/> July 8	<input type="checkbox"/> May 13

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Signature ..... Tel.No. ....



## BENCHTESTS

**92** **DATABASE BENCHTEST: DMS**  
Kathy Lang reviews Comsoft's DMS database package in its CP/M version.

**108** **HEWLETT-PACKARD HP-125**  
Dick Pountain tests HP's upmarket business micro and pronounces it very friendly.

**112** **TEXAS INSTRUMENTS 99/4A**  
TI has relaunched its home computer with some hardware improvements and a much more competitive price tag. Vincent Tseng investigates.



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## FEATURES AND SERIES

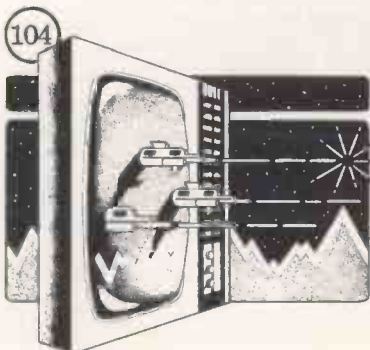
**86** **CHOOSING A DATABASE**  
As a prelude to our first package evaluation, Kathy Lang sets out the test criteria to be used in this series.

**100** **HIGH DENSITY VDU BOARD**  
Continuing last month's hardware construction feature with details of the driver software.

**104** **SCREEN PLAY**  
Dick Olney reviews games software for the TI99/4A. In future issues other popular home computers will be receiving the same attention.

**123** **FRAMES OF REFERENCE**  
Continuing Alan Wood's series which explains the facts of micro life to the DP fraternity. This month — how micros should be introduced into firms which already use mainframes, minis or timesharing.

**155** **PATTERNS**  
Alan Sutcliffe introduces a novel and powerful algorithm to solve the "hidden surfaces" problem in 3D graphics.



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Cover illustration: Paul Allen

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All the micro computing news that's fit to print plus some that isn't; brought to you by Guy Kewney.

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How to get your PCW delivered to your door.

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Hewlett-Packard announces a new networking system for its programmable calculators and desktop computers, plus some powerful peripherals.

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More readers' programs for popular machines.

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Catch up with what you missed (if we haven't sold out of it).



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Industry gossip, slander, trivialities and other worthwhile activities.

Subscriptions Manager Alexandra James; Subscription rates UK: £10.00, Overseas: £17.00; Address 14 Rathbone Place, London W1P 1DE. Published by SportsScene Publishers (PCW) Ltd, 14 Rathbone Place, London W1P 1DE, England. Tel: 01-631 1433, (10am — 6pm); Telex: 8954139 BUNCH G London; Personal Computer World is published by SportsScene Publishers (PCW) Ltd. © 1982 Felden Productions. No material may be reproduced in whole or part without written consent from the copyright holders; Printed by Riverside Press, Whitstable. Distributed by Seymour Press, 334 Brixton Road, London SW9. Tel: 01-733 4444.



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# TRADER COMPUTERS

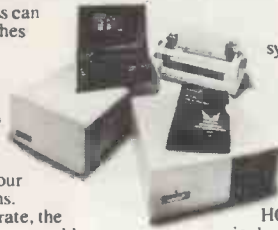
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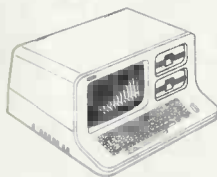
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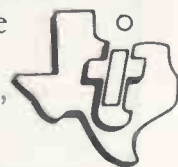
The TI-99/4A comes with TI BASIC built in. Ideal for when you want to learn programming – and to get you started there's our "Beginner's Basic" course, free with each machine – yet powerful enough for even the most experienced programmer.

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# ZX81 SOFTWARE FROM VIDEO SOFTWARE LTD 1K & 16K

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**VIDEO-SKETCH.** (ZX81 only). Move the cursor to any part of the screen. Draw or rub-out as you move it. Mix in text or graphics. Save picture in memory. Save picture sequence on cassette.

## 1K PARTY TRICKS (ZX81 only) NEW! NEW!

If you don't have a 16K RAM this set of programs is for you. Ten separate programs — some games, some more serious. All completely original, all ten programs included in the price.

<b>SHOOT</b>	Take the penalty and watch the goalie try to save.
<b>SKETCH</b>	Draw an almost full screen picture and save on cassette.
<b>NAME THE DAY</b>	Give the date, the ZX81 names the day of the week.
<b>TRAIN</b>	For the very young who would like to drive a train.
<b>ONGER-WONGER</b>	Watch the ZX81 draw its own pictures and yours.
<b>WEATHER</b>	An endless variety of completely inaccurate weather forecasts.
<b>UFO</b>	Shoot down the UFO before he gets you.
<b>WHO SHOT JR</b>	An intriguing test of your powers of detection.
<b>FIELD-GUN</b>	Can you hit the target.
<b>FOLLOW THAT</b>	Follow the path traced by the ZX81.

NOTE: These programs are not suitable for ZX80.

### \*\*\* OUR NEW SOFTWARE SCHEME \*\*\*

**SUPPORTED SOFTWARE.** This is software written for the ZX81 by named authors and approved and marketed by ourselves. The main criterion for selection is that the quality of the program matches our existing products. These programs are fully supported by ourselves. Watch out for some very interesting products in the near future.

## NEWS FOR USERS

Those of you who have already voted with your cheque books may be interested in our 'top ten'. These are the best sellers in November:

- |                |                       |
|----------------|-----------------------|
| 1. VIDEO-MAP   | 6. FORCE-FIELD        |
| 2. VIDEO-PLAN  | 7. STOCK-MARKET       |
| 3. VIDEO-VIEW  | 8. PARTY TRICKS No. 1 |
| 4. VIDEO-AD    | 9. FOOTBALL-LEAGUE    |
| 5. VIDEO-GRAPH | 10. TEST-MATCH        |

Surprisingly some of the programs which we rate most highly are well down the list.

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# MICROCOMPUTERS

# AT LASKYS



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The Osborne 1 is a new concept in microcomputing - selling at a price of £1,250. This includes £800 worth of software, comprising CP/M, MBASIC, CBASIC, Supercalc and Wordstar/Mailmerge. The machine itself is based on a Z80 microprocessor with 64 KBytes of RAM as standard. The twin built-in floppy disk drives afford 100K of storage each. RS232 and IEEE ports are both incorporated. The 5" screen acts as a window of 52 x 24 characters onto a background of 128 x 32. An external full size monitor may be plugged in.

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Osborne 12" monitor	165.00	24.75	189.75

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B/W Modulator	13.90	2.09	15.99
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● Disk Drive	295.00	44.25	339.25
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Apple Pilot	79.00	11.85	90.85
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High Speed Serial Interface Card	94.75	14.21	108.96
Centronics Card	103.00	15.45	118.45
Controller Card	100.00	15.00	115.00
● Eurocolour Card	69.00	10.35	79.35
IEEE 488 Interface	230.00	34.50	264.50
Thermal Paper for Silentype	2.75	0.41	3.16

Vinyl Carrying Case .....	16.00	2.40	18.40
Apple Ties .....	6.00	0.90	6.90



## apple SCOOP PURCHASES!

	NETT	V.A.T.	TOTAL
16K RAM Card (48K-64K) .....	69.56	10.43	79.99
Z80 Soft Card .....	185.00	27.75	212.75
Silentyper Printer .....	195.00	29.25	224.25

### Mountain Hardware

Clock/Calendar .....	173.00	25.95	198.95
Supertalker .....	185.00	27.75	212.75
Romplus + Keyboard Filter .....	127.00	19.05	146.05
Rom Writer .....	105.00	15.75	120.75
Music System Complete .....	330.00	49.50	379.50
Copyplus Rom .....	34.00	5.10	39.10
AD + DA 16 Channel .....	210.00	31.50	241.50
● CPS Card .....	160.00	24.00	184.00

### Other Items

● Omnivision .....	185.00	27.75	212.75
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### Interactive Structures

AO-03/4 Analog Output 4 Chan ...	195.00	29.25	224.25
AO-03/8 Analog Output 8 Chan ...	299.00	44.85	343.85
A1-02 Data Acquisition .....	210.00	31.50	241.50
D1-09 Digital Interface .....	235.00	32.25	270.25
● A1-13 Analog Input 16 Chan .....	395.00	59.25	454.25

### March Communications

Micro Clock .....	49.95	7.49	57.44
Micro-Port .....	49.95	7.49	57.44
Micro-Synth. ....	49.95	7.49	57.44
Micro-Talker 1 .....	85.00	12.75	97.75

## APPLESOFTWARE

● Micro Modeller .....	425.00	63.75	488.75
● Visicalc (3-3) .....	105.00	15.75	120.75
Visidex .....	110.00	16.50	126.50
Visiplot .....	98.00	14.70	112.70
Visi Trend/Plot .....	140.00	21.00	161.00
Visi Term .....	82.00	12.30	94.30
Desktop Plan II .....	110.00	16.50	126.50
CCA Datamanagement .....	56.00	8.40	64.40
● D.B. Master V2.4. ....	105.00	15.75	120.75

### Word Processing

Apple Writer .....	39.00	5.85	44.85
Magic Window Text Editor .....	49.00	7.35	56.35
Easywriter (80 Col.) .....	155.00	23.25	178.25
Mailmerge (80 Col.) .....	68.50	10.28	78.78
Easywriter (40 Col.) .....	51.30	7.70	59.00
The Address Book .....	27.00	4.05	31.05

### Games/Aids

Animation Pac .....	31.00	4.65	35.65
Saturn Navigator .....	15.00	2.25	17.25
Higher Graphics II .....	20.50	3.08	23.58
Higher Text .....	20.50	3.08	23.58
3D Super Graphics .....	22.25	3.34	25.59
Apple World .....	33.00	4.95	37.95
Memory Management System .....	25.25	3.79	29.04
Alien Rain/Typhoon .....	15.43	2.32	17.75
Sneakers .....	16.30	2.45	18.75
● Gorgon .....	16.30	2.45	18.75
Galaxy Wars .....	14.28	2.14	16.42
Raster Blaster .....	16.30	2.45	18.75
A.B.M. ....	15.22	2.28	17.50
Falcons .....	16.30	2.45	18.75
Pegasus II .....	17.17	2.58	19.75
Space Raiders .....	16.30	2.45	18.75
Mychess .....	23.00	3.45	26.45

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## APPLE BOOKS

	NETT	V.A.T.	TOTAL
Apple II Reference Manual .....	11.00	-	11.00
6502 Hardware Manual .....	9.00	-	9.00
6502 Software Manual .....	9.00	-	9.00
Apple II Basic Program Manual .....	6.00	-	6.00
Applesoft II Reference Manual .....	6.00	-	6.00
DOS 3.2 Manual .....	6.00	-	6.00
Apple II Basic Tutorial Manual .....	6.00	-	6.00
Pascal Reference Manual .....	8.50	-	8.50
Autostart ROM Manual .....	4.50	-	4.50
Fortran Reference Manual .....	12.00	-	12.00
Pascal Reference Manual .....	9.00	-	9.00
Pascal Operating Manual .....	11.50	-	11.50
Graphics Tablet Manual .....	5.00	-	5.00
Silentyper Manual .....	3.00	-	3.00
DOS 3.3 Manual .....	5.00	-	5.00
Pilot Language Reference Manual ...	9.00	-	9.00
Pilot Editors Manual .....	7.00	-	7.00



## HEWLETT PACKARD

### HP-80 Series Mainframes

	NETT	V.A.T.	TOTAL
HP-83 Computer .....	1486.35	222.95	1709.30
HP-85 Computer .....	1816.52	272.48	2089.00
16K Memory Module .....	164.35	24.65	189.00
ROM Drawer .....	29.73	4.46	34.19

### ROMS

Mass Storage ROM .....	98.19	14.73	112.92
Plotter/Printer ROM .....	98.19	14.73	112.92
Input/Output ROM .....	199.77	29.97	229.74
Matrix ROM .....	98.19	14.73	112.92
● New Advanced Programming ROM ...	98.19	14.73	112.92
Assembler ROM .....	199.77	29.97	229.74

### Interfaces & Accessories

HP-IB .....	260.94	39.14	300.08
RS232 Serial Int. ....	260.94	39.14	300.08
GP-IO .....	335.21	50.28	385.49
BCD .....	335.21	50.28	385.49
Parallel Printer Int. ....	199.77	29.97	229.74
HP-IB 1/2 metre cable .....	47.00	7.05	54.05
HP-IB 1 metre cable .....	47.00	7.05	54.05
HP-IB 2 metre cable .....	50.00	7.50	57.50
HP-IB 4 metre cable .....	57.00	8.55	65.55

### Plotter & Accessories

Plotter .....	1619.00	242.85	1861.85
Personality Module .....	496.00	74.40	570.40
Overhead Transp. Kit .....	83.00	12.45	95.45
Digitizing Sight .....	27.60	4.14	31.74
Vinyl Carrying Case .....	151.80	22.77	174.57
100 sheets Engl. ....	4.83	0.72	5.55

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Laskys, the retail division of the Ladbroke Group of Companies



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5 green pens	4.49	0.67	5.16
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100 Transp. films	18.48	2.77	21.25
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Transp. Pens (B,R,B,G)	5.87	0.88	6.75
Transp. Pens (B,O,B,V)	5.87	0.88	6.75
Transp. Pens wide (B,R,B,G)	5.87	0.88	6.75
Transp. Pens wide (B,O,B,V)	5.87	0.88	6.75

### Printers & Accessories

Printer Impact	637.81	95.67	733.48
Printer Line	2611.00	391.65	3002.65
Printer Stand	227.00	34.05	261.05
Sound Abatement Cover	69.00	10.35	79.35
Wire Paper Basket	35.00	5.25	40.25
Printer Ribbon - Pack of 2	43.00	6.45	49.45
Printer Ribbon - Pack of 2	26.00	3.90	29.90
Print Head	37.50	5.63	43.13

### Additional Accessories

Tape Cartridge (Pack of 5)	64.50	9.68	74.18
Thermal Paper Blue (Box of 2)	20.32	3.05	23.37
Thermal Paper Black (Box of 6)	60.95	9.14	70.09
Cartridges and Manual holder	6.77	1.02	7.79
HP83/85 Carrying Case	81.26	12.19	93.45
3-ring lit. binder	6.77	1.02	7.79
Dust Cover	10.16	1.52	11.68

### Manuals

Owners Manual HP83/85	17.25	-	17.25
Pocket Guide	3.45	-	3.45
Mass Storage ROM Manual	6.90	-	6.90
Plotter/Printer ROM Manual	6.90	-	6.90
I/O ROM Manual	20.70	-	20.70
Matrix ROM Manual	6.90	-	6.90
Assembler ROM Manual	13.80	-	13.80
Flexible Disc Operating Manual	3.45	-	3.45
HP-IB	6.90	-	6.90
Serial Installation Manual	6.90	-	6.90
GP/IO Manual	6.90	-	6.90
B.C.D. Manual	6.90	-	6.90
Parallel Printer Manual	6.90	-	6.90

### Application packs

Standard Pack	64.33	9.65	73.98
Basic Training	64.33	9.65	73.98
General Statistics	64.33	9.65	73.98
Finance	64.33	9.65	73.98
Math	64.33	9.65	73.98
Circuit Analysis	64.33	9.65	73.98
Games	64.33	9.65	73.98
Linear Programming	64.33	9.65	73.98
Text Editing	64.33	9.65	73.98
Wave Form Analysis	64.33	9.65	73.98
Basic Stat. & Data	64.33	9.65	73.98
Regression Analysis	64.33	9.65	73.98
Graphics Presentation	135.44	20.31	155.75
VisiCalc Plus	135.44	20.31	155.75
Surveying	135.44	20.31	155.75

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Dual Master (540K Bytes) 5 1/4 Disk	1693.00	253.95	1946.95
Dual Add-On (540K bytes) 5 1/4 Disk	1489.84	223.48	1713.32

# MICROCOMPUTERS

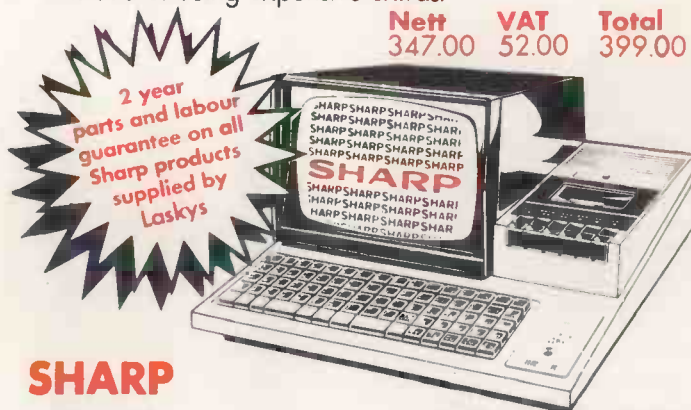
## LASKYS

Single Master (270K bytes) 5 1/4 Disk	1015.80	152.37	1168.17
Single Add-On (270K bytes) 5 1/4 Disk	858.78	128.82	987.60
Dual Master (2400K bytes) 8" Disk	4515.00	677.25	5192.25
Dual Add-On (2400K bytes) 8" Disk	3821.00	573.15	4394.15
Single Master (1200K bytes) 8" Disk	3299.00	494.85	3793.85
Single Add-On (1200K bytes) 8" Disk	2605.00	390.75	2995.75
Flexible Disk 5 1/4 (Pack of 10)	50.50	7.76	58.08
Flexible Disk 8" (Pack of 10)	71.50	10.73	82.23
Graphics Tablet	1355.00	203.25	1558.25

## MZ-80K SPECIAL OFFER!

A proper full size microcomputer for less than the real cost of a toy microcomputer. The Sharp comes with **48k** of RAM and the screen and cassette are built in, instead of being expensive extras.

Nett	VAT	Total
347.00	52.00	399.00



### SHARP

PC 1211	NETT	V.A.T.	TOTAL
● PC1211 Pocket Computer	69.52	10.43	79.95
CE121 Cassette Interface	11.00	1.65	12.65
CE122 Printer/Cassette Interface	60.86	9.13	69.99
CSR 700 Paper Rolls (40)	5.00	0.75	5.75
EA 800R Ink Ribbons	1.80	0.27	2.07

### MZ 80K

MZ 80K Computer 48K	347.00	52.00	399.00
MZ 80FD Dual Disks	560.00	84.00	644.00
MZ 80P3 Dot Matrix Printer	365.00	54.75	419.75
MZ 80F I/O Disk Interface	52.00	7.80	59.80
MZ 80 FMD Master Disk and Manual	20.00	3.00	23.00
MZ 80 F15 Disk Cable	8.00	1.20	9.20
MZ 80 FO5 Extra Disk Cable	7.00	1.05	8.05
MZ 80 I/O Expansion Box	96.00	14.40	110.40
MZ 80 BM Basic Manual	6.60	-	6.60
MZ 80 TIOB Basic Tape	9.50	1.43	10.93
MZ 80 T20C Machine Language	18.00	2.70	20.70
MZ 80 TU Assembler	36.00	5.40	41.40
MZ 80 I/O - 1 Universal Interface Card	40.00	6.00	46.00
MZ 8T70 AE FDOS for MZ 80K	67.00	10.05	77.05
MZ 8T70BE Basic Compiler for MZ80k	40.00	6.00	46.00
MZ 8T40E Pascal for MZ80K	40.00	6.00	46.00
MZ-80 DPK - Double precision Basic	38.00	5.70	43.70

### MZ 80B

MZ 80B Computer 64K	1095.00	164.25	1259.25
MZ 80 FD Dual Disks	560.00	84.00	644.00
MZ 80 P5 Dot Matrix Printer	387.00	58.05	445.05
MZ 80 P6 Dot Matrix Printer	440.00	66.00	506.00
MZ-8BP5I - P6 Interface	30.00	4.50	34.50
MZ-8BP5C - P6 Cable	24.00	3.60	27.60
MZ 80 FI Disk Interface	94.00	14.10	108.10
MZ 80 MDB Master Disk and Manual	30.00	4.50	34.50
MZ 80 F15 Disk Cable	8.00	1.20	9.20
MZ 80 FO5 Extra Disk Cable	7.00	1.05	8.05
MZ 80 BJC Disk Cable Joiner	15.00	2.25	17.25
MZ 80 EU Expansion Box	47.00	7.05	54.05
MZ 80 G/MK Graphics Option	112.00	16.80	128.80
MZ 80 I/O-2 Universal Interface Card	40.00	6.00	46.00
MZ 80 T10C K - B Converter	7.00	1.05	8.05
MZ 8 BD02 FDOS for MZ 80B	67.00	10.05	77.05
MZ 8 BT03 Basic Compiler for MZ80B	40.00	6.00	46.00
MZ 8 BT02 Pascal for MZ 80B	40.00	6.00	46.00
MZ-80 DPB - Double precision Basic	38.00	5.70	43.70



## ATARI

400 16K Computer	300.00	45.00	345.00
800 16K Computer	560.87	84.13	645.00
410 Tape Recorder	43.48	6.52	50.00
810 Disk Drive	300.00	45.00	345.00
822 Thermal Printer	230.43	34.57	265.00
825 80 Column Printer	478.26	71.74	550.00
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I/O Cable	8.26	1.24	9.50
Printer Cable	24.78	3.72	28.50
Interface Cable	20.43	3.07	23.50
RS 232 Cable	20.43	3.07	23.50
Monitor Cable	20.43	3.07	23.50
Thermal Paper	3.48	0.52	4.00
Master Disk	13.91	2.09	16.00
5 Blank Disks	13.91	2.09	16.00
Word Processor	73.91	11.09	85.00
Inv. Prog. 1	10.39	1.56	11.95
Conversational French	28.26	4.24	32.50
Conversational German	28.26	4.24	32.50
Conversational Spanish	28.26	4.24	32.50
Conversational Italian	28.26	4.24	32.50
Music Composer ROM	28.26	4.24	32.50
Touchtype	13.00	1.95	14.95
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Hangman	7.78	1.17	8.95
Kingdom	7.78	1.17	8.95
States and Capitals	7.78	1.17	8.95
States Europe	7.78	1.17	8.95
Scram	11.26	1.69	12.95
Telelink ROM	13.00	1.95	14.95
Asteroids ROM	26.04	3.91	29.95
Base/Ball ROM	21.30	3.20	24.50
Blackjack	7.78	1.17	8.95
Chess ROM	21.30	3.20	24.50
Missile Command ROM	26.04	3.91	29.95
Space Invaders ROM	21.30	3.20	24.50
Space Invaders	11.26	1.69	12.95
● Star Raiders ROM	26.04	3.91	29.95
Super Breakout ROM	21.30	3.20	24.50
Assembler Editor ROM	30.00	4.50	34.50
Pilot ROM	43.04	6.46	49.50
Microsoft Basic	43.04	6.46	49.50
Technical Notes	14.74	-	14.74
Operating System Lists	9.52	-	9.52
DOS Lists	2.61	-	2.61
DOS 2 Manual	6.04	-	6.04

## The Memory

Guaranteed quality - thousands already supplied. Any faulty chips should be returned to us within 12 months of purchase with proof of purchase for replacement by return of post.

4116 **66p + V.A.T.** 200 nanoseconds  
2114 Low power 300 nanoseconds

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● Microline 80	270.00	40.50	310.50
● New Microline 82A	395.00	59.25	454.25
Microline 80 Tractor	45.00	6.75	51.75
Diplomat Card (Apple-Microline)	85.00	12.75	97.75
Microline Ribbons	2.25	0.34	2.59

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MX80 T Newtype 2	415.00	62.25	477.25
MX80 FT/1	399.00	59.85	458.85
MX80 FT Newtype 2	465.00	69.75	534.75
MX100	575.00	86.25	661.25

### Epson Interfaces

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Epson/Sharp Disk	120.00	18.00	138.00
Epson/Apple	85.00	12.75	97.75
Epson/TRS 80 Bus	59.00	8.85	67.85
Epson/TRS 80 Expansion	25.00	3.75	28.75
Epson Ribbons	7.00	1.05	8.05
Epson MX100 Ribbons	8.50	1.28	9.78

### Seikosh

● Seikosh GP80A	195.00	29.25	224.25
● Seikosh GP80D (for MZ-80)	252.13	37.82	289.95

### Seikosh Interfaces

Seiko/Apple	59.00	8.85	67.85
Seiko/Pet	59.00	8.85	67.85
Seiko/Video Genie (EG3016)	33.00	4.95	37.95
Seiko/RS232	79.00	11.85	90.85
Seiko/TTL Serial	43.00	6.45	49.45
Seiko/IEEE 488	59.00	8.85	67.85
Seiko/Sharp (Disk)	59.00	8.85	67.85
Seiko/Ribbons	4.00	0.60	4.60
Seiko Paper 8 1/4" x 11" 2000 Sheets	12.00	1.80	13.80
Paper Delivery	3.00	0.45	3.45

## VIDEO MONITORS

New 12" Green Screen	125.00	18.75	143.75
● BM12E 12" Green	150.00	22.50	172.50
VM129 12" B/W	183.00	27.45	210.45
VM906 9" HI-RES B/W	150.00	22.50	172.50
VM910 9" B/W	125.00	18.75	143.75
9" B/W Monitor	85.00	12.75	97.75
Cables	5.00	0.75	5.75

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● MP 14N (NTSC) TTL, RGB	285.00	42.75	327.75
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Mini Floppy Head Cleaning Kit	19.50	2.93	22.43
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C15 Cassettes box 100	45.00	6.75	51.75
● C15 Cassettes Box 1000	370.00	55.50	425.50
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Mini Floppy SS/DD x 10	20.00	3.00	23.00
Mini Floppy SS/DD x 50	87.50	13.13	100.63
Mini Floppy SS/DD x 100	150.00	22.50	172.50
Mini Floppy DS/DD	4.00	0.60	4.60
Mini Floppy DS/DD x 10	33.00	4.95	37.95
Mini Floppy DS/DD x 50	150.00	22.50	172.50
Mini Floppy DS/DD x 100	275.00	41.25	316.25
● 4116, 200 N.S.	0.66	0.10	0.76
● 2114, 300 N.S.	1.00	0.15	1.15
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On the edge of the atmosphere, space shuttle Columbia was about to lose all contact with Earth: for 21 agonising minutes, touch-down would be touch-and-go. As the world held its breath, the £4½ billion project relied on a £165 hand-held calculator, small enough to live in the pocket of Robert Crippen's flight suit. The Hewlett-Packard HP-41C. Unmodified. Just as you buy it today. . .

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Sooner or later, a basic calculator is too basic. Suddenly you need to 'compute' – but with a 'computer' that's as simple and pocketable as a hand-held calculator. And, as NASA found, that means an HP-41C.

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## The friendly calculator with power in reserve.

As a straightforward calculator, the HP-41C is a masterpiece of compact power.

It gives you read-out in letters, as well as figures and symbols, so the display can talk to you in an easy, simple way.

Yet, inside, it has the effortless, problem-solving power normally associated with computers.

Among other things, that means the HP-41C is fully programmable. You can feed its built-in 400-line memory with ready-made programs or develop your own. Its friendly style makes it surprisingly easy. And, because the memory is continuous, what you put into it stays in – even when you switch off.

But that's not the end of the story by any means. Because, unlike any other advanced programmable calculator you are likely to see, the HP-41C has behind it a highly developed package of software support representing many years of heavy investment by Hewlett-Packard. So when you buy the HP-41C you don't just *own* a powerful system; you can put it powerfully to *work*.

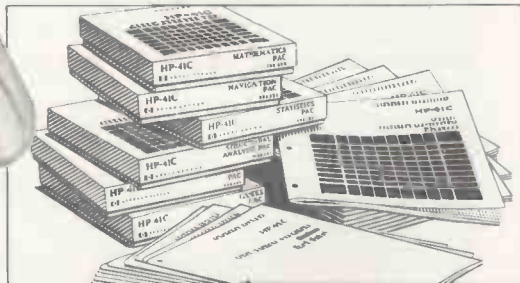


The HP-41C hand-held 'computer' in a box. £184 brings you the calculator, a comprehensive 270-page manual, owner's handbook, and programming guide, a standard applications handbook, customising overlays. HP Users' Library membership reply card, free one year's subscription to HP's User's Newsletter, batteries, carrying pouch and 12 months' full guarantee.



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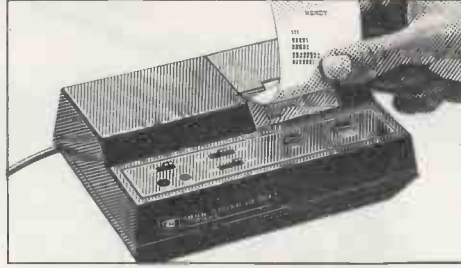
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## Two ways to make your system grow...

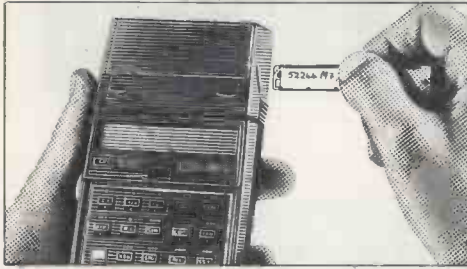


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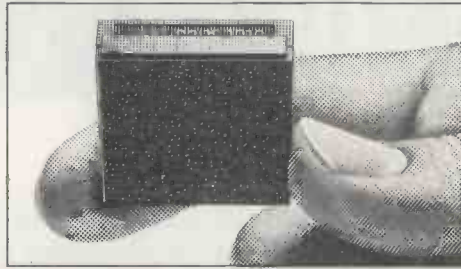


**Plug-in a printer.** The HP-41C printer handles upper and lower case, in alpha, numeric and graph-plotting modes. Use it for final hard copy, or to follow program execution.

## Four ways to program your HP-41C...



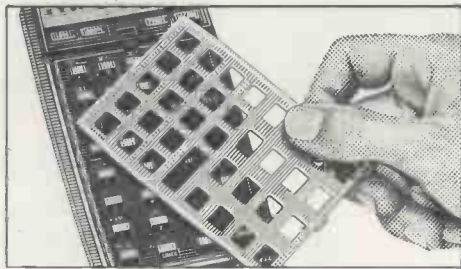
**Card reader.** This reads pre-programmed magnetic cards. It can also record and read your own programs and data.



**Application modules.** These are plug-in modules each containing a whole range of ready-made programs on your chosen subject.



**Bar code reader.** A quick and easy way of loading any one of the software packages. The wand simply 'lifts' the coded program straight off the page of your HP-41C solution books.



**Keyboard customising.** Develop your own programs and enter them through the keyboard. You can assign any function or program to any key and mark them on your own customising overlay.

## Thousands of easy ways to solve problems.

Think of a problem! As an HP-41C owner you won't have far to look for the solution - or long to wait before it's locked in your system's memory. Any of HP's hundreds of pre-programmed solutions can be easily entered in any of the four ways we illustrate above. You'll certainly want to devise your own solutions, too. The guidance manual in your basic pack tells you how. If you develop an original one you could submit it to the HP-41C Users' Library. It already contains thousands of tested programs which 10,000 users worldwide are happy for you to share.

## Quality from HP - the big computer manufacturer.

The HP-41C is made from the chip upwards by Hewlett-Packard, a world leader in computers. And you can tell! By the detail like the permanent inlaid key notations, tough ABS case, and gold-plated port contacts. By the elegant simplicity designed into the HP-41C's operating style. By the sort of software support only a computer giant would be capable of. By the utter reliability that is the HP hallmark throughout the world of computers.



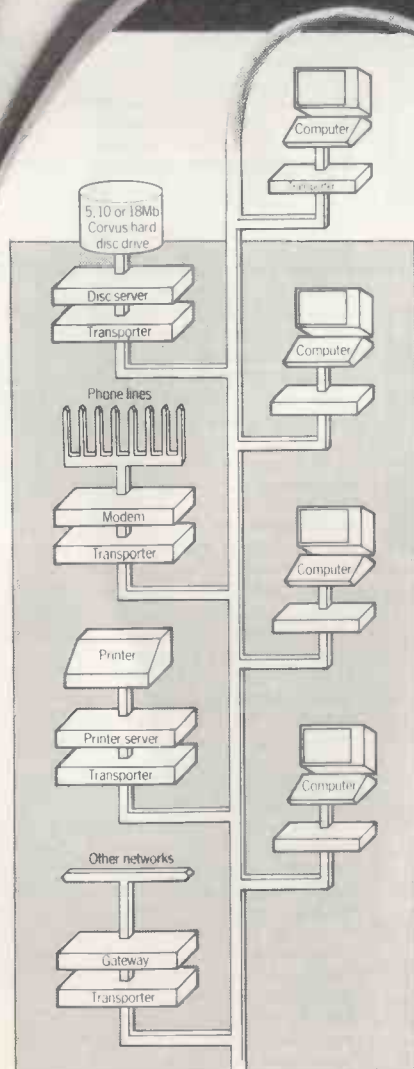
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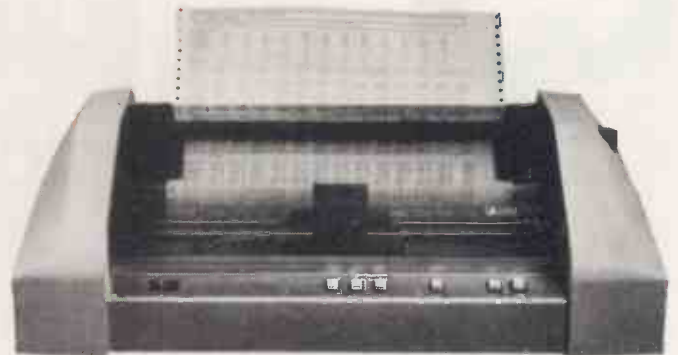
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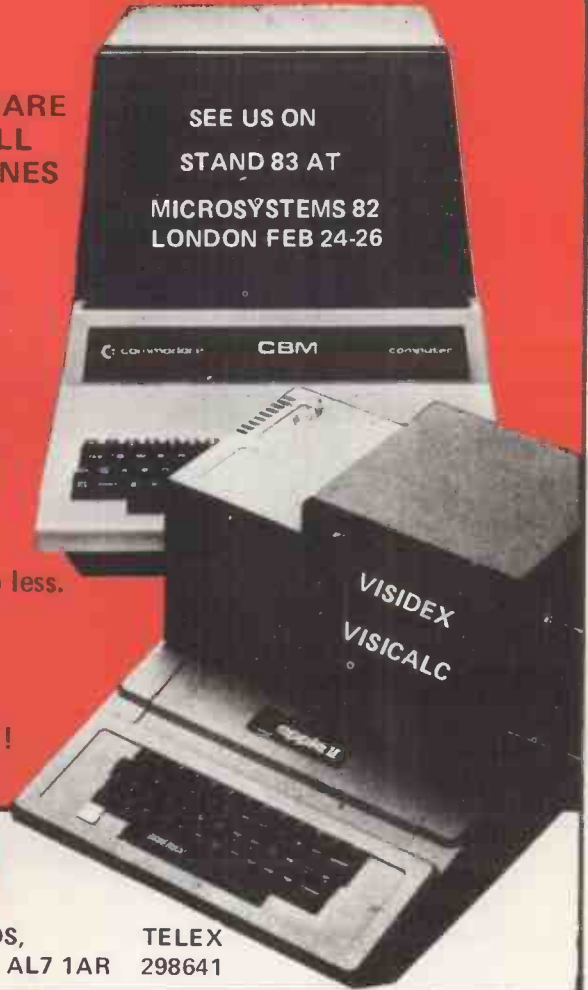
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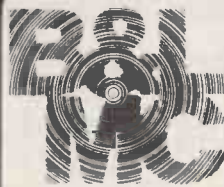


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D) Alternate Char. Set = 0  
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*from the professionals*

# LDOS

First there were the TRSDOS's, 2.0, 2.1, 2.2 and 2.3. Then came Newdos +, essentially a patched version of the TRSDOS's but with a number of very useful commands and utilities added. Then VTOS 3.0 and VTOS 4.0. These constituted a departure from the earlier DOS's and featured Device Independence so that devices such as the keyboard, printer, VDU and disk drives could interact directly together. Then came Newdos80 which is a rewrite of Newdos +, adding new utilities and new Basic commands, its main features being the ability to mix different capacity drives on the same cable and the ability to use variable length records. Now from LOBO International comes LDOS, the fifth generation disk operating system for the TRS-80 microcomputer. It combines most of the advantages of the preceding disk operating systems and unlike some of them, is accompanied by a complete and readable set of documentation, which includes a Technical Section containing relevant addresses.

It is impossible to describe all of the features of LDOS in an advertisement. For instance it includes no less than 35 library commands as follows:—

APPEND	COPY	DEVICE	DIR	DO	FILTER	KILL
LIB	LINK	LIST	LOAD	MEMORY	RENAME	RESET
ROUTE	RUN	SET	SPOOL	ATTRIB	AUTO	BOOT
BUILD	CLOCK	CREATE	DATE	DEBUG	DUMP	FREE
PROT	PURGE	SYSTEM	TIME	TRACE	VERIFY	XFER

All of the useful abbreviations in Newdos are included and the System Commands in Basic (CMD) now number eleven. A program called LBASIC/FIX is included, with which the normal TRSDOS Disk Basic may be patched to include a number of new commands and features. A Job Control Language is included and in fact is one of the most powerful features of LDOS. It allows the user to compile a sequence of commands or key strokes for later execution as a chain, with or without user intervention. There are too many new features to list them herein, but examples are: The ability to provide an audible signal, output through the cassette port. To flash or blink a one line message on the video display. A WAIT feature is included so that the machine can be put into a "sleep" state until such time as the system clock matches the time specified. And so on!

Hard disks in addition to single/double density, single/double sided, 8" and 5 1/4" floppies are supported although they may, of course, require hardware modifications. Utilities included in the package are:

BACKUP	COMMAND FILE	FORMAT	LCOMM
PATCH	RS232	KEY STROKE/MULTIPLIER	PRINTER FILTER

A Basic Renumber facility is included, as is a Basic Cross Reference function. Both are similar to the ones in Newdos + and Newdos80. Most of the utilities are library commands which were existent in the previous DOS's, have been improved with the addition of new functions or facilities.

The prime development team of LDOS consisted of no less than 8 first rank programmers and they had the support and advice of six other well known programmers. They have done an excellent job to bring to the user what must be the best disk operating system so far produced for a microcomputer, which is destined to become the Standard DOS.

LDOS is totally upward compatible with TRSDOS, that is to say LDOS will be able to copy files and programs from TRSDOS disks onto LDOS formatted disks. As they are competitive disk operating systems, it is not surprising that the manual states that disks created under Newdos are not guaranteed to be compatible with LDOS, but we have not experienced any difficulty. We have done some work on investigating the compatibility of LDOS and the Video Genie and at the time of going to press we have found no incompatibilities. LDOS appears to run on the Video Genie without any problems at all. LDOS is compatible with either the Tandy or Electric Pencil lowercase modifications and Scripsit. LDOS is available for the Model I and Model III. A Model II version will be available shortly.

LDOS .....£85.00 plus VAT and £1.50 P&P.



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A remarkable breakthrough in price/performance, the CompuStar boasts nearly 1 megabyte of on-line mini-disk storage (almost 2 megabytes on CompuStar III) and can be easily expanded to 20, 36 or 96 megabytes of hard-disk in just seconds. And since each user station can accommodate up to 64k of RAM, a total of over one million bytes can be incorporated into the system to tackle even your most difficult programming tasks.

CompuStar user stations can be configured in a countless number of ways. A series of three intelligent-type terminals are offered. Each is a perfect cosmetic and electrical match to the system. The CompuStar 10 - a 32k programmable RAM-based terminal (expandable to 64k) is just right if your requirement is a data entry or enquiry/readonly application. And, if your terminal needs are more sophisticated, select either our CompuStar 20 or CompuStar 40 as user stations. Both units offer dual disk storage in addition to the disk system in the CompuStar. The Model 20 features 32k of RAM (expandable to 64k) and 350k of disk storage. The Model 40 comes equipped with 54k of RAM and over 700k of disk storage. But, most importantly, no matter what your investment in hardware, the possibility of obsolescence or incompatibility is completely eliminated since user stations can be configured in any fashion you like - whenever you want - at amazingly low cost!

## COMPUSTAR™



### Functional characteristics

The CompuStar 10 megabyte Disk Storage System (DSS) consists of read/write and control electronics, read/write heads, a track positioning mechanism, a spindle drive mechanism, dual disks, an air filtration system, and our exclusive 255 user controller - all packaged in a compact desktop enclosure. Although designed primarily to accommodate multiple CompuStar Video Processing Units (described at left), the unit can easily be connected to a single SuperBrain Video Computer System to facilitate additional disk storage. When used with CompuStar VDUs, however, the integral Z80 based controller will permit up to 255 users to 'share' the resources of the disk with minimal CPU response degradation.

### Read/Write Heads and Disks

The recording media consists of a lubricated thin magnetic oxide coating on a 200mm diameter aluminum substrate. This coating for multiread, together with the low load force/low mass Winchester type flying heads, permits reliable contact start/stop operation. Data on each disk surface is read by one read/write head, each of which accesses 255 tracks.

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DBMS2 is a *record relational* as well as a *file relational* database management tool that is capable of being at different times, many different things. The one core program can be set up to perform tasks normally associated with the following list.

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Stock control	Address mailing	Letter writing
Simulations	Time recording	Filing
Calc-type predictions	Hospital indexing	Profit analysis
Bureaux services	General analysis	Mathematics
Answer what-if's	Employees records	Tabulate values
Print reports	Sort files	Edit records

Within hours perform all the above in French or German. The list is as endless as that which meets the requirements of your own imagination. Within the appropriate frames of reference you could ask questions like the following.

Find someone whose name begins with W, who is either in London or Birmingham, and available for work at a salary of less than 10,000.00, and is under 40 years of age, not married, of credit worthiness grade 1, with a car, prepared to travel, and who likes horses, does not mind the hours he works, is congenial and has good references. When you find such persons produce a printed list of them showing their names, telephone numbers, and what their salaries are as well as their salary if increased

by 10% and show their availability for work. At the end of the list enumerate the total of such persons.

Find all stock items that are codes *micro-computers* that are either in warehouse 1 or warehouse 2, where the quantity on hand is more than 50 units, the cost is less than 1000.00, the selling price higher than 2000.00; that are not in cartons, bought from supplier 52, allocated more than 20, rated for tax at .15% and weigh less than 50 lbs. When you find such categories then print a report showing the description, cost price, quantity on hand, lead time for refills, what the selling price should be if raised by 12.3% as well as the profit in either per-cent or round figures of that projected selling price.

Find all patients who suffered from cold, that are either girls or women younger than 23 years old, and who live in London at a socio-economic grade higher than 3; do not smoke; have more than 3 children, are currently at work and where treatment failed to effect a cure in under 6 days. When you find such persons then print a list showing their age, marital status, income, and frequency of illness in the past 2 years.

Currently you can ask 5 types of questions 20 times for a single selection criterion, and then you can compute 10 mathematical relationships between the questions for the individual as well as for the total number of matches. In all some 60 bits of information relating to one record or a group of records on simply one permutation of the selection criterion, with a cross referencing facility as well.

Every word in the system, as well as the file architectures, print masks, and field attributes, is capable of alteration by you without programming expertise (but with some thought).

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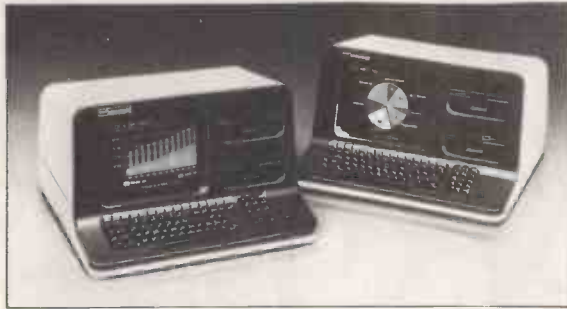


SuperBrain users get exceptional performance for just a fraction of what they'd expect to pay. Standard SuperBrain features include: two double density mini-floppies with 350k bytes of disk storage, 32k of RAM memory (expandable to 64k) to handle even the most sophisticated programs, a CP/M® Disk Operating System with a high powered text editor, assembler, debugger and a disk formatter. And, with SuperBrain's S-100 bus adaptor, you can add all the programming power you will ever need... almost any type of S-100 compatible bus accessory.

SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL, and APL. Whatever your application... General Ledger, Accounts Receivable, Payroll, Inventory of Word Processing, SuperBrain is tops in its class. And the SuperBrain QD boasts the same powerful performance but also features a double-sided drive system to render more than 700k bytes of disk storage and a full 64k of RAM. All standard!

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04 = Sales ledger	10 = Order files	16 = Print tax statements	21 = Disk directories
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64K + 6.3 M DISK	4595.00	64K MDL 40 VPU	3195.00	EPSON MX80F/T	475.00
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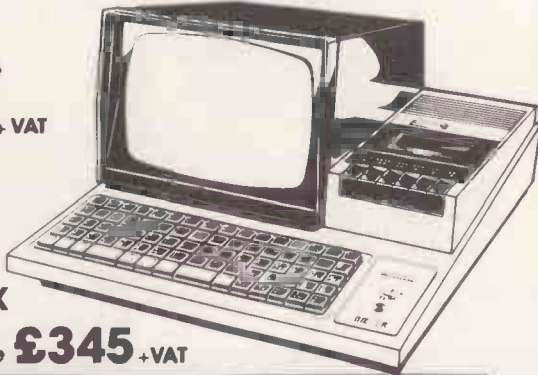
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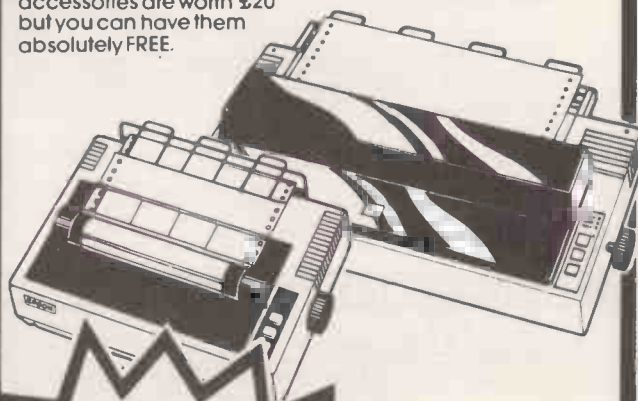
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With hundreds in daily use the Gemini Disk system is now the standard for Nascom and Gemini MultiBoard systems. Single or twin drive configurations are available, giving 350K storage per drive. The CP/M 2.2 package supplied supports on-screen editing with either the normal Nascom or Gemini IVC screens, parallel or serial printers, and auto single-double density selection. An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 2 it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

Single drive system (G809, G815/1)

**£450 + VAT**

Double drive system (G809, G815/2)

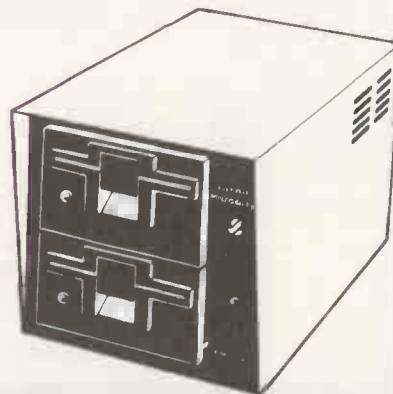
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A new CP/M system  
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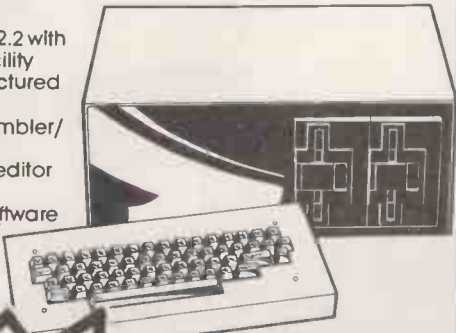
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- \* Twin Z80A CP/M System
- \* 64K Dynamic RAM
- \* 700K Disk Storage (Formatted)
- \* 80 x 25 Screen Format
- \* Inverse Video

- \* Prog. Character Generator
- \* 160 x 75 Pixel Graphics
- \* Centronics Parallel I/O
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- \* Light pen interface
- \* 59-Key ASCII Keyboard

## SOFTWARE

- \* Full 64K CP/M 2.2 with screen edit facility
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- \* GEM-PEN Text editor
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Nascom owners can now have a professional 80 x 25 Video display by using the Gemini G812 Intelligent Video Card with onboard 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. Built and tested.

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The new Quantum Micros I/O board takes a unique approach to the problems of interfacing your Nascom or Gemini Multiboard to external devices. This 80 Bus and Nasbus compatible card is supplied fully built, populated and tested and includes three Z80 PIOs, a CTC and a Real Time Clock with battery back-up. In addition, a range of "daughter" boards that attach straight to the I/O board are under development catering for a wide variety of interfacing requirements.

Quantum I/O board  
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Prototyping daughter board  
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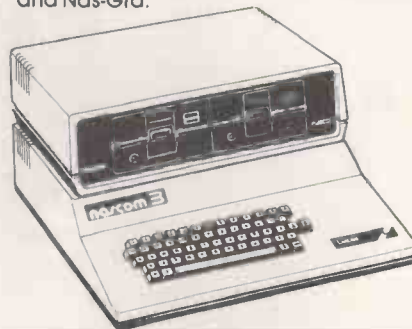
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IBR Microcomputers (England/Wales  
Distributor) Sution Park, London Road,  
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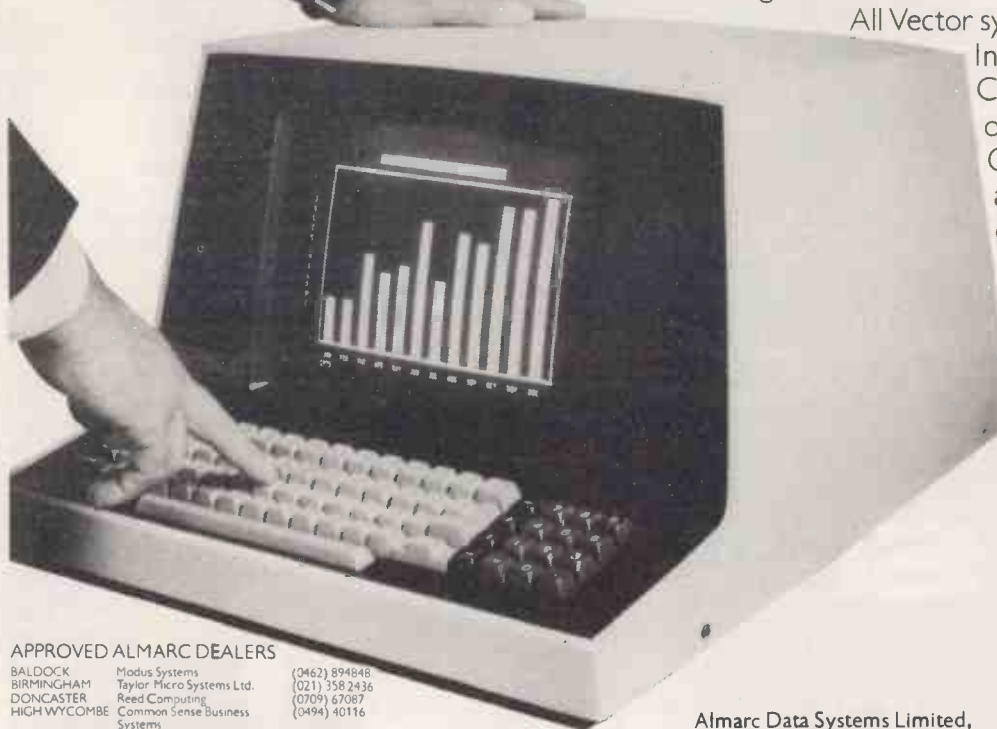


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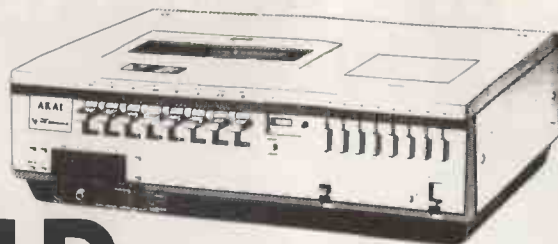
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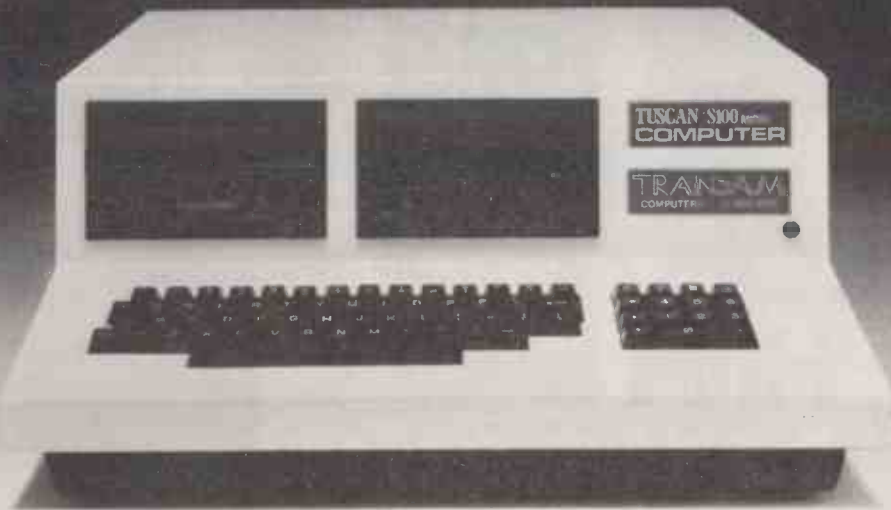
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TRANSAM COMPONENTS LIMITED  
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Fast data transfer rate of 6000 bps.

Powered from NASBUS.

8" sq NASBUS compatible PCB.

Far more reliable than any floppy disk system.

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- T – Transfer file to another drive.
- W – Write a file.
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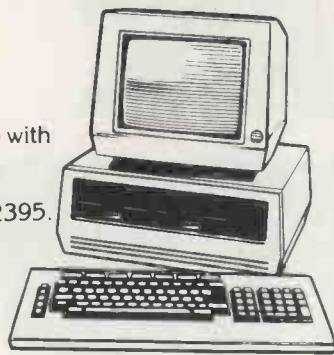
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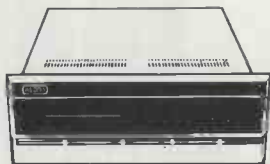
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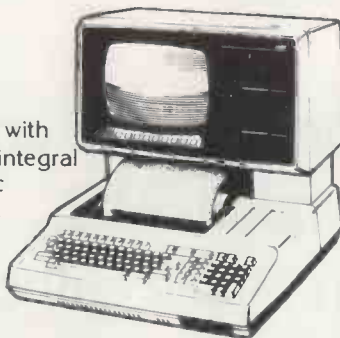
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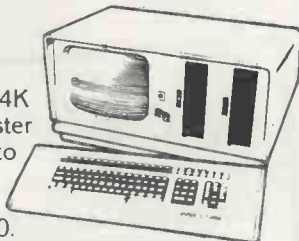
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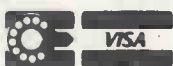
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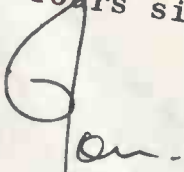
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We have now had the opportunity to follow up the many leads we received at the 1981 Microcomputer Show, and are pleased to say that this show was, without doubt, the most successful show we have ever attended.

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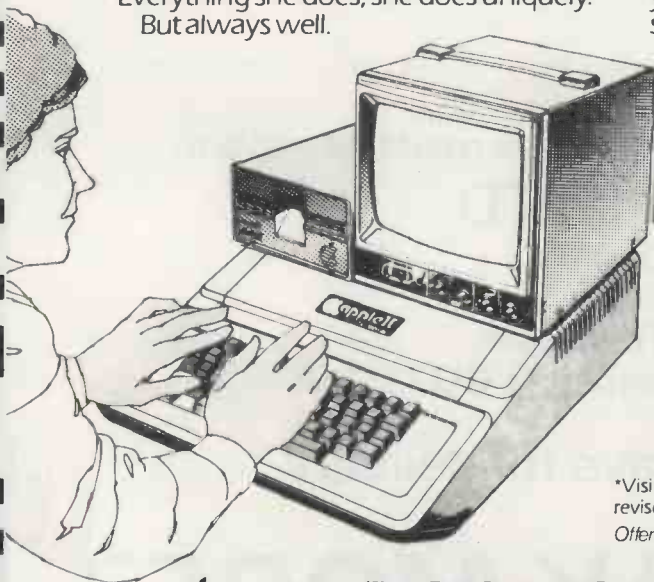
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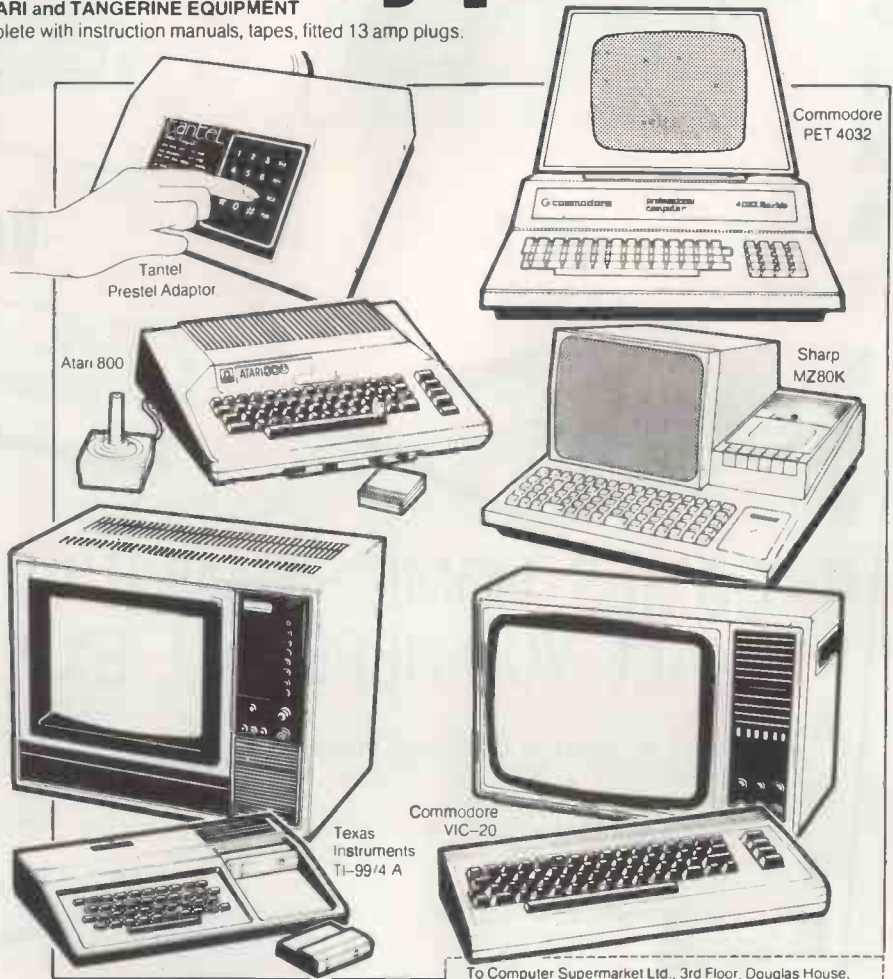
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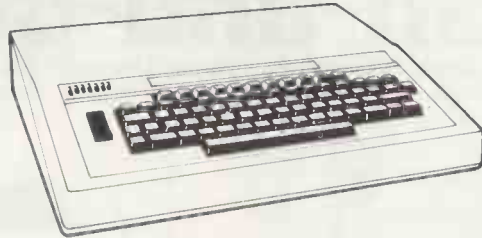
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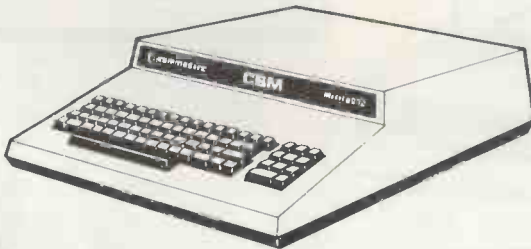
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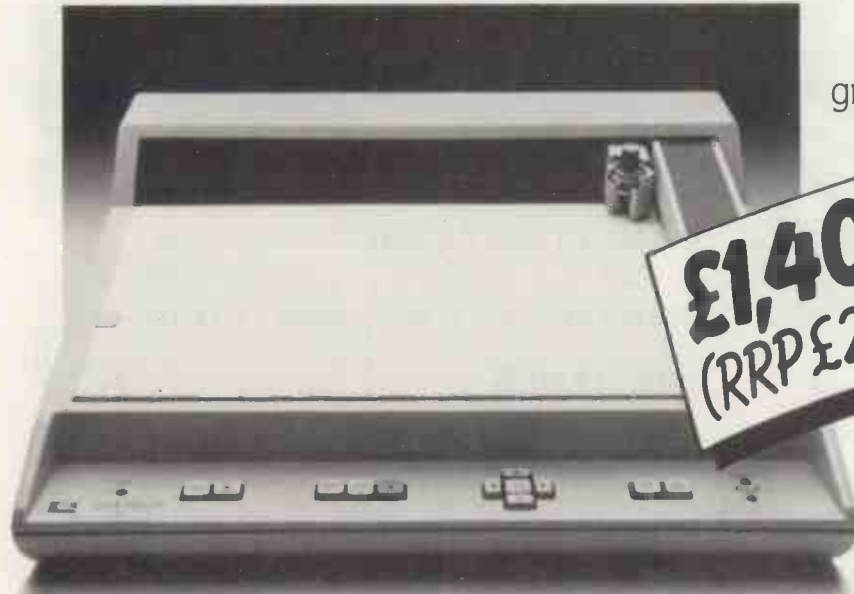
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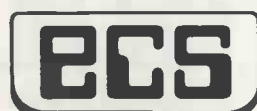
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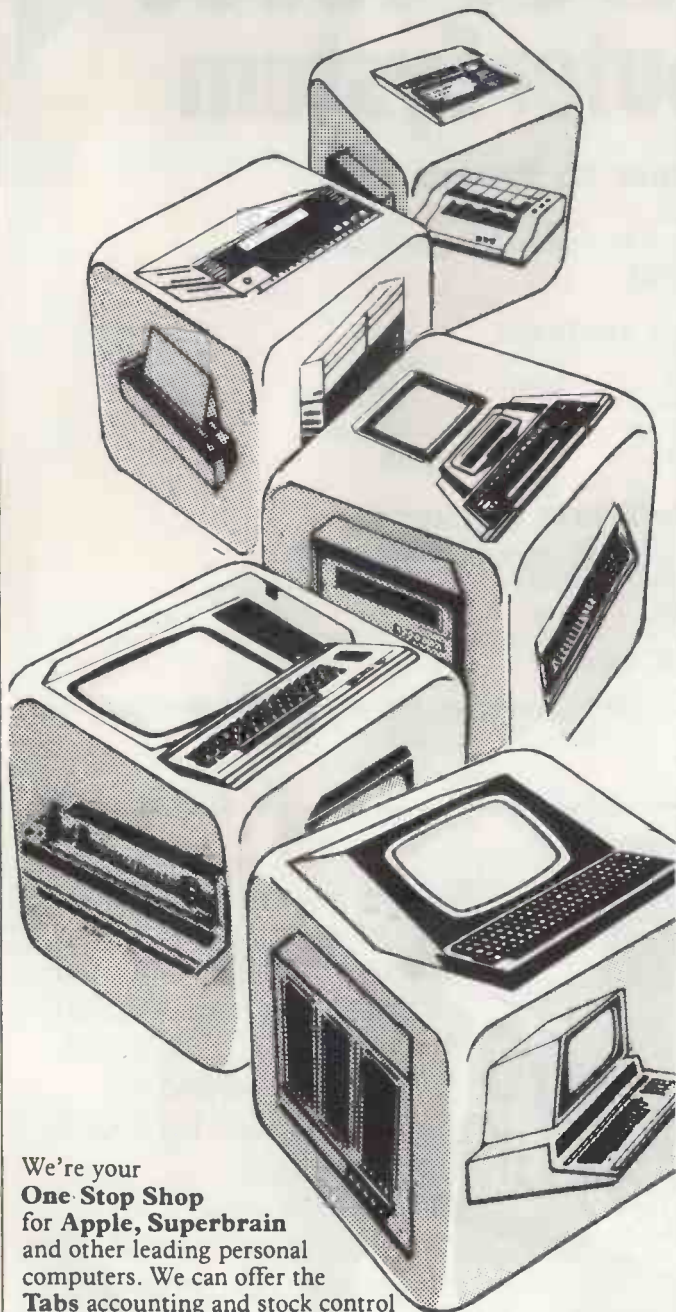
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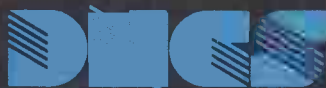
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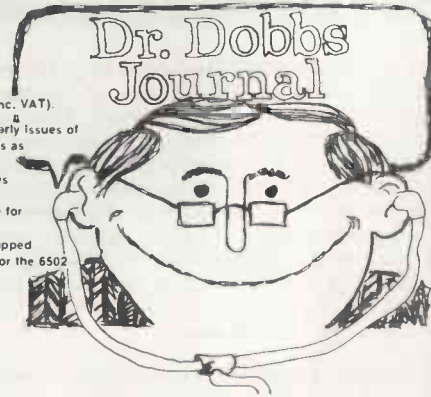
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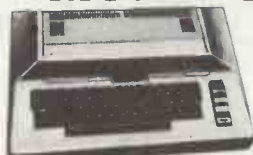
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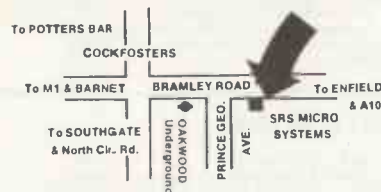


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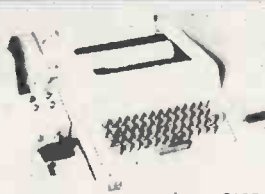
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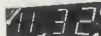
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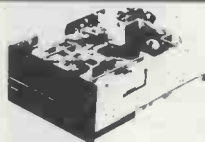
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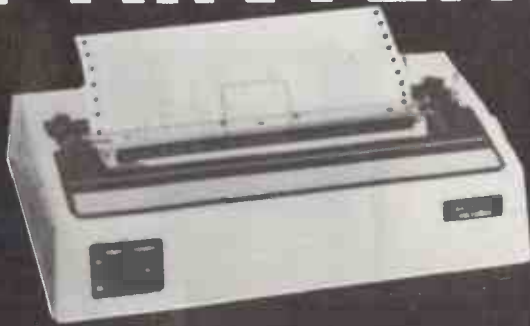


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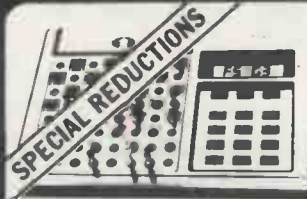
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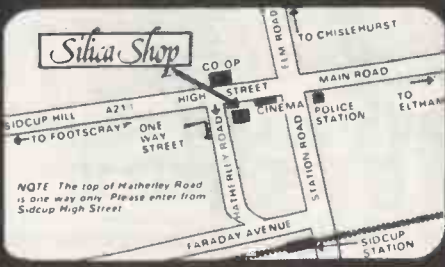
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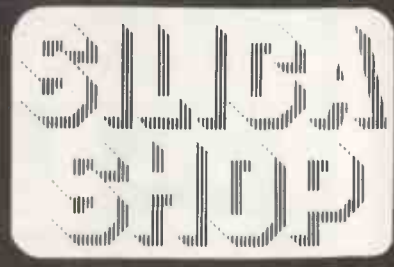
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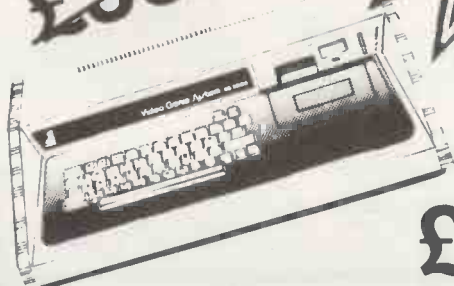
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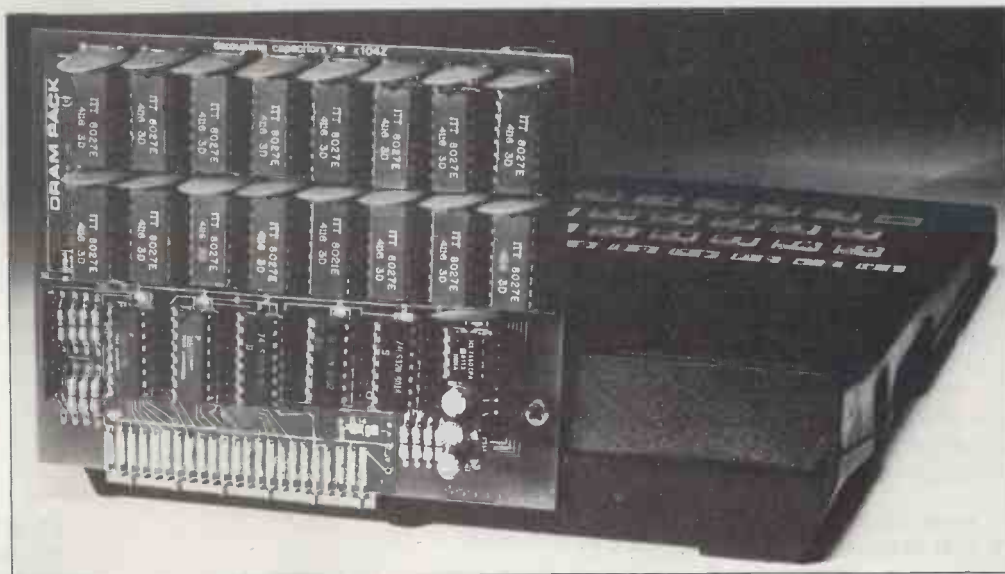
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Compiled by Guy Kewney



## Apple sauce

Apple will probably respond to the challenge of the portable Osborne computer, with some kind of packaged system in a small box, within six months.

Intriguingly, this magazine has, after four years, finally received a review Apple micro-computer for Benchtesting. And so have I (I keep my reviewing quite separate from the official Benchtesting programme).

The main result of my reviewing is this: thank God the machine hasn't long to live. But it is too important a design to dismiss merely because of its out-of-date features.

Nonetheless, the portable Apple planned for late summer will come none too soon. Never having taken an Apple out of its boxes before, I had no idea what a performance it would be. And after plugging in Silentype, disk and games add-ons, the prospect of experimenting with other printer interfaces, 80-column cards, Pascal language systems, and so on, gets a bit frightening.

When all the good things of the Apple II are packaged nicely into one box, with plugs on the *outside* rather than inside, then it will be easy to see why people like Colin Crook of Zynar (selling the Nestar Apple network) predict several life-extensions of the beast. Life extensions, by the way, are recognisable in the motor trade by the appearance of a new bit of chrome, or a new flashing light, so that the people can see it really is this year's model, not an old one with a newer registration. In micros, you are talking more of real upgrades; such as the ability to add hard disks, to double memory capacity, or to put it all in one box with a handle on the side. And that, apparently, is the next trick for the Apple II.

Apart from that, the arrival of the machine has dispelled one or two comfortable illusions. It has been my erroneous belief, for all the years the Apple has been on the market, that you could edit Basic on it the way you can on the PET and

HP-85 and Atom — by moving the cursor up to the line involved and re-entering or altering it. It's a severe blow to find out that you can't — and I don't understand why not. And, given that you can't, why hasn't Apple rapidly added this feature?

That said, the truly amazing thing about having easy access to the machine is the incredible amount of software which I can now load and try out, and which previously had to be passed on to reviewers without any real idea of what it was supposed to do.

And of course it was this software that made me interested in having the Apple in the first place.

My attitude to getting free hardware left in my office is not quite as simple as the average user might expect. For a start, it costs me a bit in 'extras' such as printer interfaces, screens, disks, cables, and (not least) storage space. Second, there is no easy way to judge the donors' good faith — they may say they agree that journalists need machines to evaluate software, but what they really means is that this particular journalist should write something truly flattering about the supplier — or the machine will not be needed. And third, there are always undercurrents of friendship and dislike to deal with. Nobody in Apple UK will believe me for a moment when I swear that I've never disliked any of them just because of some of the daft things they've done. Now that I have an Apple to check things out on, will the old Micro-sense team now expect me to be more favourable 'because we are on better terms', believing that it was animosity which caused criticism before?

Oh, it's a great life being a commentator. I think I'll conclude by passing the hat round for the 'Agonies of Conscience' fund...

## Think in colour

Colour on the computer screen, when it is of use, is very powerful. For example, it can make a graph with several different functions more understandable than a

mere tangle. So, of course, can colour on paper — but most computers don't have any way of making coloured marks on paper.

The 'spreadsheet' program Micromodeller now has colour print available. Since its function is to display complicated sets of financial data, the usefulness of colour can't really be doubted — as long as the user is trained to 'think in colour'.

The producer of this new feature is (not altogether a surprise) a manufacturer of colour printers — DE Computer Services of Middleton, Manchester. The company claims this is the first package program to come with colour printout as standard. Details on 061-643 0016

## Alphapology

One should never make off-the-cuff remarks, because of the danger of telling only a small part of the story. The occasion which I have in mind is the passing reference to the Triumph-Adler Alphasonic and its RS232 interface which appeared in this column a couple of months ago, and which pointed out the danger of 'improving' such standards. I think I must pay Triumph-Adler the compliment of an

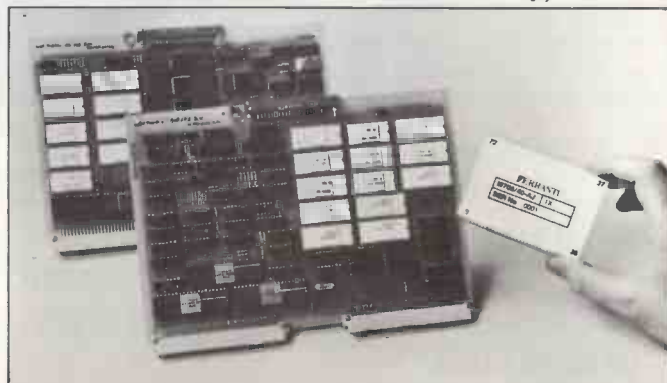
apology — because in mentioning the Alphasonic's extremely non-standard printer interface, I omitted to add that the machine possesses a perfectly standard RS232 interface as well. This was a serious omission, because with the standard interface you can plug into a printer or modem — and without it, you can't.

## Deadly dongle

Program Protection (of Arizona) has announced a product, called the Deadbolt, which makes illegal copying impossible. It works on Apple computers and is a chip which plugs into the machine's internal games paddle socket. Program Protection supplies this product at \$10 per Deadbolt, plus a charge to the software writer, for the service of adjusting the program to run with the Deadbolt in place. This service costs \$1200 for the 'initial package' — though exactly what that is isn't too clear.

The trouble with this system of protecting programs is that it works very well with small-time crooks like you and me, who can afford one or two essential programs in a year and four or five games, perhaps, and that's that.

Unfortunately, most soft-



*Ferranti's excellent engineers should be very pleased to have their abilities recognised by a Ministry of Defence contract to turn Ferranti minis into very large-scale integration microprocessors — not before time, one might say.*

*It is a waste of resources, however, to convert a well-used defence computer into a single chip just for the sake of the defence software it will run. In three years' time, the software for the dratted machine will be produced by some Japanese code factory anyway, and the money that should have been spent to prepare for this threat will have been wasted on an obsolete mini.*

*It's what's known as cutting back on public expenditure, I think.*



ware theft is organised, usually by a computer retailer who's having a tough time competing with the shop down the road and who can't match the other shop's low prices. All too often, the dealer makes his package look better by throwing in a little 'free' software like a word processing package, or a stock control system, or even a couple of games, or all four, without charging any extra.

This sort of crook is normally equipped with a programmer and an engineer and can, with a little effort, find a way of duplicating programs even if they are protected by secret codes and Deadbolt-type dongles.

Still, the Deadbolt idea does usually allow the user to make a copy of a disk for his own purposes (in case the original disk wears out, which it will do) so the idea is not totally without merit. Details from PO Box 27268, Tempe, Arizona 85282, or phone (714) 770 8843.

## Iona micro

First details of the Iona micro from IOTEC indicate that it will be both very expensive and very cheap.

The machine is being offered by a new company, set up to handle the marketing of the new product, and one of the things it still hasn't quite sorted out is the pricing policy.

However, since most CP/M systems provide 64kbytes or less, and since the Iona can go up to 960 kbytes, it is obviously a lot bigger than most. And since most CP/M systems these days come with their own screens and the Iona can drive an ordinary television, which saves money, it must also have a very cheap version. And since most micros these days (new ones, not old-fashioned things like TRS-80s and Apples) don't bother with audio cassette recorders for storing programs, and this one does. I think we can safely say that the company is planning to appeal to the beginner as well as the corporate chequewriter.

Notice also that the machine can connect to a colour screen as well as to a black-and-white one.

With 960 kbytes, of course, it is obvious that the operating system can't be ordinary CP/M, so the normal warning applies: you may be able to run programs designed to run under CP/M on this machine, but don't count on being able to run this machine's programs under normal CP/M afterwards. Details from Nigel A Tompkins on 01-236 7968.

## Services guide

The Computer Retailers' Association (CRA) is something that readers of this column in past months may

have noticed mentioned from time to time. From the tone of the voice in which it has been mentioned, it might have been possible to deduce a lack of true reverence towards its aims and existences.

This was never because I saw the CRA as a waste of time. Rather, I saw the idea of setting up a 'club' for retailers, where the entry fee was a promise to follow a system of ethics, as a good idea which could easily be ruined by praising the members.

The first thing that happens when a bunch of people get together to monitor their own behaviour is that they sort out a few cowboys. The second thing that happens is that they want to be told how clever they were. And flattery being a powerful aid to getting favours done, this usually follows: before you can say 'prestige', you find the association president being quoted in headlines. And within a year, every cowboy in the business is trying to be the president, not to improve the ethics, but to get into the headlines.

This is all by the way of introducing you to the Computer Services Association (CSA), which has for some years represented the interests of companies who hire out computer programmers and operators, who rent large mainframe computers to large corporations, who sell computer time on their own large mainframes, and who supply hardware and software which they did or didn't produce themselves.

This body has just associated itself with a £25 guide to the services industry. The book was published in January by Gower Press. It looks to be an excellent guide, with 502 pages, a lot of different classifications of service companies, including a very valuable 'first' in this type of book — a geographical index to show not only what firms provide the service you are looking for, but also which of them are within an hour's drive of your problem.

The only warning is that, even though the CSA may have lived through the dangerous period I spoke of above it is still in no position to describe all its members as legal, decent, honest and so on, and the presence of a firm's name in this book should be taken as an indication that nothing is known to the book's Editors about the company that would involve actually taking them to court.

No, you're quite right. I don't trust trade associations, do I? Details on 0252 512331.

## IEEE add-on

The new add-in circuit which Mike Sterland's Personal Computers company has announced for Apple II is an IEEE-488 interface card. It



Today's enthusiasts (mumbled the ancient sage) don't know what the inside of a computer looks like because they all come in boxes. They probably think this memory board is a computer — but it isn't, it's an attempt to improve on one of IBM's little miscalculations; it provides its personal computer with too little memory. Pic shows, in fact, the Datamac 64 kbyte memory expansion board which can be increased to become a 256 kbytes board — allowing users to squeeze a megabyte into the box.

And to think it's only two years since Kells Elmquist of Ithaca was boasting about the three or so megabytes that the new S100 bus could control, and everybody laughed when I asked 'why so little?'

Datamac is in the US, on (408) 735 0323 — but I think you'll find that Mick Punter at Microcomputerland has heard of them.

has so many essential features included 'for the first time in a product of this type' that it's hard to imagine what previous circuits of this type did at all.

The device costs £300 and is made by California-based SSM Microcomputer Products (for whom Sterland is now official UK distributor).

Unlike previous products, this doesn't merely ensure that the right number of wires emerge from the Apple in IEEE-488 format.

According to Sterland, it makes the job of producing software to drive them a lot easier, too.

'This card differs from other Apple compatible IEEE cards in the following ways: first it has a six-foot cable (others have only one foot); it supports instruments which operate in binary data mode, it handles bus timeouts and will inform the application program so that necessary action may be taken; it can be controlled from Pascal or Fortran language programs as well; and finally the data can be transmitted at 10 kbytes per second.'

It all sounds like the sort of thing that any IEEE-488 card should do anyway, but

when people announce an enhancement of this sort they usually aren't too bothered to explain what it doesn't do.

For example, the PET has an inbuilt IEEE interface, which it uses to drive its disks: to make the Apple use PET disks is therefore a theoretical possibility with this interface. All you need is a purpose-written operating program which will control the disk drives and read them and the interface will do it — but getting that software written might just take you a couple of years. Details on 01-626 8121.

## IBM woos punter?

Don't believe anybody who tells you that IBM, the biggest computer company in the world, is angry and annoyed to see Mick Punter of Zeus-Hermes importing the IBM Personal Computer to the UK under his new Microcomputerland label. It is true that IBM doesn't (at the moment) produce a UK version of the machine and it is also true that it doesn't know quite how to

# IF ANY OF THE FOLLOWING WORDS GIVE YOU A BUZZ . . . ANALYSIS STATISTICS DESIGN PLOTTING GRAPHICS REPORT WRITING SPECIFICATIONS SCHEDULES COSTING PLANT MAINTENANCE PRODUCTION CONTROL SIMULATIONS IEEE INTERFACING INSTRUMENT CONTROL MONITORING TERMINAL COMMUNICATIONS PAPERTAPE READING PUNCHING & EDITING SELF PROGRAMMING BASIC ASSEMBLER LANGUAGE MACHINE CODE . . . **GIVE US A BUZZ (OR SEND BACK THE COUPON)**

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**Who needs PET? And why?** The list above speaks for itself, but that's only part of the story as the PET now has over 600 applications. It's good news for any engineer who's tried to get even a modest budget approved – the PET is very acceptable to the most sceptical of money people.

It's an attractive proposition, too, to DP professionals who need their fingers on the pulse and are fed up with waiting for their turn on the company computer.

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Micro Computation N14  
01-882 5104  
Microcomputer Centre SW14  
01-878 7044/7  
Sumlock Bondain Ltd EC1  
01-250 0505  
Informex-London Ltd SE13  
01-318 4213/7  
CSS (Systems) Ltd E8  
01-254 9293  
Meares Consultants Ltd NW3  
01-431 3410  
Data Base NW2  
01-450 1388

## SURREY & MIDDLESEX

Douglas Moore Ltd Kingston-Upon-Thames  
01-549 2121  
Micro Facilities Ltd Hampton Hill  
01-979 4546/941 1197  
PMM Ltd Woking  
04867-80111  
Datalect Computers Ltd Croydon  
01-680 3581  
Datalect Computers Ltd Woking  
04862-25995  
Johnson Microcomputers Camberley  
0276-20446  
Wego Computers Ltd Caterham  
0883-49235  
Cream Computer Shop Harrow  
01-863 0833  
Da Vinci Computer Shop Edgware  
01-852 0526  
L & J Computers Stanmore  
01-204 7525/206 0440

## KENT, SUSSEX & HAMPSHIRE

Amplicon Micro Systems Brighton  
0273-562163/608331  
Business Electronics Southampton  
0703-738248  
HSV (Microcomputers) Ltd Hants  
0256-62444/0703-331422  
Millhouse Designs Ltd Alton  
042-084517  
The Computer Room Tonbridge  
0732-355962  
Scan Computers Storrington  
09066-5432

## ESSEX

Datanew Colchester  
0206-865835  
CSSC Ltd Ilford  
01-554 3344  
DDM Brentwood  
0277-229379  
Stuart R Dean Ltd Southend-on-Sea  
0702-62707

## BERKSHIRE, BUCKINGHAMSHIRE, OXFORDSHIRE & WILTSHIRE

Commonsense Business Systems Ltd High Wycombe  
0494-40116  
Orchard Computer Services Wallingford  
0491-335529  
Wymark Micro-Computer Centre Salisbury  
04254-77012  
Alphascan Ltd Banbury  
029575-8202  
J R Ward Computers Ltd Milton Keynes  
0908-562850  
The Computer Shop Oxford  
0865-722872  
Kingsley Computers High Wycombe  
0494-449749

## HERTFORDSHIRE & BEDFORDSHIRE

Alpha Business Systems Ware  
0920-68926  
Bromwall Data Services Old Hatfield  
07072-60980/63295  
Computer Plus Watford  
0923-33927  
HB Computers (Luton) Ltd Luton  
0582-454466  
Photo Acoustics Watford  
0923-40698/32006  
MMS Ltd Bedford  
0234-40601  
Brent Computer Systems Rickmansworth  
87-71 306/70329

## EAST MIDLANDS, SOUTH HUMBERSIDE & DERBYSHIRE

Davidson Richards Ltd Derby  
0332-366803/4  
Roger Clark (Business Systems) Ltd Leicester  
0533-20455  
Arden Data Processing Leicester  
0533-22255  
Betos Systems Ltd Nottingham  
0602-48108  
Caddis Computer Systems Ltd Hinckley  
0455-613544

## EAST ANGLIA, LINCOLNSHIRE & NORTHAMPTONSHIRE

Arden Data Processing Peterborough  
0733-47767  
HB Computers Ltd Kettering  
0536-520910  
Sumlock Bondain Ltd Norwich  
0603-26259/614302  
Dataview Norwich  
0603-616221

## WEST MIDLANDS, STAFFORDSHIRE & WARWICKSHIRE

Joseph Ware Associates Birmingham  
021-643 8033  
Camden Electronics Ltd Birmingham  
021-773 8240  
Micro Associates Birmingham  
021-328 4574  
Taylor Wilson Systems Dorrige, Solihull  
05645-6192  
Walters Computer Systems Ltd Stourbridge  
03843-70811

CBS Consultants Ltd Birmingham  
021-772 8181  
Peach Data Services Burton-on-Trent  
0283-44968  
Computer Services Midlands Ltd Birmingham  
021-382 4171  
Business Equipment Rentals Ltd Rugby  
0788-65756  
Business Equipment Rentals Ltd Coventry  
0203-20246

## NORTH WALES, CHESHIRE & MERSEYSIDE

Rockliff Micro Computers Mold  
0352-59629  
North Wales Computer Services Colwyn Bay  
0492-33151  
Office & Business Equipment (Chester) Ltd Queensferry  
0244-816803  
Catlands Information Systems Wimslow  
0625-527166  
Rockliff Micro Computers Liverpool  
051-521 5830

## MANCHESTER

Cytek (UK) Ltd Old Trafford  
061-872 4682  
Executive Reprographic Manchester  
061-228 1637  
Sumlock (Manchester) Ltd Manchester  
061-834 4233  
D Kipping Salford  
061-834 6367/9  
Computastore Ltd Manchester  
061-832 4761

## LANCASHIRE

Preston Computer Centre Preston  
0772-57684  
Thurston Ltd Burnley  
0282-813299

## YORKSHIRE & HUMBERSIDE

Ackroyd Typewriter Co Ltd Bradford  
0274-31835  
Akor Computer Systems Ltd Muddersfield  
0494-512352  
Deans Computer Services Leeds  
0532-452966  
Holbrook Business Systems Sheffield  
0742-484466  
Holdene Ltd Leeds  
0532-459459  
Microware Computers Hull  
0482-562107  
Mitre Finch Fishergate  
0904-52995  
Yorkshire Electronics Morley  
0532-522181  
Computer Centre (Sheffield) Ltd Sheffield  
0742-53519/588731  
Microprocessor Services Hull  
0482-23146  
Ram Computer Services Ltd Bradford  
0274-391166

## NORTH EAST

Currie & Maughan Gateshead  
0632-774540  
Dysons Instruments Houghton-Le-Spring  
0783-260452  
Inrex Datalog Ltd Eaglescliffe  
0642-781193  
Key Computer Services Ltd Jesmond  
0632-815157

## AVON, WALES & WEST COUNTRY

Calculator Services & Sales (Bristol) Ltd Bristol  
0272-779452/3  
Computer Supplies (Swansea) Sketty  
0792-290047  
McDowell Knaggs & Associates Worcester  
0905-28466  
Somerset Business Computers Taunton  
0823-52149  
Mitequip Ltd Gloucester  
0452-411010  
Reeves Computers Ltd Carmarthen  
0267-32441/2  
Welsh Computer Centre Bridgend  
0656-2757  
Sigma Systems Ltd Cardiff  
0222-21515/34869  
Reeves Computers Newport  
0633-212331/2  
Computer Shack Ltd Cheltenham  
0242-584343  
Midland Micro Stourport-on-Severn  
02993-77098/6706  
Sumlock Tabdown Ltd Bristol  
0272-276685/6  
Radan Computational Ltd Bath  
0225-318483

## DEVON & CORNWALL

AC Systems Exeter  
0392-71718  
Devon Computers Paignton  
0803-526303  
Jeffrey Martin Computer Services Ltd Truro  
0872-71626  
AC Systems Plymouth  
0752-260861  
JAD Integrated Services (Plymouth) Ltd Plymouth  
0752-662616/29038

## SCOTLAND

Ayrshire Office Services Ltd Kilmarnock  
0563-24255/20551  
Holdene Microsystems Ltd Edinburgh  
031-557 4060  
Robox Office Equipment Ltd Glasgow  
041-221 8413/4  
Gate Microsystems Ltd Dundee  
0382-28194  
Gate Microsystems Ltd Glasgow  
041-221 9372  
Mac Micro Ltd Inverness  
0463-712774

## EIRE & NORTHERN IRELAND

Northern Ireland Computer Centre Co. Down  
02317-6548/9  
Crowley Computers Ltd Dublin 2  
0001-600681

## ISLE OF MAN

Resource Planning Ltd Douglas  
0624-42478

# NEWSPRINT

get the machine onto the market here. But even when IBM doesn't know what to do, it still knows what it is doing and what IBM is doing is planning to release a software standard which could be as enduring as the 78rpm shellac record was.

And so, while you may find the odd IBM executive raging down in Havant, the company itself is corporately very happy to see Punter doing a bit of market research for it.

Punter has just upgraded the imported version (it is different from what IBM will launch because it uses a US mains supply at 60Hz) to offer a great deal more software, plus more capacity.

At the *Which Computer?* Show, Punter exhibited a version with very big disk capacity (up to 20 megabytes), much enlarged user memory (up to one megabyte) and new languages, including Basic, Fortran and Pascal, with CIS Cobol under CP/M-86.

That makes it much more able to match ACT and its rival import, the Sirius, and it will be interesting to see how the rival three letters — ACT and IBM — variously impress dealers and users. You can bet, at any rate, that it will be interesting to IBM. Details from Microcomputerland on 01-637 4071.

## Kilostream cometh

Maybe 100,000 miles of wire sounds like a lot but that's how much British Telecom would need today if it wanted to put in the digital communications network that is now running in the UK and if it still used wire.

In fact, a lot of that mileage is in microwave links. And in a few years' time — for example, by 1985 — Telecom believes that it will be installing that amount each year.

From our point of view as computer users, the advantage of digital links is that our computers should be able to use them directly rather than having to translate the ASCII codes of dots and dashes into audio tones of beeps and bloops first. Bleeps and bloops can get distorted over long distances but digital dots and dashes don't: they are either there or they aren't (roughly), so voice phones of the future will go the other way, and be translated into code dots and dashes first, to ensure they emerge from long-distance calls without sounding as though they've been shouted through a tunnel.

Now British Telecom has announced that it plans to link up with an American company called Satellite Business Systems (one-third

owned by IBM), to offer a wide range of joint digital services, particularly video teleconferencing, high speed data, and electronic mail.

And its digital transmission, able to carry computer messages at ultra-high speed is to be called X-Stream, the most interesting of which is a service to be called Kilo-Stream.

KiloStream will link 40 exchanges in London with 60 exchanges in 30 'main business centres' in the rest of the UK by the end of next year (1983). This, says Telecom chairman Sir George Jefferson, will grow to interlink 200 exchanges by 1985.

From that simple bit of information, you can start to plan for the future, because that would seem to be a good rule of thumb for the level at which it will become seriously possible to offer high speed computer communications to any 'main business centre' in the UK. Which means, very simply, that electronic mail will become the business norm.

And that means that having your own business micro will have to be the norm too. There is no point, really, in getting instant mail in the office building if you have to wait for it to be distributed internally by messenger trolley.

## Multifunction

Those who believe that the Apple should have a socket into which you can plug a printer or a modem can now get both on one add-in circuit (costing £138 including VAT) from Data Efficiency — and a little digital watch into the bargain.

The card is the Mountain computer CPS Multifunction card, which can generate serial input and output signals (for a modem, for example) or parallel output signals (for a printer, say) and has a permanent clock, with its own battery, good for two years, providing the machine with a way of telling not only the time, but the date, even if you switch the mains power off.

Details on 0442 64561 for dealers. Apple dealers will stock, says DE.

## Machine bites master

There is a vast difference between the game of chess and the chess problem. At chess, a very clever player can still beat the cleverest computers. At chess problems, however, a £300 chess-playing micro has now proved itself superior to any problem-setting or problem solving human, by finding three solutions to a famous problem set in 1972 by



leading Soviet expert L Zagorujko.

A chess problem, for those who don't play chess, involves a set of chess pieces placed on a board in a set position. This can be done without any regard to whether or not they could have possibly got into that position in the course of a real game. The idea is to arrange things so that one player can make a move — or a series of moves — which absolutely and inevitably makes him win. That is the problem-setter's job, at any rate. The solver's job is to find that move, or moves.

Zagorujko won first prize in a competition by setting his problem, and in 10 years nobody has succeeded in finding any other way of solving the problem besides the way he showed. The motivation to find other solutions would have been strong: if there is more than one solution the problem is not valid and certainly couldn't win first prize.

Last month, Chess Champion Mark V found three solutions, while racing to find solutions against a human being — problem solving champion Dr John Nunn (right in our picture). Nunn found no solutions to the Zagorujko problem.

Details of the problem can be obtained from Andrew Page, SciSys Computers, on 01-352 8855 or 352 8912 — or send self-addressed envelopes to him at Suite 8, London House, 266 Fulham Road, London SW10. I dare say he'll try to sell you a Mark V, too.

## Micro course

The University of London is now running courses, based around the Commodore PET, on micro subjects. There are three courses: 'Micro-computers and information' (aimed at 'information specialists', which I suppose means librarians) is the first; 'Basic computer language for information specialists' is the second; and 'Design your own system' is the third. Dates, in order: 21-23 April, 19-21 May, and for the last, 17-19 March and 30 June to 2 July.

Details from Mrs A Vickery on 01-636 4514.

## Development tools

In a world where you find everybody being urged to sit down and use a micro to do their work, you will find computer programmers doing their work in front of a piece of paper with a rubber on the end of the pencil (getting worn down).

If you ever do find someone working on a computer project with a micro in front



See 'Machine Bites Master'

of them, chances are it's an engineer, not a programmer, and the micro is an 'instrument' called a development system.

At last the worm is turning, and programmers are wanting their own systems. And they're finding that the 'instruments' do very well for the purpose, even if the programming aids at the language level tend to be a bit out-dated.

The trouble is that development systems are very expensive and programmer budgets all too often just don't run to that sort of thing.

Hence we find chip maker Mostek producing a sort of truncated development system called a Software Development Tool, for programmers working on Z80 systems (Mostek makes the Z80). It is a piece of hardware with specialised software aids for the software writer. And it is compatible with the full engineers' instrument, but cheaper.

And we also find micro-computer distributor Vector in Belgium moving from user-computers into the development business, by launching a CP/M based development system for 8080 and 8085 based micro-computers — as an aid for the design engineer.

The two systems sell for very similar prices — Vector's machine for 'under \$5000' in basic form, and Mostek's for £2289.

Details from Mostek agent Celdis on (0734) 582211; and from Vector in Leuven, on 32 2 538 91 14 if you can sort out the dialling code from that.

## Sanyos arrive

This month, the Japanese Sanyo machines should make their appearance, with two UK distributors at least handling the business — one of these being a new company called Lend-Let.

Four Sanyo machines should appear, all reported by those eager to sell them as 'very impressive', starting with a machine in a briefcase, cheaper than the Osborne, and rising to an expensive job with hard disk options, 22 special function keys, and CP/M capacity.

Watch this space for details. I also gather that software producer Microtrend has a couple of sample computers from Sanyo, to develop programs.

## Robot teacher

If robots are to be the salvation of incompetent factory managers who can't manage humans, someone had better start training our factory engineers in the art of managing robots.

Cheap educational robots are the way to do this, according to Colne Robotics of Twickenham, where a £200 kit for a robot arm has just been launched.

The machine has five axes (joints) and is driven by stepper motors. It has a reach of 17 inches, it has a three-fingered gripper, and it can lift a 10-ounce weight.

Colne reckons any 8-bit microcomputer with a bi-directional parallel port can be programmed to drive the arm and also reckons that eight kbytes of memory is all you need to fit the program in.

Already written is a program for the Tandy TRS-80 level II (that's the Video Genie model) 'which can be modified for any Z80 machine', Colne says.

A competition (with a first prize of £100) is being run by a popular electronic experimenters' magazine *Electronics Today International* to develop more programs — on the PET, Tangerine Micron, Sharp, Tandy Model III, Superboard, Video Genie, Apple, Nascom and Acorn Atom.

Details from Colne at 1

Station Road, Twickenham, Middlesex, or phone 01-892 7044.

## Texas tunes

The definition of a 'serious musician' according to Texas Instruments, is one who uses treble and bass clefs, rather than the special Sound Graph TI has invented for its 99/4A home computer.

Composition of three-part music is now possible on the machine — either using standard music notes and staves, or using these Sound Graphs — once you have added the £34.95 Music Maker module to the basic £300 machine.

All this is part of the battle between Texas, Atari, Commodore and the BBC to produce the most efficient cheap, colour, sound and pictures machine. This is a nice module, but I'm afraid my money is still on the BBC.

## Better late ...

Why the BBC micro was not out on time when the computer programme 'The Computer Programme' started on television is not a question with one answer.

The actual fault which delayed the release of the BBC Computer was the failure of two mass-produced special chips, made by Ferranti.

The fault lay in the choice of silicon for the chips. On the prototypes, Ferranti had used silicon which produced fast-switching circuits; on the production run, a slower silicon substrate was used. The result was that the chips didn't work. Actually, if you want to get technical, the result was that the chips worked perfectly, but only if you pumped the clock signal directly into the centre of the chip with a probe — because the clock signal was losing its nice, clean 'instantly on, instantly off' square wave pattern as it was passed from component to component across the chip.

Before it was found that the design was okay but the production at fault, Ferranti had moved heaven and earth and the Ferranti design department computer, and had produced three separate redesigns on the chip, John Coll at Acorn tells me. He was most impressed, and clearly quite forgave Ferranti.

To be sure, it is a very understandable mistake, often made by semiconductor production people but I somehow felt (talking to people who rang me up to ask if I knew what 'those conmen' had done with the machine they had paid for already) that customers weren't quite so ready to forgive as John Coll.

If it helps at all, I can say



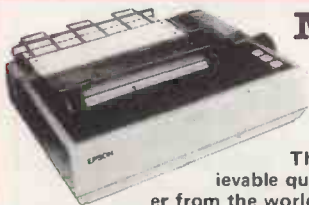
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this: it's a miracle that the machine is even half-way off the drawing boards, never mind only a couple of weeks (okay, months) later than it was hoped.

Remember, the Acorn Proton design was only half-baked in spring last year, when the BBC found itself high and dry without the Newbrain (which it had chosen to star in the TV series in November 1980). The design then had to be adapted, improved, approved, and finalised, before plans for its production could be started.

Acorn was under another handicap, too. The blaze of publicity around the BBC machine once its full specification was known was exactly the sort of publicity that Nascom once attributed its collapse to. That is, everybody who was thinking of buying an Acorn Atom knew that the company had something vaguely similar, only slightly more expensive, and a lot better, under way. When the Nascom 2 was first rumoured, sales of the Nascom 1 dropped off sharply — or so the people who used to run Nascom assure me.

Acorn, nonetheless, had to carry on selling Atoms to survive. I must admit I'm impressed.

## CC Writer

'Dear Editor: It's not every day that a young upstart company announces that it intends to take on the Tandy Corp and win. So spare us a few moments before filing this letter in the round file alongside your desk.'

Derek Tidman who wrote me that absurd letter is quite wrong: that sort of grandiose statement gets transmitted here every week and sometimes for something more impressive than a word processing package for the Tandy Colour Computer. What doesn't happen every day, Derek, is that the person who announces that he will take on Tandy actually does win.

Derek is importing a word processing package called CC Writer. His company, Work Force in Luton, is importing the package from Transformation Technologies of Illinois. 'The package can drive any printer that can be attached to the colour computer, it is written in extended Basic, it will fit in 16 or 32 kbytes, and is supplied unprotected.'

Without using the package, my opinions count for nothing, of course: but I was impressed with one feature which Tidman claimed for the software. That is: you can input ASCII codes into your text, to control printer operations directly. As long as that isn't the only way to control the printer, the

package may be interesting. At £26, it sounds as if it's worth a look — and the manual costs £6, refundable if you buy the program.

## Big disk

Biggest of Control Data's big-storage disk drives is the latest, the Finch with 32 megabyte capacity. Like the eight and 16 megabyte drives, this one will fit into the space normally left for an 8in disk drive in a microcomputer crate. Details from Control Data on 01-240 3400.

## No disk calc

Simplicalc, according to the programmer who wrote it, 'is not machine code Visicalc rewritten in Basic for the 8 kbyte PET'.

At £30, obviously it isn't; what it is, then, is 'a completely new program which recognises that in small computers, program and data fight for memory space.'

The main point about Simplicalc is that you don't need a disk drive to use it. Like Visicalc, Simplicalc allows the user to perform 'what if' projections of business projections.

It is a 134-line Basic program, according to its creator, accountant Mark Turner, who heads up the new computer division of Cronite Group (a company specialising in high grade nickel alloys used in nuclear and energy equipment, it says here).

Apparently they use Simplicalc at Cronite. And as well as working on the PET, it now runs on the VIC and the Apple, while there are plans to put something of the sort on the Sinclair and BBC micros. Details from Turner on 021-773 8281.

## Unix nox eighty six?

Now that we have seen the first 16-bit micros and have seen CP/M-86 on them, we can be sure that some other operating system will dominate the world in five years' time. The question 'will it be Unix?' is one which CDS Computers is prepared to answer quickly enough: 'The portability of Unix and these new low prices mean that Unix will dominate the 16- and 32-bit market and to the detriment of older competitors.'

It probably isn't all that simple because, even making allowances for the fact that CDS is selling multi-user licences, the company's optimism appears to be totally untempered by knowledge. It refers to competitors which it will displace: they are listed as TSX, RSX-11M,

RSTS-E, and VMS on DEC hardware. A company incapable of grasping that DEC hardware is not the universe, and that an inferior product (CP/M) might be more significant to the 16-bit market, shouldn't worry Digital Research too much.

For DEC users, CDS is on 01-726 6501, and prices for Unix binary licences start at £1000, coming down to £300 for 10 or more processors.

More significant to the future of Unix on micros is the arrival of /USR/ group in the UK. This started out in the laid-back reaches of the hippy kingdoms in Santa Cruz, with a few commercial adaptors of Unix getting together to grouse about Bell's uncooperative attitude to their work.

Now, Tim Keen of Keen Computers, an importer of one of the software products involved in that grouching (Onix) has been asked to set up a /USR/ Group in the country. Keen proposes to take this function under the wing of the Computer Retailers' Association: contact him on 0763 71209 to arrange a first meeting of interested British parties.

## No flash, no weave

The screen display on the Nascom 2 micro has two deficiencies, says EDAC Engineering.

'First, screen flash when the screen memory is written to or read from, and secondly, the ripple effect that Nascom owners have come to know as screen weave.'

Both problems have been tackled by EDAC, which has now announced a £14.75 screen weave eliminator. Product specifications can be received in an envelope with your name and address on, which you send to Edwin Crook at 257 Orphanage Road, Erdington, Birmingham B24 0BD. Or phone 021-373 1260.

## Close call comp

One of the very first things Clive Sinclair told me he would do, when he had just about got ready to launch his second computer, was to design a Prestel adaptor for it.

No, that wasn't for the ZX81, you aren't thinking. That was his third computer. His first was the Science of Cambridge Mk 14. And from that day to this, he has dodged all questions as to 'when?' with the simple statement that he hadn't got a suitable design.

Now he's proved it: Uncle Clive has announced a competition — 'to design the best Prestel adaptor for the Sinclair ZX81 personal

computer.'

Clive's company will provide one of the judges for British Telecom, which is actually organising the competition. I don't think he can have designed the competition itself, which is billed on the press handout as 'closing date March 14th'. I know there are a couple of weeks between the appearance of the March PCW edition and 14 March, but surely not enough to design an adaptor 'which best combines low price, elegant design and practical robustness'?

Phone Tony Sweet at Prestel headquarters (01-583 9811) and inform him about one or two of the publishing realities of life — like printing lead times and editorial deadlines. Doesn't he want any entries? Go on, ask him!

## New Commodores

On the face of it, the new super-cheap super-VIC (not the one you know about already, but a 40-column one announced in January) and extra-cheap Commodore 64 are worth getting very excited about. Their new music and TV games machine, too, looks like a remarkable announcement.

In Britain, however, you would do best to save your excitement for this time next year.

The new machines from the PET stable start off at an amazingly low \$150 in the USA — around the cost of a Sinclair kit — for a machine called the Ultimax. This appeared for the first time at the Las Vegas Consumer Electronics Show in January.

Ultimax is designed for those people who just want to play Space Invaders at home; but, unlike most machines of this type, it can be used as a computer, too. It has some sophisticated music synthesiser circuits in it, too, but there is no news yet on what it costs to turn it into a computer — and it must cost something to put even a very cheap second keyboard on the thing.

The Super-VIC sells at \$400, with 16 kbytes of memory, giving a 40-column display. This comes as no surprise, since it was revealed almost a year ago that such a beast was on the way.

The really interesting product, however, is the Commodore 64, which has a full 64 kbytes of memory in it. It is obviously designed to sell to the people who would like an Apple II or an Atari 800 but want to pay a bit less (a lot less in the case of the \$1530 Apple).

There isn't too much point in getting all worked up about the details of these three machines, however, as



they have only just been shown to the trade in the USA. They won't appear, even for the trade, in Europe until the Hanover Fair at the end of April — and the British trade won't see them until the June Commodore Show.

As to when they will appear as products in shops, your guess is as good as mine. Commodore reckons it will be 'late 1982 or early 1983', and Commodore isn't famous for its pessimism on these matters. Watch this space for details.

## Z8000 second source

Zilog may have been deserted by its partner AMD over the big Z8000 microprocessor chip, with AMD moving back to its former lover (Intel) and the 8086 — but the Italian link with SGS-Ates remains firm. The two companies have announced that the Z80 deal (under which SGS made the 8-bit chip) now covers the big Z8000, too, plus several new support chips which SGS has not agreed to produce before. Good for morale inside Exxon, I suppose.

## Pupil power

ZX81 programs for pupils as well as teachers have been announced by Scisoft in Nottingham.

The teachers' program is one to impress parents with at the end of term — it sorts out marks for each pupil, and sorts the whole class or whatever into either alphabetical order or rank order. It can print out either a full page of marks or an individual pupil profile. That is 'Markbook'. 'Revise' is for pupils and is aimed at the physics student, in four-part helpfulness. First, it includes O-level revision notes for the syllabus. Second, it advises and demonstrates good revision technique. Third, there are test programs for formulae on heat, pressure and sound, light and electricity, mechanics and units. And finally, there is a program of questions which are 'typical of the problem type found in O-level papers'. Contact D R Valentine at 5 Minster Gardens, Newthorpe, Eastwood, Notts.

## DOSsers' delight

The activity of program-writing resulting from the IBM personal computer has already reached enormous proportions, even though the machine isn't available (officially) outside America yet. Software products announced so far include programs in which to write programs for the IBM

machine on something different. And, of course, programs to help get your old programs (written for ordinary CP/M) transferred to the IBM machine.

A package to help the machine send messages down the line to large computers, or to swap files from one machine to another, has been announced by Westico in Connecticut. It is called Ascom, and it works under the IBM DOS requiring a serial communications module.

The bit about running under IBM DOS is worth a little after-note.

There are two official programs which are sold as operating system software for the IBM machine. One is a version of CP/M which is apparently merely a copy of all the functions of the original CP/M with a few new special bugs all of its own. The other was written by Microsoft, and is called MS DOS or PC DOS or IBM DOS depending on who you're

talking to.

Now it so happens that MS DOS is not ready yet, and so most people who want to buy programs for the IBM machine do so under CP/M-86 (for the obvious reason that they want to run them and they won't run under a non-existent operating system).

Perhaps we have all learned from the past that if an operating system 'catches on' we are stuck with it — and all the horrors that go with it. For example, we have computers with cursor arrows which don't work because CP/M doesn't know what an up cursor means. We have Z80 machines that are restricted to 8080. And lots more features that came out of the ark but have been encased in granite by common usage.

But delaying programs that run under CP/M-86 is not the answer to a late MS DOS. I don't know what the answer is, and it may be that there isn't one — but taking a

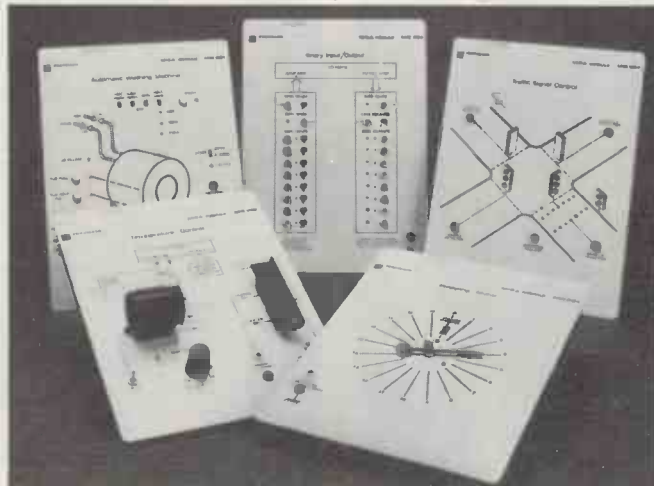
restrictive attitude is no solution to anything.

I have to be honest and say that CP/M-86 fills me with horror because, in the short time it has been around, I find that many programs which 'run under it' don't. They have their own operating routines, written in assembler, because the producer of the code just couldn't be bothered with the restrictions of the outdated system structure, and so did it 'properly' the way the operating code should have done.

But surely Microsoft, of all people, must know that you take advantage of what exists, rather than trying to direct the market yourself. It was Microsoft which launched the CP/M card for the Apple, even though CP/M was not its own product — and that did a lot of good for everybody. The fact that it also benefited Digital Research (originator of CP/M) and Digital Research is a rival of Microsoft was a plus, not a minus, surely?

Wake up, Microsoft! You can't bank might-have revenues from might-have sales. And we can't run maybe programs.

Details of Ascom from Westico, (203) 853 6880. It costs \$175. The company also sells a critical path method program called MicroGANTT, for \$395, also for the IBM machine.



You have probably seen these pix before, but don't expect an apology for repetition — because the devices, made by Feedback Instruments, carry a message.

'It is at last being recognised,' the company says, 'among educationalists that "teaching computers" in schools, colleges and universities involves a lot more than buying one micro and teaching a clutch of students the rudiments of programming.'

These devices are 'models' of the sort of controllable machinery micro engineers will have to understand — washing machines, temperature meters (not the same as thermometers), traffic lights, generators, and so on — in the near future.

Feedback warns: 'What we said in our special report on micros in the eighties, published early last year, was that coupled with serious shortages of staff in micro based industries there was a lack of anything being done to correct the situation.'

Manpower shortages, says Feedback, are clearly going to be prevalent among electronics process engineers, applications engineers, electronics test technicians, electronics maintenance and service technicians, control technicians and theorists, not among computer programmers and data processing staff.

In other words, despite the fears of a country in which factories will be deserted except for robots, 'the shortages are not going to be in the office, but on the factory floor'.

Well, it's true, and having cheap training devices like these can help the teacher or lecturer, so I think they are worth a plug at £45 to £132 for each module.

I hope that somewhere there's a firm which is training software engineers, and which can start offering similar training equipment to teachers of the people who will have to rival the Japanese software factories of the '90s.

Feedback is on Crowborough (089 26) 3322.

## Hook - up 1

For anybody who has ever admired Olivetti's electric typewriter and wanted to hook it up to a computer as a printer, the people to approach are Duplex Communications, who have done it. They call the result the Octet 121. Details on 0455 209131.

## Hook - up 2

To my incredible relief, users of the new Osborne don't have to buy the ugly Osborne-supplied add-on screen if they want a big display (the machine has a five-inch screen which frightens some people). Ian Dunkley at Datron is now working on a simple modulator which allows you to whip the green monitor off your Apple and plug it right into the normal 'ext vid' socket on the Osborne.

## Displaywriter software

It was not entirely accurate of me to explain, painstakingly, that since IBM's big word processing box (the Displaywriter) had an Intel 8086 inside it, it could be used for ordinary 8086



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### CP/M PRICES

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<input type="checkbox"/> MAILMERGE	£ 85.00	£ 55.00	£15.00	£ 70.00	£ 50.00	£15.00
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● Price of software includes manual. If manual purchased initially, 100% credit if software purchased subsequently ● Calcstar, Datastar, Wordstar, Mailmerge, Supersort, Spellstar, Infostar and Wordmaster are all Trademarks of MicroPro International Corp. ● Prices do not include VAT and are subject to change without notice.



computing applications.

IBM, it now appears, cleverly used one or two of the normal programming instructions of the 8086 for their own purposes in the machine. The result is that you can't use programs which use these instructions.

In announcing CP/M-86 for the Displaywriter, Digital Reserach's agent in the UK (Xitan Systems in Southampton) has let it be known that the software has had to reconstruct the missing instructions. Apparently it all works fine now, but there must have been one or two uncomfortable moments... Xitan (0703 38740) also has CBasic-86 for the Displaywriter, by the way.

## Alice in Logoland

Logo is a language originally developed by Massachusetts Institute of Technology for teaching programming to young people. It is now available on the Apple II for \$180 from a New York firm called Krell Software Corp.

Krell specialises in educational software (it has run into incredible trouble by offering a training package to help students with the equivalent of the 11-Plus there — the local authorities believe that the name of the exam is a trademark and that Krell has violated it by talking about it in the adverts, but never mind), and claims that its Logo language is not a cut-down version, but the full programming language.

The package, they say, 'includes an instant Logo tutorial program, and "Alice in Logoland", an introduction to Logo'. Since Logo

requires a disk system with 64k of memory, an optional 16k memory board extension is available at the special price of \$109.95, the company adds. Details on (516) 751 5139.

## Atari games

Prices of the Atari 400 and 800 in Britain are still what I would call unrealistically high, presumably because Ingersol still can't get as many as it would like from the American supplier, but the games software remains excellent and improves daily.

Latest development is that the superb games developed by the eager-beaver programmers inside Thorn EMI in London's Soho have been taken on board by *Creative Computing* in the USA.

This may be a Triumph; then again, it may be only a modified triumph because the deal was always going to include US distribution, and my original understanding was that games would be sold by Atari centrally, not by David Ahl's software publishing house. Maybe somebody was boasting too soon.

The games include Darts, Cribbage, Pool, Snooker, Billiards and Tilt.

## NEC packs

If Apple does adopt Micro-modeller as its first official Apple software product — as it is now planning to do — then the decision by its distributors to put the price up will have been justified.

The package has sold extremely well, despite my astonishment at its high price, and it has now been adopted by IBR Microcomputers for



The diminutive object in this picture is a ZX81 embedded in a new monitor devised by the Danish firm of Bergqvist and Hobberstad. No soldering or dismantling of the '81 is required; two self-tapping screws fix it, and connection is made via the normal TV output. Power for the ZX comes from an internal supply making it a neat stand-alone unit. The bus connector for printer and RAM expansion is extended through to the rear panel of the monitor.

The 7½in screen has 1800 line/22MHz resolution giving crisp characters — which should delight those used to the fuzzy TV display — and a combined green phosphor and green filter provide excellent contrast even in strong direct light. Phono sockets allow composite video input from other computers or output to another monitor.

B&H expects it to be on sale in a couple of months through a large retail chain and it hopes to do well in the educational market, Beebopoly notwithstanding. At £79 ex VAT, it could find its way into some homes too (no more fighting over the telly).

B&H is on Copenhagen 451 133 188.



If the Sinclair ZX81 cost £500, then a price of £33 (including postage, VAT and everything) for a desk console for it would seem cheap. As it is, if the thing shown here looks like a good way of tidying up all the cables, flopping memory add-ons, and other spaghetti problems of using an expanded ZX81, then justify it on aesthetic or functional grounds, not cost. Details from Traffic Technology, PO Box 2, Warminster, Wilts, BA12 7QX.

the Japanese NEC PC8000 micro which that firm imports. The cost of a full package (computer and Micromodeller software) will be around £3000, says IBR.

I do note, however, that a package called Micro Finesse has been released by P-E Consultants, and that this is selling like mad in the USA through Osborne-McGraw-Hill; it is priced much lower than Micromodeller in the UK as a result.

Micro Finesse does a similar job (say its adherents), but is menu-driven — making it 'too friendly' for the expert user, say its detractors.

## WPL package

After Applewriter, the 'word processor' (joke) given away with Apple II machines so that you know what software is like to load, there is the Applewriter II and, for the new big brother machine, Applewriter III. 'An important and useful feature,' says Apple, 'is Word Processing Language (WPL) which allows you to write your own programs and make automated word processing possible.' This feature will allow you to merge infor-

mation from Visicalc, and will even allow the user to 'translate' typewriter shorthand into longhand automatically. The package costs £135 from Apple dealers.

## Bonsai!

Connoisseurs of false modesty will not be pleased by the outspoken bravado of Michael Kraftman, who has opened a micro shop called Bonsai (Japanese for 'small', he says) in London, with the words: Within 10 years, there will be a Bonsai micro-computer showroom in every major conurbation in this country.

Kraftman holds (with equal lack of reticence) strong opinions on how computer shops should be run, because he has 'conducted probably the most exhaustive investigation ever by an Englishman into the US microcomputer business.' So says his publicity man, Simon Chapman.

Now Kraftman has bought the old hi-fi shop where Imhofs used to live, in the shadow of Centre Point in London.

And he reckons he will supply the businessman who

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(as described in W.W. 17 January 81)

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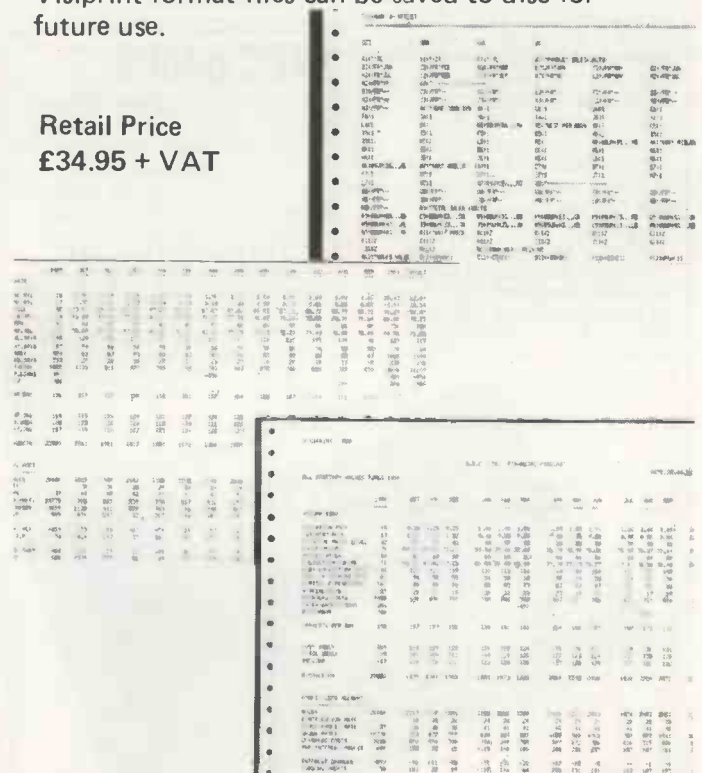
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Machines include the Japanese NEC machine, plus the Micromation and LSI Computers products. Software will be a package called Integrated Accountancy Software System, and a word processor which checks spelling according to English usage rather than American.

Contact this 24-year old genius and workaholic on 01-580 0902.

## All night chaos

Regular readers will know that recently PCW's Publisher won an Atari 800 whilst sunning himself on a Caribbean cruise on the QE2.

The acquisition of this machine has brought chaos to the higher echelons of management in our establishment. The office cleaners arrived one day last month at 6.30 in the morning to find our Publisher slumped over his desk after an all-night session. Had this representative of British entrepreneurial spirit been wrestling for 12 hours with Visicalc projections of the impact of dollar exchange rates on paper prices for his magazines? Or examining ways of rewarding his over-worked staff with complex incentive bonuses without crashing the cashflow?

Had he hell! He'd been trying to extricate Princess Buddir from the clutches of Dragons and Minotaurs in the depths of the Magic Mountain. While we quietly removed him on a stretcher

he revived long enough to tell us the grisly details of what is apparently a first-class fantasy game featuring over 120 characters in full colour high resolution graphics, plenty of music and sound effects and which obviously provides hours of amusement and frustration for any owner of an Atari Personal Computer with 32k RAM and a disk drive. The price is £23 including VAT, post and packing. Name of the game is Ali Baba and The Forty Thieves by Quality Software of California. Details from Audio Video Offers, Hoddesdon 68870.

## Programmers' Ada

Please, Zilog, if you are going to get Litton Systems to fix it so that we can write programs in the new, exciting Ada language for your wonderful 16-bit micros (the Z8000) do ask them to bring computers into the 1980s.

I mean, simply: let us pretend that computer programmers are people whose work would be made easier by the use of computers. Let us have a program which allows the programmer to do his work at the computer keyboard and screen, rather than putting it all down on coding sheets with pencil and paper, then queuing up to use the compiler, then going back with a sheaf of error reports and code dumps to start with pencil and paper again.

The whole point of using Ada, after all, is to make the programmer's life easier, so that he can get more done in less time and with less effort; so that he can actually get more done.

But I bet we end up with a compiler, a debugger, a



If I had known that this product was on show at the huge Compec exhibition in November last year, I'd have got quite excited about it — it's a removable 10 megabyte disk storage cartridge.

Normally, the magnetic storage disk is locked permanently into the box of these hard disks, so you do get ten million characters of storage but you can't get rid of it and replace it with another ten million. With this one, you can, just as if you were pulling out a humble 200,000 characters on a floppy disk.

The Lynx DP100 comes from Data Peripherals in California, and is distributed in the UK by X-Data. A drive is £1999 and cartridges are £99 each (one-off prices).

Details from X-Data in Slough, on 0753 49117.

loader and a run-time package, all running separately in batch mode.

Ada is being put onto the Zilog micros by Litton under an agreement designed to get military computer contracts, since the military designed Ada and is going to use it. It will take some time: the agreement still has to be 'formalised'. Details from Zilog on Maidenhead, (0628) 39200.

## Constructive comment

Construction isn't everyone's line, but the announcement of a micro expert specialising in that trade is unusual enough to catch my eye — especially when it is selling specialist software, as Jacys Computing Services is.

Jacys software 'has been specially designed for structural engineering in general and concrete design by the current author of the best-selling reference books in this field,' says the announcement, 'Charles E Reynolds and James C Steedman' — I haven't time to work out why he has two names, so you can ask.

The software runs on Apple II, and details are available on (0903) 814923.

## Comal for Gemini

As a rival to the BBC's shiny new Basic language, many educationists have proposed a Danish development called Comal: both are described as 'having none of the disadvan-

tages of Basic'.

Comal has now been adopted by Gemini Micro-computers, the family of British-built cheap micros being promoted by John Marshall (he who once became famous as the founder of Nascom).

The machine it is available on is the Multi-Board system, which is not the nice low-cost Mimi, but a rather more ambitious family of systems which can be expanded by plugging in extra circuits — as the name suggests (tested in Feb PCW).

'Comal', says Gemini's announcement, 'contains (besides a full extended Basic), a great number of the structures found in Pascal. It is believed to be the most extensive interpreter available for today's micros.'

Features highlighted by the announcement are: built-in programming support — such as free-format input, line-by-line syntax checking, and run-time error messages that identify correct lines; plus the fact that it is easy to learn (that's the Basic inheritance).

It is also 'structured' — a favourite bit of programmers' jargon which mainly means that sections of code which do specific sub-tasks are easy to see on the page or the screen, and easy to change in themselves without breaking the flow of the rest of the program.

Comal for the Gemini MultiBoard is available either on tape or on 5¼ inch diskette at £115 inc VAT from MicroValue dealers (see adverts in most PCW issues). Or get details on (02403) 28321.



See 'All night chaos'

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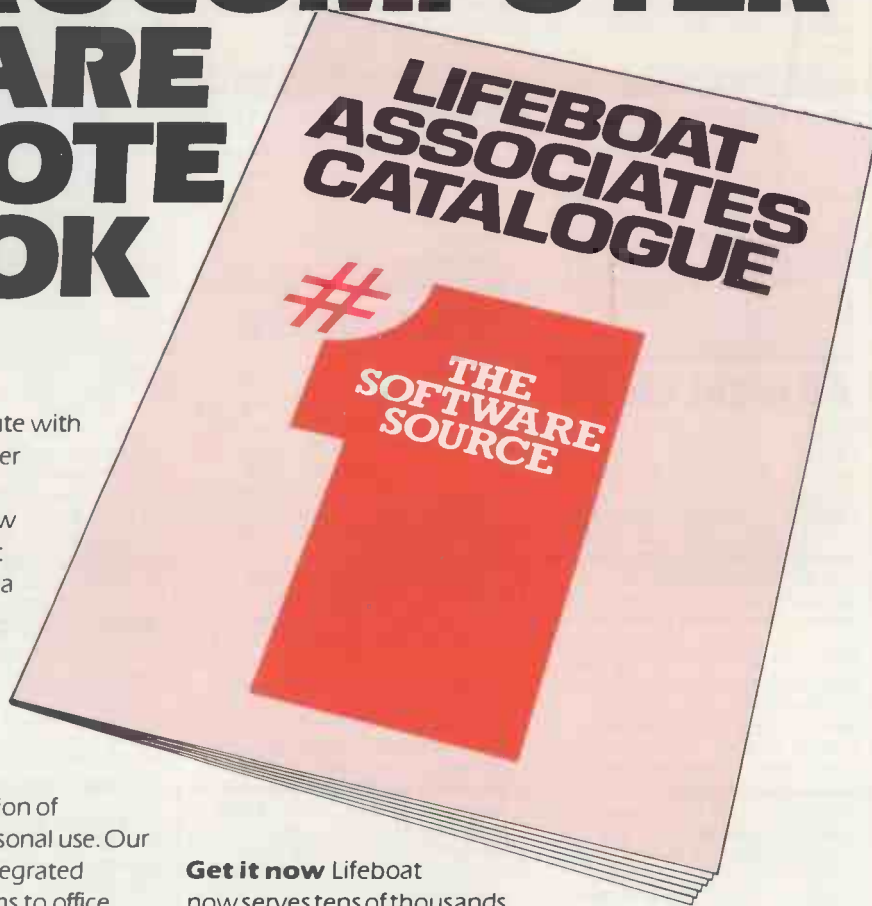
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## David Tebbutt brings you the latest update.

Remember Alan Waring? He started ComputerTown Enfield and then decided to start one in Palmer's Green as well. As if that wasn't enough, he has just decided to open his third ComputerTown! This one is for the benefit of the staff of the City of London Corporation, where he works. ComputerTown Guildhall will usually be run on the first Thursday of each month in this lovely building. Since Lyn Antill and ComputerTown Barbican is virtually on the doorstep, there seems to be plenty of scope there for some collaboration.

Alan got the idea of starting the group when he discovered that several departments in the Corporation had quietly acquired microcomputers almost without the people in the next office realising it. All sorts of machines are in use, primarily PETs, Tandys and ZX-81s. A letter from Alan circulated to all departments elicited 38 responses from people wanting to come along to the proposed ComputerTown meetings. Only six of those replies came from the computer department. The others were users and interested people from all levels of experience.

Maybe this idea of an 'in-house' ComputerTown would work in your Organisation. Think about it and let me know if you decide to pursue the idea.

Before leaving Alan and his one-man computer literacy movement, I should mention that he has some software available to bona-fida ComputerTowns (as listed in *PCW*). The first in an interactive ComputerTown demonstration which explains ComputerTown, what a computer is, what it can do, etc. This is available on the TRS-80 16k, Video Genie 16k, UK 101 and PET 8032. He also has a ComputerTown directory of some 60 names and addresses and their relevance to CTUK. Of these, probably 20 are local references, the others are global. This runs on the PET 8032. If you are interested, write to Alan (his address is at the back of *PCW*), enclosing appropriate blank cassettes, an envelope and the necessary postage.

Now for the people who have expressed a serious interest in starting their own ComputerTowns;

Frank Fadipe of 1 Brook Close, Ruislip, Middlesex is an Apple owner, and he would like to join others in the area interested in setting up a 'Town in the Barn Library. The borough librarian has already been approached and he would be very happy to see a ComputerTown in every library in the borough of Hillingdon. If you live in another part of the borough and you would like to start a ComputerTown then contact me at the address in the box below.

Mick Marston writes from 22

Coventry Gardens, Newcastle-upon-Tyne 4. He is very keen to start spreading the word in local youth and community centres.

Paul Tombling has written from Abingdon to express his intention of starting a ComputerTown there later in the year. For the moment, anyone wanting to contact Paul should write c/o me at the address in the box below and I will pass the letters on as soon as they arrive.

Charles Cooper of 2 Langfield Road, Knowle, Solihull, West Midlands, B93 9PN is well on the way to setting up a Solihull ComputerTown. Charles and a number of friends are already investigating likely venues and rustling up the necessary equipment. I'm sure that, like all other 'Towns, a little extra help wouldn't go amiss.

Sean Grimes is thinking of starting a 'Town in Sutton Coldfield. His address is 98 Wylde Green Road, Sutton Coldfield, West Midlands, B72 1HH.

Mr P Burton, the Assistant Chief Librarian of Cambridgeshire Libraries, read about ComputerTown in the *Training Action* magazine. He is planning to celebrate Information Technology Year by holding a list of all the libraries presently involved in CTUK. Now he is looking for local suppliers to join forces with him. Write to Mr Burton at Cambridgeshire Libraries, Peterborough Divisional Headquarters, Broadway, Peterborough PE1 1RX or telephone him on Peterborough 48343.

Other enquiries have been received this month from (in no particular order) Ovington, Ipswich, Boston (Lincs), Canterbury, Maidenhead, Porthcawl, Plymouth, Portsmouth, London, Woking, Northwood, Clara Vale, Belfast and Harrow.

If you are interested in going along to an existing ComputerTown, then all

the addresses are listed at the back of the magazine. If you would like to start one, write to me and I will put you in touch with anyone else in your area who has also expressed an interest.

Now that Christmas is out of the way, (this is being written in mid-January) I hope to receive a flood of letters from newly-started ComputerTowns. Two or three people said they would launch 'Towns in the New Year. Also, it seems that Alan Waring is the only person providing regular updates about activities in existing 'Towns. How about it, you others? — It gives your ComputerTown some free publicity and it helps others treading the same path.

Thank you all for your help and support. Remember to write whenever you have some news or advice to give to others involved in setting up or running their own ComputerTowns.

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 maybe in a school after hours. The emphasis is on making computing enjoyable and non-threatening and, because Computer Town is entirely non-commercial, overt axe-grinding of any sort is banned. Guidelines are available for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL and remember to enclose a large SAE (A4 would be fine) for your reply. Please don't try to telephone *PCW* for information because this project is entirely a spare-time activity.



'You don't even talk to me anymore.'

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, 14 Rathbone Place, London W1P 1DE.

## Queries answered

A query on Number Crunching (PCW Jan '82). The final formula in the article for pi ( $\pi/4 = 4 \arctan 1/5 - \arctan 1/239$ ) is described as converging. What are the later terms which make it converge? As a beginner interested in such problems I would appreciate a more detailed explanation of the program.

I recently purchased a copy of the *Penguin Dictionary of Computers* (£2.75), hoping to find explanations of terms used in PCW and not described in 'Newcomers Start Here' (CP/M for example). Although described as 'Revised in 1977', the book didn't include terms like ROM, RAM, PROM, EPROM, etc. Can you recommend a more up-to-date book?

In a magazine of 256 pages, an index on page 1 of the page number of articles would be most useful, especially for later reference.  
Mike Priestley, Edinburgh

1. The arctan terms must be expanded as Taylor series — the formula is a shorthand description.
2. Personal Computing by Peter Lafferty (Newnes Technical Books) may be of help.
3. What's wrong with the index on page 3? — Ed.

## Lusty BASGF

Sean Morgan (Communications October PCW) will be pleased to note that the Basic keyword table for RML BASGF 9k Basic begins at 5F9E with the letter E of End and ends at 60ED with the R of LVAR. Between locations 60EF and 6271 he will find the Error Messages. Location 6277 contains the first letter of the message 'Break'. Locations 6306 to 6318 contain the message 'RML 9k Basic' issued when the Basic is first loaded.

This information will I hope be of interest and help to users of the 380Z.

In response to George Sassoon (Communications Jan PCW), 2 years ago when I was still at school I had a modified version of BASGF which accepted obscene key-

words such as, 'Lust' for 'List' and others like 'Gimme' for 'Input'. It also gave out messages like 'Major Cockup At Line XX'. This I think made it more of a personal computer, but also had the effect of hiding your programs from other users.

Although, alas, I no longer have access to an RML380Z (kind offers gladly accepted), I have upwards of 1000 programs for this machine and I am more than willing to swap listings (or sell) to any one who sends an SAE to me. As I have a 16k Compukit, maybe some one would like to send software for that.

G Staples,  
Beckenham, Kent

## Basic Interpreters

I enjoyed AFT Winfield's article on Basic interpreters (Jan '82); it straightened me out on many points. But he doesn't discuss one thing that has puzzled me, namely the arrangements for finding the return address for RETURN and NEXT.

My interpreter stores the return line number, which then has to be searched for as in a GOTO. This line number is stored as part of the interpretation of the corresponding GOSUB or FOR statement; but, at this stage, the absolute address of the next statement — to which the return has to be made — is bound to be readily available. If this absolute address were stored, it could be used by the RETURN or NEXT, no searching would be necessary, and the operation would be much quicker.

Do any Basic Interpreters store absolute addresses for these operations?  
W E Thomson, Aldeburgh

Most probably store just the appropriate line number rather than pushing absolute addresses onto a stack — Ed.

## Up the BEEB!

Regarding your review of the BBC computer, which I hope to receive on February 12th, I feel that you have missed several important points about the system:

The BBC has one of the fastest set of Benchmark timings for any machine you have reviewed.

The BBC use of long variable names means that the obscure commands such as PLOT and SOUND could be made easy to read as shown below:

10 filltriangle = 85  
20 point = &41

100 PLOT filltriangle,  
Xcoord, Ycoord  
200 PLOT point, across, up

The placing of a TV/monitor on the case should be an unlikely practice, anyway, and in the 'domestic environment' most colour TVs are around 22in anyway, so would crush even the strongest micro.

Finally, although the review ended on a good note, couldn't you have emphasised the fact that this British machine offers more than, say, an Apple II on almost all fronts — the likely sales — but is under half the price?

Say it: the BBC is a brilliant machine and, although not perfect, is near to it for almost any use, and beats machines up to £700.

Please continue to provide full details of delivery dates and hardware/software for it, and keep PCW the best.

I have nothing to do with the BBC except that I watch it, sometimes (but I wouldn't say no to delivery a few days earlier!).  
MGT Morris, Barnet

But what would you say to delivery a few weeks late? — Ed.

## Beeb correction

I would like to point out that information as to the purchase of a BBC Computer, given on page 188 of your January edition, is incorrect.

It says that the BBC can be bought from BBC Microcomputer Systems, 14 Station Road, Kettering, Northampton.

After trying Directory Enquiries and finding there was no number for them I decided to buy a day return rail ticket (£10.90) to Kettering as my eldest son was hoping for one as a Xmas present.

Much to my dismay 14 Station Road turned out to be Alba Marketing through whom the BBC can be purchased after filling in the necessary order form and going on the lengthy waiting list.

Whilst I appreciate you could not have known, the people at Alba Marketing were quite appalled at the possibility of other people travelling long distances in the mistaken belief that the computer can be bought over the counter.

J Proctor, Didsbury,  
Manchester

We would like to make it clear that the BBC Micro is available by mail order only from the above address — Ed.

## Someone has one

In the February 'Communications' you state that the absence of PEEK and POKE in BBC Basic helps with portability. Considering the number of micros which do have these commands, this statement is a little strange. Why did you not refer the reader to page 162 of the same issue, where Sheridan Williams correctly reveals that the equivalent Atom commands? and! are available?

I think Sheridan should have said that the BBC Model A comes with only the cassette interface — extra components are required for all others. Sheridan also says that the RAM cannot be extended without the rest of the upgrade, but this sounds to me like a marketing policy rather than a hardware problem. From the appearance of the insides of my Model A, eight RAMs and a couple of links are all that are needed.

Your readers might like to know that production standards on the early models may be a bit low — when I unpacked mine, it rattled! Opening the case revealed three ROMs out of their sockets and the modulator case about to lose its lid! The power supply occasionally breaks into a nasty hum which upsets the TV output as well.

As a mainframe user (Cyber 170), I'm used to getting as much memory as I need without having to think much about it. It didn't take me long to find out that using graphics means that most of your RAM is used for the screen, leaving only around 2k for your program. I'm slowly learning how to get around this kind of problem, but the provisional User Guide is no help at all — I hope the next version is



somewhat better.  
David Allman, Hulme,  
Manchester

## Next one

Is November's Chip Chat going to be the last mention of The Last One in PCW?  
J Read, Martuck, Somerset

No, neither is this — Ed.

## Spare part surgery

I read your Benchtest of the Casio fx-9000p with considerable interest — as I am sure did many of your regular readers. In particular I noted the kind references to the Hewlett-Packard HP-85A.

May I point out that, while the HP-85A may have cost 'an arm, a leg and several back teeth' in the past, this is no longer strictly the case. Since the 1 January 1982, the HP-85A has been reduced by £330 — with the same high performance.

I would appreciate it, therefore, if you could inform your readers at the earliest convenient opportunity that the HP-85A now *only* costs an arm and a leg!

Andrew Palmer, Marketing Specialist, Personal Computing Products, Hewlett-Packard.

## Knuckles rapping spot

May I firstly thank you for your understanding and courtesy when dealing with an irate managing director of this company, with reference to a letter published by PCW on page 74 of the January issue under the section 'Communications', sent in by Mr Sinclair of Sible Headingham, Halstead, Essex, relating to a secondhand ICL 7075 Termiprinter, shipped by Securicor on 3rd September 1981.

May I firstly take PCW to task, in that, before publishing this letter from Mr Sinclair, we were not approached, nor invited to make comment. Mr Sinclair is obviously one of those people who don't think nor make sure 'brain is engaged before opening mouth' (or writing).

On reading his first paragraph, one must assume he is a technically competent 'expert', in that since he could not record Ceefax data last January, ergo, no one else could. (Is this violation of copyright?)

Mr Sinclair also in his flippant letter doesn't give all the facts. This order was placed by telephone, and

serviced via Access. The conversation included the information that he 'had on order from company XXXXXX, a Termiprinter for 3 months, and was still awaiting delivery — at a price of £295 plus VAT & carriage — in working order' — but no manuals mentioned.

Within a few days of delivery Mr Sinclair telephoned us, stating he 'could not make it work — and had spent £190 for nothing, and what were we going to do about it? We suggested he returned his equipment to us, and we would interface the Termiprinter and make it work — no charges were mentioned, but it is normal practice that goods are returned carriage paid, and people get paid for work and knowledge.

This offer Mr Sinclair refused, then demanded his money back, at the same time telling Nick that he had 'sold his RS232 interface anyway'. I wonder what funny toy he has as a machine — that hardware interfaces such as this are not fitted as standard.

The previous notes don't in any way question Mr Sinclair's system understanding and technical ability to ensure that the system/interface/Termiprinter protocols were compatible, that the driver software was compatible, that the transfer speeds were compatible, that the character codes were compatible, that the cable-form pin connections were correct, etc. One is forced to assume that Mr Sinclair knew the capabilities of the Termiprinter, and its age as a type, before placing his previous order with the other company, who must be thanking their lucky stars that they were 'out of stock' at the pertinent time.  
Ron G Smith, Managing Director, Purley Computer Systems Ltd

## Shameless flattery spot

Congratulations for your 'Newcomers start here' introduction to the computer world. When I became interested in computers last spring, I sorely missed such a guide in your French counterpart *L'Ordinateur Individuel*. I lost lots of time wondering what PEEK and POKE meant in French or what a bus could be outside a public transport authority!

Best wishes for '82 and a long & happy life!  
Marc Ducommun, Lausanne, Switzerland

C'est rien — Ed

The submission of PET 'Fantasy' by Jeff Aughton (a well-admired programmer

in my school) from your December edition who states that no one has yet succeeded in gaining enough treasure in which to escape has now been proved wrong.

It all began on a cold winter's day as the snow lay thick outside. We arrived at school to find that it was to close down for the day at 12.30pm due to the weather conditions, but a handful of us from our sixth form computer club, plus teacher, attempted to get out of the adventure game using a 32k 40 column PET for which the program was designed, and after three hours we eventually got out.

This wasn't done by pure chance but by the use of a map which was constructed very laboriously by trying each exit given to us, and so we found that we had consequently drawn a foolproof map which would work each time the program was run.

The program was a great challenge to us all and we praise all the various other programs which have been submitted by Jeff Aughton in the past.  
The Helena Romanes Sixth Form Computer Club

## Doubling up

On page 147 of the December 1981 issue you suggest that the RAM of a ZX81 can be doubled 'easily' by replacing the existing RAM chip with a 2K\*8 chip.

Please warn your readers. It may not be so easy! Out of four machines that I have seen, none had IC sockets for the 4118 but, curiously, two had the other three chips in sockets.

A solder sucker is a *must* and after removing the RAM it is best to solder a socket in the IC4 position and plug the 4118 back. If it still works and PRINT PEEK 16388+256\* PEEK 16389 still gives 17408, change the chip and try again.

There are screws under three of the four rubber feet. The 'odd man out' is the back one on the side away from the extension connector. The two short screws belong at the front when you put it back together. There are four interesting pins at the end of the RAM socket.  
Peter Bendall, Kaltenkirchen, West Germany

## Fame at last

You have at last reached the highest possible level of official recognition. . . I turned on the television this morning and happened to notice that the test card didn't look quite right. I took a closer look. . . the girl in the photograph was

not using any chalk, in fact she was playing OXO on a TV screen. And yes, there was a keyboard in front of her partner — *The BBC used the picture from the front of your December issue*. I thought I was imagining things at first, but what a complement!!! It was only for about 5 minutes, at about 10.35am on BBC2, but it was still a surprise! Keep up the work on a great magazine.

Andrew D Wallace, Wigan

## Dongle replacement

Replying to Mike Lake and his request for a replacement for his 'dongle' I would suggest the word 'doobrie' which has the following advantages:

1. Having been used by a colleague of mine for over 15 years it has shown no long term side effects to either user or recipient.
2. 'Doobrie' is pure bred as the catalogue of 'doobries' has several thousand entries to date.
3. It can be used several times in one sentence without confusion.
4. With such a pedigree it is practically an industry standard and almost certainly qualifies for a BS number.

I hope this has solved your doobrie.  
Peter A Elbro, Sandyballs Estate(!), Fordingbridge

## One liner

The conversion of decimal numbers to binary often causes problems, particularly when negative numbers are converted using '2's complement'.

Here is a compact conversion program in Microsoft 2 Basic, which can be added to the collection of 'one-liners', (PCW Oct '80, Aug '81).  
0 INPUT D:D=D/16A 4:  
FOR I=0 TO 15:D=2\*  
(D-INT(D)):PRINT-  
(D>=1);:NEXT:RUN  
Jack Pike, Bedford



## Stop press

The price of the BBC Micro is to go up to £299 for the A model and £399 for the B, from 1 Feb. The 12,000 people already on the waiting list will be supplied at the old price.

# Banks Statement

## RENT-A-MICRO



Rent asunder — what a lovely, rounded phrase that is. I must admit that I'm not entirely sure what a sunder is, or whether I would want to rent one even if I did know. It sounds, however, as though it somehow ought to be interesting, something worth renting for that smart party you're planning, something to put on the coffee table as a conversation piece. It is certainly a more interesting word than 'micro'. Perhaps that is why renting micros has never really taken off.

At face value it is easy to assume that it could be something as simple as that: the fact that renting a 'micro' has not had the panache for the general public that renting a 'limo' has had. Seems unlikely somehow, but it could be the reason why the rental side of the personal computer industry has played such a minor role in the development of the marketplace.

There are, in fact, one or two very sound reasons why rental has never really become a strong marketing force, and they are mainly related to money. There are, however, indications that this situation is slowly changing and that renting could become viable in the future. If it does, this could have some interesting effects on one of the major growth sectors of the personal computer market for the immediate future: the very large customers.

In theory, renting in the personal computer business should have taken off like a rocket. It would have been, and to some extent should have been, the ideal way for potential users to find out whether the system they were thinking of spending their hard-earned cash on was going to be suitable — or a dog. It must have been hard on some of them to find that the £400 or £500 they had recently laid out on a probably oversold can of worms had not been a good idea. One particular sector of that mass of potential users could, and again maybe should, have found the idea of renting systems very attractive. That group can be lumped under the general heading of 'large customers', the type of user now being targeted by many of the major manufacturers and distributors as a big source of future revenue.

This group of customers can be characterised as a large company with many internal departments or divisions. It could quite possibly be a multinational organisation. It will almost cer-

### Martin Banks examines the potential for microcomputer rental.

tainly already be extensively computerised, with either mainframe and/or mini-computer installations scattered around. The addition of personal computer systems within that structure is quite logical and a sensible place for the personal computer manufacturers to go looking for business. They are, however, very structured organisations that normally have to impose fairly rigid controls on the way internal operations are carried out. There is therefore a natural desire for some measure of control over the introduction of personal computers into the infrastructure of the organisation. This task, as it involves computer-type objects, often becomes the responsibility of the data-processing manager. The DPM has to decide which type or types of hardware are allowable and what software will be used. Now DPMs as a breed actually seem to have something against personal computers; but that is the subject of another discussion. What would (or might) have helped them come to whatever decision they might arrive at would have been the ready availability of rented systems with which to play.

So why weren't they around? As I have already said, the answer lies primarily with money, or more precisely with the people who control the activities that money gets involved with. It is also related to the actual technology and the systems it has produced. Although it can be extremely profit-

able, renting equipment of any sort requires two main things. One is a reasonably large amount of money to start with, and the other is a fair degree of patience. The former is needed to purchase the equipment that is to be rented out. A reasonable cross-section of a product range may be needed to cover the potential marketplace, and a reasonable volume of each selected type of product will be needed to ensure that the potential demand can actually be met.

The latter is essential, for it will take some time for this up-front investment to yield a real return. Certainly, accountants can juggle the figures so that revenues can be shown at any time, but it is normally eighteen months to two years before the actual investment is paid back with interest.

This is the point where the technology of personal computing comes into play, for historically (if such a word is yet tenable in the personal computer business) the speed with which the technology itself has developed has pushed the rate at which systems have developed. No sooner has a personal computer hit the market, and been accepted there, than the technology allows the production of a bigger read-only memory (for the sake of argument), which in turn allows a more comprehensive monitor to be written and installed, allowing a more comprehensive high level language to be used which cannot be run on the older machine (probably because the new ROM is in a different package that won't fit). Now, a better(?) language means better(?) applications programs that the user will want, so he swaps the system currently on rent for the later version. The renter is then left holding an expensive baby that not many users want to rent — they all want the later machine.

These changes seem to occur with startling regularity, and certainly at a rate that is considered far too risky by most companies normally involved in renting — even those involved in renting computer systems such as mainframes and minicomputers.

A subsidiary problem for the renters has been a shortage of suitable systems to rent. In practice, items such as personal computers are best rented to the business community, and it is only recently that suitable systems have started to appear that fill the gap between



the low end machines such as the PET and Apple and the more powerful but vastly more expensive low end of the minicomputer range.

One of the current favourites amongst the newer systems seems to be the Intertec SuperBrain. This appears to have gained favour as much for its integral design as for its facilities or intrinsic computing power. It is, however, the system that is starting to break through on the renting front, because the renters believe that it both fits the right slot in the renting marketplace and will be around for long enough for them to get the pay-back

they feel they deserve.

So, renting is at last showing signs of taking off and perhaps having some degree of significance in the overall personal computer marketplace. Some of the renters are beginning to think in terms of market estimates for the future (in fact, they must have thought about them for ages — now they are starting to talk about them, which shows some measure of confidence). While renting is currently responsible for only about one to two percent of installations in this country, it is now being estimated that by 1985 as many as 25 percent of that year's installations

will be rented systems. Given the size of the market by that time (which will be doing badly if it is not topping a 30 percent growth rate by that year) renting should be a healthy business to be in.

It does depend, of course, on what technology still has up its sleeve, for the existing systems are liable to change, and new systems introduced, at a continually rapid rate. Not all of the new systems, or the changed ones, will be as good as at first they might appear (as has oft been the case in the past). There are plenty of colds out there, just waiting to be caught. **END**

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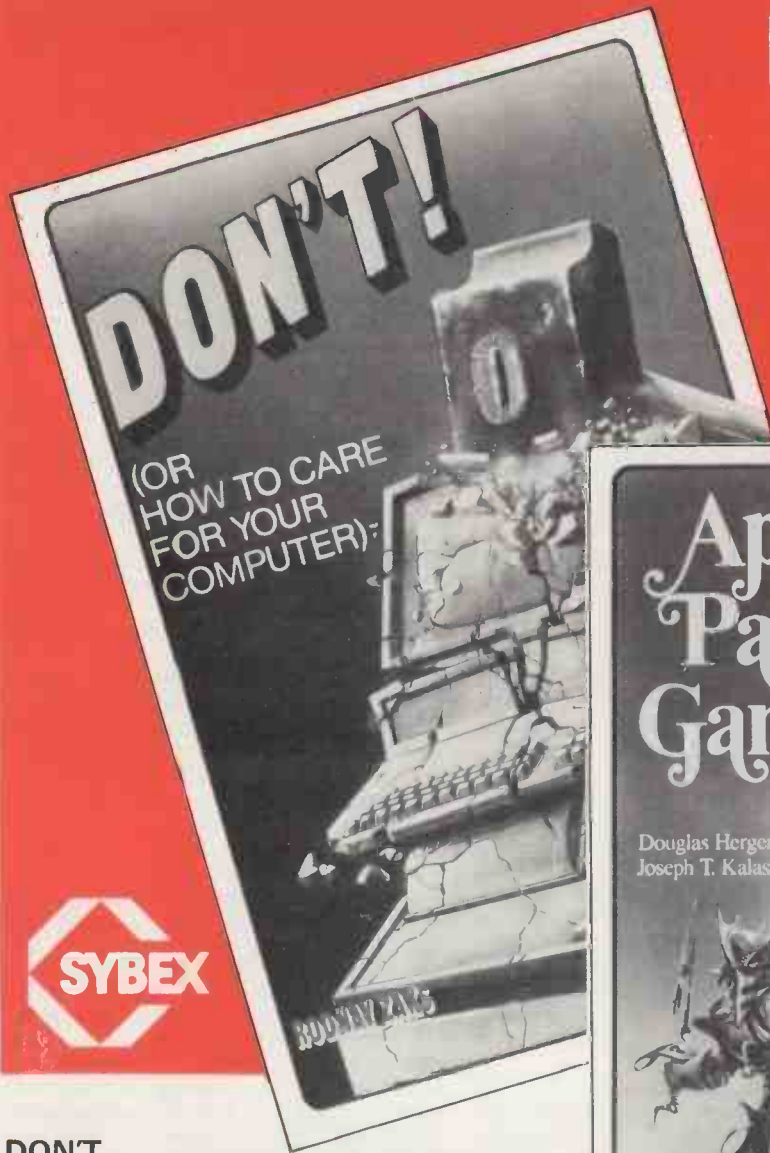
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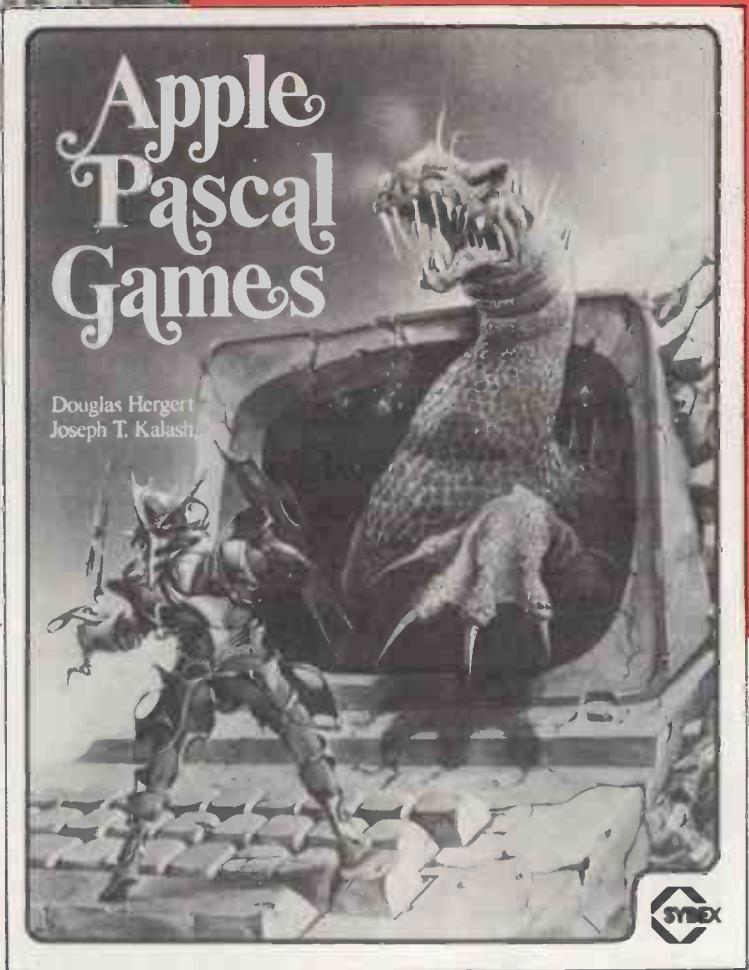
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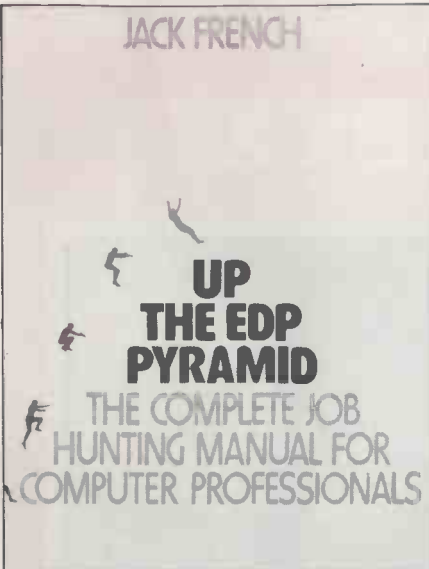
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## Malcolm Peltu looks at the latest micro literature

### DP snakes and ladders



Alan Woods's Frames of Reference series is an important bridge-building initiative (see page 123 for the latest frame). With expertise, intelligence and wit, he tells professional data processing hacks about the brave new world of micros.

It would be useful if someone started work at the other end of the bridge — telling personal computer hacks about the brave middle-aged world of professional DP. After all, computing experts are scheduled to inherit the earth in the 21st century, and micro freaks should know what kind of career may be in store for them. Bodies like the National Computing Centre and British Computer Society provide good advice on careers in computing; but there is also a need for literature which evokes the smell and tang, as well as the facts, of DP life.

*Up The EDP Pyramid* by Jack French calls itself 'the complete job hunting manual for computing professionals'. It is not. It is very good at capturing the style of a particular way of DP life. Unfortunately (or fortunately, depending on your outlook on life), its setting is in the macho jungle of American business, where the motto seems to be 'hunt and kill — or be killed'. (Note: EDP is an abbreviation for Electronic Data Processing.) French offers some universal truths about commercial DP. But the harsh American accent means that the book is more interesting as a sociological comment on what motivates Americans than a practical guide to working in a British (or any other non-American) 'DP shop'.

This is a pity because French scatters nuggets of useful advice along the way in his ruthless route-march to the top of the corporate heap. Although the managerial in-fighting may be more openly vicious in the States, many of these helpful tips relate to organisation politics rather than the technical aspects of computing.

It is appropriate that one of French's key warnings is taken from that arch schemer, Machiavelli. French's whole approach to career planning is machiavellian. For example, he recommends that 'one effective way to search for a position is to develop friends who are a couple of levels higher than you'. When you go for a job interview, he boldly says, you should tell the DP manager that 'you have heard he is one of the best at his job and you simply want to meet him to get some advice. He will be flattered, unless he is a computer.'

French brings in Machiavelli explicitly in a section on systems development. Way back in 1513, Machiavelli showed the foresight to write: 'It must be remembered that there is nothing more difficult to plan, more doubtful of success nor more dangerous to manage than the creation of a new system. For the initiator has the enmity of all who would profit by the preservation of the old institution and merely lukewarm defenders in those who would gain by the new one.' In a typical career game-plan, French translates this to modern times by advising: 'You can advance your career significantly by engaging in new systems development [provided you remember that] evolution in small pieces is the key to career success. Sometimes even the smallest of systems results can make you a hero in your own time.'

French also rightly suggests that, to develop within an organisation, DP staff should be aware of corporate objectives and operations and should gain experience and understanding of the industry in which the organisation is active. Otherwise the DP professional can become boxed-in. 'Because of the specialised training required for DP persons, some companies regard DP staff as mere technicians with little talent or potential for promotion up into other parts of the business. While accountants, salespeople, and engineers move to the leadership positions, DP professionals are often relegated to supporting roles,' he says.

In French's world, there seems to be no place for the person who would like to spend a whole career in DP. 'In DP there can be no retirement. You either progress up or not,' he quips. Then, after telling you how to clamber up the DP ladder, he depressingly states, 'If you thought your career planning ended when you got to the top of the DP pyramid, you were wrong. It has just begun, and it is now much more difficult because the way has narrowed and the competition has increased.'

In addition to the ladder, French also sees snakes everywhere, ready to hurl you down into the pits. Apparently, 'terminations' are a common experience to American executives. In Britain it would be known as 'getting the boot'.

In such a jungle, it is no wonder that French advises the aspirant DP person to prepare a career thoroughly. This ranges from making sure the com-

pany you are joining is financially secure to such personal comments as: 'If you are married you are okay. If you are single and past thirty, you are odd or a swinger.' Not to mention: 'If you are ugly, you had better be good. If you are handsome, you are in until you are forty.'

In his single-minded pursuit of power, French throws a sharp light on the underbelly of the American Dream. 'If you have a name indicating and ethnic background, change it.' And if you are a female, 'You can always find functional jobs, but your chances of becoming a manager of men are not equal. You are acceptable as a supervisor of women.'

His ultimate in sick-making honesty is to say, 'Be sure your image closely parallels that of your boss. . . bosses tend to hire and keep people like themselves.' By almost parodying the naked, clawing nature of American business, French does hold up a magnifying mirror to many of our own warts, attitudes and business practices. Much of what he says could therefore be translated into subdued European terms.

To get by in computing in Britain, however, less attention is paid to appearances — at least in more technically oriented jobs. Most British programmers who have gone to work in the States have commented that the typical US DP professional is less hairy, more conventionally dressed, more concerned about formal timekeeping but less productive than his British counterpart.

French's biggest mistake, however, is that his obsession with defining and sticking to a clear career path has blinded him to the most significant developments to have hit DP recently — micros and office automation. His description of the typical DP environment is a snapshot of a passing phase, just before it disappears into the history books. The availability of personal computers, intelligent terminals, Visicalc, non-specialist programming languages, word processors, electronic mail, etc, is transforming the role of DP.

The real managerial battlefield is becoming the post of Information Manager who co-ordinates DP, personal computing, office automation, telecommunications, etc. Yet this gets barely a mention. (Immodestly, I would refer you to my own book, *Using Computers — A Managers' Guide* (National Computing Centre, £7.50) in which I explore the evolving nature of information management.)

The kind of DP shop described by French will remain in existence for many years to come because there is a heavy investment in systems and in the skills and attitudes of managers like him.

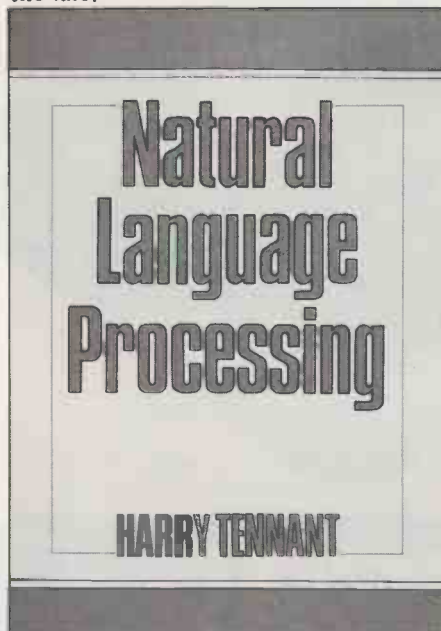
If you have come to computing through the excitement of micros, you could have a head start on older DP people because you are *au fait* with new developments. To succeed, however, you must also be aware of what you don't know. Provided you do the neces-





sary transatlantic translation, the excesses of French's approach to career planning and executive snakes and ladders make a vivid, if incomplete, first rung.

You should also keep on reading *Frames of Reference*. You will find out a lot about the attitudes and knowledge of DP people, because Woody is one of the rare breed of people who have crossed the bridge from traditional DP to personal computing and has lived to tell the tale.



## Natural lingo

*Natural Language Processing* by Harry Tennant is a beaut of a book. It treats a serious and important subject with intelligence, clarity and honesty. Whether you want to program your own natural language systems or just wish to gain an insight into the current state of understanding on the subject, this book is an excellent starting point.

Natural languages are the languages which humans use — English, French, Swahili. The subtleties and complexities of natural languages may be within the group of children but are still generally beyond the capability of computer systems. The issue addressed by Tennant is not so much concerned with natural languages for programming but with the development of natural languages' interactions, dialogues, enquiries to databases, etc.

As low cost silicon power has spread through computing, the need for providing more flexible and easy to use interfaces has become one of the prime objectives for systems designers. Tennant lucidly explains the underlying principles of natural language research; these are primarily concerned with linguistic analysis of the syntax, semantics (understanding), and structure of languages. He fleshes out the theoretical skeleton by quoting a large number of research case studies to illustrate the underlying principles and to show how far these have been translated into working systems.

The most refreshing aspect of

Tennant's approach is the way he highlights his scepticism about over-optimistic research findings. And he uses his own research as an example of the holes that could be picked in what seems to be a perfect development approach.

Tennant developed an Automatic Adviser which can be used to provide answers and 'advice' on a database holding information on engineering courses. Although the Adviser can handle a wide variety of queries and dialogues using ordinary language, Tennant shows that it also failed to handle many sentences and questions which could crop up.

Tennant says that he is able to point out the shortcomings of the Automatic Adviser because he wrote it and used it. But, he adds, 'unfortunately the same kind of criticism is not possible for the other natural language programs [I describe] in the book. They all have their shortcomings... but it has not been common practice for the designers to discuss the limitations... Readers should be aware that the kinds of criticisms made about the Automatic Adviser could be made about all current natural language processors; they must therefore beware when reading about other systems. The faults are there — they just have not been identified by the program designers.'

This comment is applicable to many write-ups of research work in other fields. Tennant's honesty is to be commended.

The case studies provided by Tennant cover each major aspect discussed by him, starting with an interesting historical perspective on early natural language programs. He makes the important point that the average hobbyists today have more computing power under their control at home than most researchers into natural language processing in the largest universities had twenty years ago. That is one reason why the pace of work in natural language processing has gained momentum in the last five years or so.

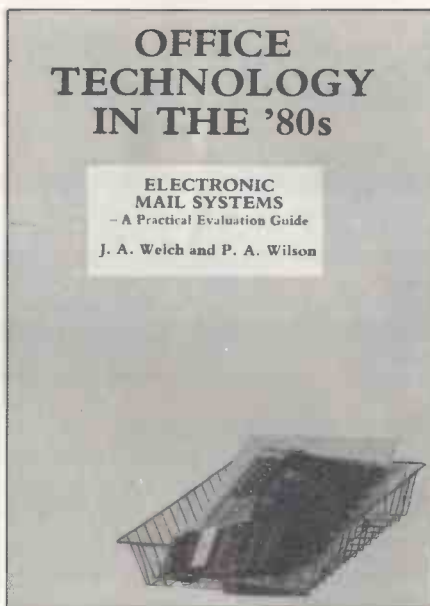
Another is that researchers have, to some extent, become less ambitious. Early research tried to find general solutions — 'natural language compilers' that could operate in many environments. There were also attempts at creating automatic language translators. These general solutions quickly gave way to the current mainstream of enquiry, which is to aim initially at solving a problem within a specific environment or 'domain'. This could be, for example, a doctor/patient dialogue, answering travel enquiries or access to a database. Tennant describes the most significant landmark research projects, such as Weizenbaum's Doctor, Winograd's SHRDLU, and LUNA (the system used to analyse the Apollo moon landings' geological booty).

He describes these and many other interesting case studies in sufficient depth to give an understanding of how a system works and how it illustrates a general principle of syntax, semantics, knowledge and representation of dialogue structure. Yet he does not get bogged down in too much detail. He

does not provide the program code used to implement any routines but if you are interested in the subject his case studies provide sufficient systems description for you to translate into your own requirement. Tennant sticks to the central issues of natural language processing but he does provide pointers to other interesting related areas, such as artificial intelligence, linguistics and psychology. Each chapter has a good bibliography of further reading.

My only real criticism is that the American origins of the book get in the way. This is particularly annoying in a book on linguistics. For example, where he is describing linguistic ambiguities he uses the word 'heater' as an example. Now, I did not know that heater was American slang for a gun. So I did not understand what he was talking about.

This American blemish, however, doesn't really get in the way of the book's main appeal. If you ever wanted to find out about the practical aspects of natural language processing, this is the one to kick off with.



## Electromail

The National Computing Centre is publishing a useful little series of briefings called *Office Technology In The '80s*. The first is on one of the most trendy office automation topics, electronic mail systems.

The NCC approach, however, is far from trendy. The neat little book (about 120 pages) by J A Welch and P A Wilson looks and reads something like a reference manual. In fact, it is essentially a specification of the capabilities of electronic mail systems, as can be gathered from its subtitle — a practical evaluation guide.

There are two main sections. The first examines in detail the criteria that should be considered in selecting a system. These include a range of functions to be expected, such as the ability to prepare, send, receive and file messages with adequate security.

It is good to see that the authors give equal priority to two other evaluation criteria — ease of use and the stability

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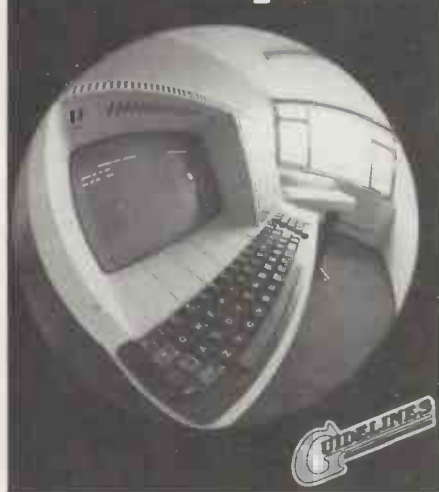


and performance of the vendor. These are often forgotten in the rush to enunciate all the technical bells and silicon whistles.

The second section discusses how the evaluation procedure should be carried out. At present, electronic mail may be of particular interest only to larger organisations. But office automation is such an important and integral part of computing that nobody can afford to ignore these developments.

The NCC series looks like filling the gap between skimpy intros and detailed technical material. The books could be very useful as part of general course on computing and information technology as well as being of practical benefit to people actually selecting systems.

## Introducing Computers



### Looking good

The look and feel of an introductory book can be as important as the content. If you are new to a subject, the last thing you want is to be presented with a daunting and unappealing tome.

As far as looks go, *Introducing Computers* by Ron Condon is one of the prettiest I have seen and is cheap to boot. Its approach is similar to Chris Evans's *Making of the Micro* (Bookfare, April 1981). It mixes a description of the history and technology of computing with pictures, graphics, drawings, etc.

The accompanying text by journalist Condon is a professional round-up of the varied views about the impact of microelectronics and computing. Some of the main chapter headings give a flavour of the structure and approach of the book: Computers Mean Change; History of Computers; Structure of Computers; Working with Computers; Communications; Computer Intelligence; The Future; Social Implications.

For a book of this nature, Condon gets a bit bogged down in describing the innards of a computer, binary arithmetic, etc. The main thrust of the book is also too biased towards traditional mainframe and mini computing, with micros making their main appearance at the end in chapters on choosing

a system and programming in Basic.

With less than 100 pages including many illustrations, do not expect *Introducing Computers* to go into great depth. At only £2.50, however, it is good value for money particularly for the less technically oriented beginner.

In addition to Condon, credit should be given to designer David Worth and picture researcher Caroline Mitchell for putting together this attractive little package.

### On target

One of the problems with many introductory books on micros is that they attempt to cover everything from bits to satellites, personal computers to international networks. *Introducing Microprocessors* by Ian R Sinclair avoids this danger by sticking to a narrow hardware scope.

His ambition may be limited in terms of the range of technology covered, but he pursues his chosen objective with a straightforward and reasonable text which makes the book much more useful than those which try inadequately to cover the whole computer waterfront.

There are seven chapters, each less than 30 pages long, indicating that he goes beneath the surface but does not dig too deeply into each topic. The chapter headings are: Digital circuits and actions; The Microprocessor; Other chips (mainly about memories); The microprocessor registers; Load and store instructions; More program operations; The next steps (mainly about software, compilers, etc.).

From this it can be seen that Sinclair sticks primarily to the hard end of the micro spectrum. The programming examples are mainly for Z80 and 6502 assembler. Although he introduces programming principles, he does not attempt to provide an intro to high level language programming.

Sinclair achieves what should be every author's main intention — to live up to his own Preface: 'Because of the sudden expansion in the use of digital methods,

many people are finding the need to try to understand the action of the microprocessor without having progressed along the traditional path of electronics, and with no time to follow such a path.'

'This book is intended specifically for such readers; no previous knowledge of electronics is assumed, but since microprocessors are invariably a part of other electrical circuits and exercise control by electrical means, some background knowledge of elementary circuits must be assumed.'

If that description fits your bill, this is the book for you.

### The right way

According to C Roger Smolin, there are two ways of avoiding a cock-up when buying a business computer — education and planning. 'By educating yourself, you gain the vocabulary you need to allow fruitful interactions with those in the industry who stand ready to help you. Planning ahead will allow an orderly transition from the manual mode to the more efficient, productive, and profitable automated business in the future,' he writes in his *How To Buy The Right Business Computer Systems*.

Smolin concentrates mainly on the education side, trying to familiarise the reader with the basic jargon of commercial computing. Despite the title of the book, however, he does not go into great detail into the evaluation and selection procedures to be undertaken, when buying a system. He covers all the computing capabilities you would expect — hardware, systems software and (in two chapters which take up almost half the book) applications software.

The best aspect of the book is not so much the technical material covered but Smolin's practical cynical comments which get through to the truth rather than the theory of computing.

He has a useful little section on human engineering of software. This should have been expanded and extended to include hardware ergonomics.

Unlike other similar books, Smolin steers clear of specific system specifications and prices, except for some 'ball-park' figures. By sticking to general principles and practice, he has written a book which will last a long time and which is as valid outside America as it is in the States.

*Up The EDP Pyramid* by Jack French (John Wiley & Sons, £14.75).

*Natural Language Processing* by Harry Tennant (Petrocelli/Van Nostrand Reinhold, £14.90).

*Office Technology in the '80s — Electronic Mail Systems* by JA Welch and PA Wilson (National Computing Centre, £4.00).

*Introducing Computers* by Ron Condon (Macdonald Educational Guidelines, £2.50 paperback, £3.95 hardback).

*How To Buy The Right Small Business Computer System* by C Roger Smolin (John Wiley & Sons, £6.60).

*Introducing Microprocessors* by Ian R Sinclair (Keith Dickson Publishing, 17 Hendon Lane, London N3, £4.50). **END**

## INTRODUCING MICROPROCESSORS



IAN R. SINCLAIR



# CHOOSING A DATABASE

Following January's introduction to databases, Kathy Lang describes the criteria for testing DB packages

All programs which process data on a computer could be called data management systems, since they all process or manage data. Here, though, we shall be talking about those packages whose *main* concern is with managing information — checking it on input, storing it, retrieving it for display at the terminal and using it to create printed reports. There are dozens of packages on the market which aim to allow the end user (rather than the computer buff) to tailor a system to meet particular needs for a set of personnel records, stock recording system, register of houses for sale, etc. This article will set out some criteria to use when deciding if a particular data management system will meet the user's needs in a small business or the like — where the volumes of data are likely to be rather larger than in a typical home application.

In January's *PCW* Lyn Antill described the various methods used to implement databases. This month we'll look at the limitations imposed on the user: the facilities provided for storage, retrieval, security, tailoring to meet particular needs; the ease of use and friendliness of the system; stability and reliability of the system and its supplier; and the costs — obvious and hidden — in implementing the system.

## System limitations

Most packages put limits on the numbers and sizes of files which may form part of the information management system, either globally or in simultaneous use. These limitations may not make it impossible for you to do particular things but they may affect your approach. For instance, if you want to keep all your stock items on a single file you may find that the total amount of information will exceed the size of file allowed, and you will be obliged to split your records into two or more files.

The extent to which you can link files together is also important. For instance, in our stock/supplier example, one solution would be to allow both files to be read at the same time, with information from the two being merged. Another would be to select from the stock file all the required items, keeping a separate list in the computer's memory of the supplier code for each selected record and then using that list to select the supplier records from the supplier file. If you can neither read two data files in harness nor link them

indirectly, you could still achieve your purpose by keeping the supplier's name and address on each product record. But this would give you an extra 150 characters or so in every product record, increasing search times and perhaps bringing you up against the limit on total file size. You would also need to keep this name and address information on your purchase ledger, and change it in both places if the supplier moved premises: more wasted storage space, and — even more important — greater danger of error in updating, or of forgetting to make the change everywhere the data item occurred.

Most systems also have limits on the size of a record, and of a field within a record. Only by having a fairly clear idea of what you want to do can you decide before you buy whether these constraints will affect you in practice. A hidden problem in this area concerns record structure. If the system requires all records in a file to have the same structure, then records may sometimes become unnecessarily long. For instance, a file consisting of records about cars might include some data on their gearboxes which differed in structure for cars with manual and automatic gearboxes. Since no single car will have both, a sensible system would allow the alternative information to occupy the same position and space in the record — but in many systems you would have to have space for both kinds of information in each record. A similar problem concerns variable amounts of information: records about a family for instance, might include several fields of data about each child, where a family might have no children, one, two or more, etc. In most systems, you would need to allow for the maximum number of children there is ever likely to be, so that most records would contain much empty space, wasting storage capacity.

A final point on limitations relates to accessing information. To retrieve particular records, you will want to be able to specify search criteria of varying complexity; for instance, to find all the houses for sale in Bradford with two garages and double glazing, you would need to be able to search on three fields — location, number of garages, and presence or absence of double glazing. Some systems allow searching only on a single field, and have to use trick methods to search several fields. Others allow such searches only on fields you have specified when you set up the file, while others again give you fast searching on a single field and use

slower methods to search on subsequent criteria.

It is often hard to discover exactly a system's limitations. They should be clearly set out in the documentation; if not, you may find such reserve a good indication of the standards of professionalism of the software as a whole.

## Data storage facilities

Before you can get data out, you must put it in. This involves creating a file of records in the first place, keeping those records up to date and adding new records as necessary. The data management system can help in two main ways. Firstly, good systems provide methods of formatting the terminal screen to make it easy to provide the information needed and make good use of keyboard facilities such as cursor controls. Secondly, good data checking facilities (ie, to prevent the user entering alphabetic characters in a field meant only for numbers) help a good deal in getting the data right. This applies not only when creating records but also when updating them — by requiring confirmation it ensures that the record to be changed is the one the user intended, for example.

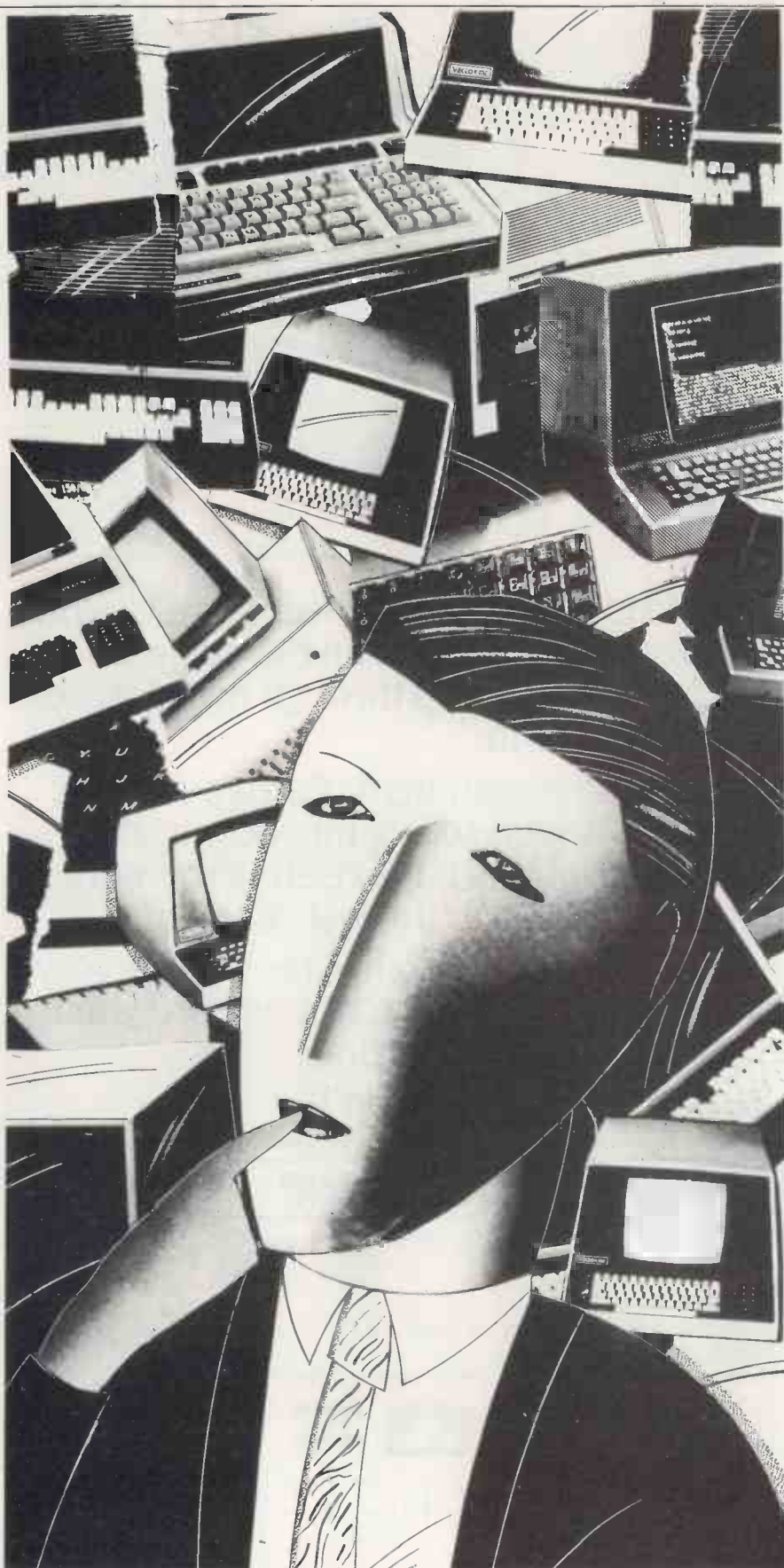
All this assumes that the data is being entered from the keyboard. Sometimes the data may be in the computer already and perhaps just needs incorporating in another file, or reformatting; it can be very helpful if the data management system can read files of data created outside the system itself by other programs, such as your accounting-suite. (You may also want to write to files which such software can read, thus integrating your information processing activities to prevent waste and duplication.)

Pitfalls to watch out for when updating include restrictions on file size, which may affect how many new records you can add, and constraints on changes to record structures, which may prevent you adding new fields to existing records.

## Data retrieval facilities

Occasionally you will want to get all your data back in just the order you put it in but usually you will want to select parts of it. This may mean selecting some fields from every record, or every





Catherine Denuir

field from some records, or some fields from selected records. To select some records from the file, the system must either read every record to decide whether it is needed or not, or else be told in advance how to make such decisions to provide a more efficient method of selection. Because it takes a comparatively long time to read each record in turn, most systems use a form of indexing.

Some systems allow only one field

to be used as the key for indexing, while others permit several, which may have to be specified when you set up the file — more flexible systems allow you to specify fields later. Frequently a key field has to contain unique information, so one may index on, say, the names in a telephone directory only if each person's name appears only once, and must use a modified form of the name to make each name entry unique if there are duplicates. Of course indexes

are only useful if they are kept up to date when the data file changes, and in some systems this is not done automatically — you must ask for a new index to be made after each set of changes to the data file. Even if indexes are updated automatically they will eventually become less efficient and need reorganising. You should try to get some idea how often such reorganisation is needed and how much time — yours and the computer's — will be needed. Another difficulty to watch out for here is any restrictions on space allowed for indexing, which will of course need to increase as the data file grows and with any growth in the number of fields to be used as keys.

Some data fields will have values which cause the record to be selected on the basis of the presence or the absence of the value — for instance, a telephone directory entry either relates to a particular person or it doesn't. But there are several other kinds of selection you may wish to make. A common requirement is to extract all records relating to a particular time span — all orders issued in the last VAT quarter, say. Or you may perhaps wish to find out which of your customers owe you more than £1000. Frequently it is necessary to combine several selection criteria, as in our house example. Data management systems vary considerably in their flexibility and power in this respect.

Having specified the records you want, the package may give you a choice about how they are displayed. Some systems allow you to show the records with equal ease on the screen and as a printed report, while others have only limited facilities for screen selection and display and require you to create a file of specifications to 'batch up' the more complex criteria. Either way, you should have some choice about the way printed reports are shown, with user-supplied headings and format specifications. The best systems supply simple layouts which you can use unmodified to start with, and then adapt to your own needs. Whether on screen or printer, the system should allow you to manipulate the results — perhaps totalling all the entries in a particular column, or using one entry to modify another — and should let you specify that the records should be sorted in a particular order before they are displayed.

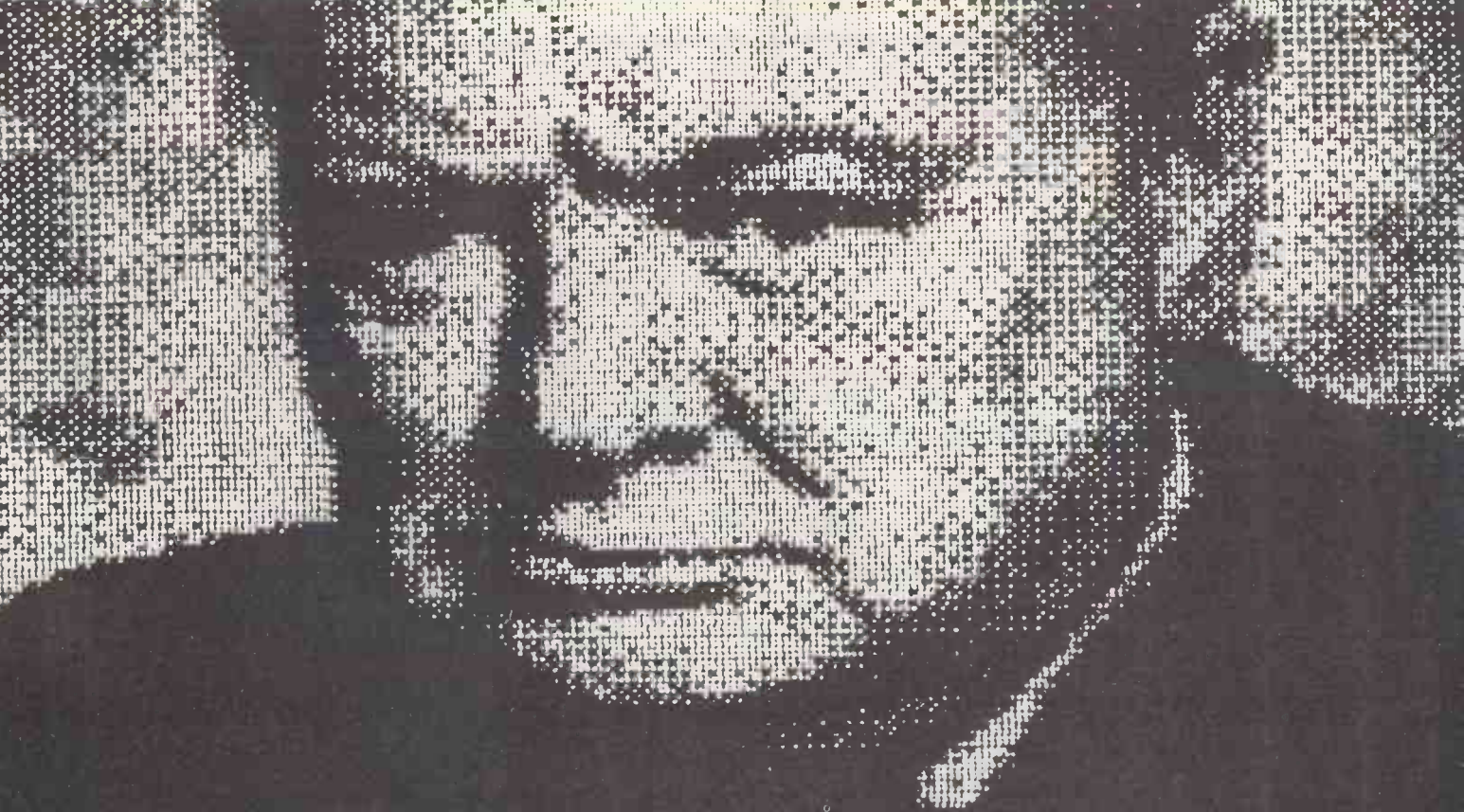
## Security

As far as *human* error is concerned, security is involved both with the right people doing the wrong thing by mistake, and with anyone doing the wrong thing deliberately. Errors may involve









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# CHOOSING A DATABASE

updating the wrong file, or making mistakes when changing a record. The system should be able to provide checks, such as the data validation we've already mentioned, to minimise the risk of mistakes occurring. 'Doing the wrong thing deliberately' may simply mean gaining unauthorised access to confidential records, or it may go as far as positive fraud — perhaps by falsifying payroll records. Some systems provide password protection on important files, and sometimes on individual records as well. So much for prevention: detection of human error (unintended and deliberate) and recovery from it may be possible if the system keeps records, known in some contexts as audit trails, of what changes have recently been made to the data.

The package should also have some protection against system errors. For instance, when a system is used by several people it should not be possible for two users to change a record simultaneously. The system should also keep a journal of its own activities, so that if the system fails for any reason information is not damaged beyond recall. Ideally, there should be some way to repeat the activities being undertaken when the system failed.

## Tailoring the system

Every data management application will involve tailoring the system to your requirements; how much will be possible and/or desirable will depend on the system and on your needs. First you must describe to the system the nature of the data. Once described, the way in which the data is input may be specified completely by the package, or the user may be able to adapt the user image to the needs of his application. The most obvious adaptation is to design the screen display to make it easy to enter data quickly and accurately. But data management systems can permit much greater adaptation of the user image, allowing the user to present selection menus or to set up detailed messages for novice users. It should also be possible, within the limitations of direct instructions in the package's own command language, to specify a range of calculating and manipulating functions. Often, too, you will want to carry out the same sequence of actions many times — every day or week, perhaps — and a system which allows you to use some kind of shorthand to initiate the sequence can both save you time and prevent errors. Finally, there is a limit to the amount of flexibility any system can allow within its own command language. You can gain even more flexibility if the system allows you an interface with another program, either one written (in Basic, Cobol or whatever) by the user or to his specifications, or else to another general purpose package. The latter is most likely to be one which will process the results further; for instance, you might want to use a word processing package to write circular letters to all those customers who owe you more than £1000. A link to such a package

means that the data management system need not duplicate these facilities itself.

## Ease of use

Probably the most obvious aspect of this is the image the system presents to the end user — the person who has to design the data structures and sit at the terminal entering the information. A good system will make it easy for the user to tell the system what is required of it, enter correct information and recover from errors. You should remember, too, that users change as they get to know a system; the user image should be adaptable, so that an experienced user can make use of his knowledge to take safe shortcuts through the detailed instructions needed by the novice.

Where a system has more than the most rudimentary facilities for tailoring to meet particular needs, especially if it can be interfaced to user-supplied programs, different considerations arise. Usually the biggest problem is finding out enough about the internal working of the information management system to be able to hook in one's own program. This usually has to be gleaned from the system's manual, and a close look at the documentation should give you a pretty good idea quite quickly about how helpful the package is in this area.

However helpful the system is to the end user when at the screen, he too will need to rely heavily upon the documentation. Sad to say, the quality of most computing manuals ranges from barely adequate to appalling. Pointers to look for include the amount of computing jargon, the size and adequacy of the index and the clarity with which the manual is laid out. Plenty of diagrams, simulated drawings or photographs of the screen displays and lots of examples of practical applications all help to make technical manuals more intelligible. The quality of the user documentation is usually a good indication of the amount of thought and effort which has gone into the user image as a whole.

Some suppliers give training in the use of their software, so that you may not have to rely wholly on the documentation to learn about the package. Such training is likely to be oriented solely towards acquainting the user with the software which is supposed to solve his problems. Of course, you must have some knowledge of the system in order to be able to use it, but such a 'solution-oriented' approach is not enough by itself. The user starts with a problem, and may need help to see it in terms to which he can apply the solution provided by the information management system. If you can find someone — another user, the supplier if he is a good one, a consultant who will help for a fee — who can help you find answers to all those questions which begin 'How do I...' by taking a 'problem-oriented' approach, you stand a much better chance of achieving your aims with the system than if you just try and muddle through by yourself.

## Stability and reliability

Obviously, a system that is to hold important information needs to be re-

liable. The more users a system has, the longer it has been in use, the more likely it is that the system will be reliable. But bugs will occur — you may not come across them, if you're lucky, but the only bug-free program is one that's no longer in use — and it's important to find out what arrangements there are for reporting faults, and how, as well as how quickly, errors are put right. If the system is still being developed, because it's widely used and popular and people keep requesting enhancements, it's worth checking how such improvements are marketed — do you have to buy a complete new system if you want the new features? Will data stored under earlier versions still be usable by later releases of the software? (If the system is still being developed in order to give it basic facilities, treat it like the measles until it's been around a bit longer.)

## Costs

As well as the straight monetary cost of the system itself, there are two other areas to consider. Data management systems can be quite demanding of computing resources, especially processor power and disk storage, so it's important to check properly that the system will run in reasonable time on the computer on which you plan to use it. An important consideration is the amount of trial you can give the system before you buy it. Many systems have a dealer demonstration pack which is free to suppliers, but which can only show a very small set of data in use — typically five or ten records in a file. With such small amounts of data any system will run quickly. If you can, get the supplier to show you a more realistic demonstration. The dealer packs are sufficient to show the supplier whether the system is worth taking seriously, but any dealer worth his salt should be prepared to buy a full copy of the system to demonstrate its facilities properly and to enable him to become sufficiently acquainted with it to deal with his customers' queries.

Remember, too, that while you may buy data management software for a particular purpose, the chances are that if it's successful in its first application you will want to implement others; find out about how easily the system can be extended and how much such enhancements might cost. The other costs involved will be your resources — the time and effort needed to set up and run the system. This is probably the hardest cost to estimate but if you don't do the implementation thoroughly, the system will be a failure however good its potential facilities.

## What next?

In this and following issues, the selection criteria outlined will be used to review a number of data management systems. A data management system is likely to be at the centre of most business computing and it's worth taking time and effort to get the right system because that system will have a big impact on your subsequent computing development. The aim of this article and of the reviews of particular systems which will follow, is to help you to get that decision right.

END



# DMS UNDER CP/M

## Kathy Lang begins our series of database Benchtests with an all-british product.

DMS is a data management system for CP/M written by Compssoft and based on the PET system of the same name. The package uses a single data file for each application, with one key field in each record which must be unique within the file. The file of data can be processed by a series of linked programs which are invoked from a main menu. Each program provides a feature such as, for example creating a file of data from the keyboard, sorting the data in ways specified by the user, selecting records which meet a certain set of criteria — all four-bedroomed houses in Walthamstow with central heating and a garage, for instance — or printing reports using the data and simple derived calculations. The data is stored in a DMS file indexed by the unique key; when you ask to sort the file on other fields the package creates one or more indexes which allow screen displays and printed reports to access the data file in the correct order.

So DMS would be suitable for fairly straightforward applications, provided your needs fitted within this quite limited framework. It would not be so suitable if you needed to keep two sets of data in separate files and then relate them to each other. For instance, you might have information about products and about suppliers, where some suppliers sold several products and some products could be obtained from several suppliers. The most convenient way to process this kind of information would be to have two files, using a product key and a supplier key to interrelate them; this would be seem to be impossible within DMS.

Although DMS allows you to process just one data file at a time, it is quite generous in its allowances of space and amounts of data, permitting a maximum of 26,214 records in one file or a file up to 8 Mbytes in size, whichever limitation is reached first. However, you might not be able to reach either limit in practice, since under CP/M a data file may not spread over more than one floppy disk, so you would also be limited by the capacity of your disk drives unless you have a winchester, of course.

You must decide when you set up a data file how many records you will need and what the format of each

record should be. If you later find that you need more records, or a different structure, you can use utility programs to set up a restructured file containing the existing data in the new format.

Each record may contain up to 1024 characters; every record must have the same structure. You may have up to 60 fields in each record, and these may contain numbers, characters (letters and numbers mixed), or dates. Character fields may be up to 80 characters long; numeric fields may contain up to 14 digits. When creating a data file, you will first be asked to define the data structure, giving each field a description which may be up to 15 characters long, and specifying for each field its type and length; numbers occupy one byte for each digit and the plus or minus sign, and one byte for the decimal point if any. To estimate the total size of the data file in bytes, multiply the number of records by the length of each record and then increase the result by 20 per cent. Index files are economical in space and take about two bytes for each record in the data file.

### Data input and updating

There are two main ways to get information into a DMS data file. Before using either you must first tell DMS how to format the data file, using the CREATE function. This sets up a data description file and uses this to format the data file to receive the maximum number of records you specify. This process takes a little time — six minutes to format a data file of 1200 records each of 155 characters on the Benchtest machine — but after that the data input process is as quick as your typing can make it. At this stage, you may specify a password for your data file to stop any unauthorised person getting access to it. Once you have formatted the file, you use either the KEY function or the TRANSACT function to get data into it. KEY can be used only by those who know the password to the data file, while TRANSACT can be used by others but with their access limited in whatever way you specify.

The KEY program asks you first for the value of the key field for the current record: this must be a value unique to that record. If a record with that key does not exist, you will be asked if you wish to create a record; if you reply 'Y' (throughout, DMS will accept only Y or N and will ignore all other replies), you will then be asked for the value of each field of the record in turn. DMS tells you what type of field is needed and how long it should be; you will not be allowed to give a date of 31 November, type a value longer than the maximum length allowed for a field, or put letters into a numeric field. It also saves you some typing by allowing some short cuts; if you have records in which one field is the same for several records — perhaps a personnel file where several staff belong to the same department — you may ask DMS to duplicate the corresponding field in the previous record. The current date may be specified by pressing a single key.

If, either during input or just before the record is saved, you realise you've made a mistake, you can abandon the current record and start inputting it again. Or you can continue and amend it later, using the facilities for updating.

If you specify a key which already exists, DMS will assume you want to update an existing record, you then have the option of amending parts of records by specifying the names of fields you want to change. Again, DMS saves you time by allowing you to type just enough of the field name to make it unique. You can also delete or print particular records, so this would be the program to use if you wanted a paper record of some current records with particular keys. Indeed, the mechanism of unique keys is oriented primarily towards getting at *individual* records, to update or print them, rather than retrieving *groups* of records.

The other program used for data input and updating is TRANSACT. This allows you to restrict access to the data and to specify how it is to be displayed. For instance, in the personnel records example, there is likely to be some highly confidential material on such a file, as well as data to which many people may rightly be allowed access. TRANSACT allows you to design masks for your



data files, so that only part of them may be displayed using TRANSACT and perhaps a still smaller subset modified. A mask could be set up displaying the person's payroll reference number, his name, address and current work location, and allowing all of these except the reference number to be modified. Then if an employee changes his address, the records could be modified to show the new address without the person making the change being able to see the employee's salary or work record. You could also use this facility to allow people simply to display part of all of each record, with no power to change data at all. All masks may have passwords attached, so some people can be given more extensive access than others and, unlike the other methods of changing and inspecting data, users of masks need have only the password for the DMS data file itself. You can also attach a processing option to the mask, so that calculations are performed automatically on data items as they are input. The latest version of TRANSACT, which I did not have a chance to test, has cursor control added, so that prompts and field specifications may be placed anywhere on the screen.

Using TRANSACT, however when you set up the mask you do have to supply full prompts to guide the person putting in the data, rather than relying on DMS prompts as in KEY. You also still have only the limited validation facilities of KEY; it is not possible to design testing sequences to make sure that data is accurate as well as valid. For instance, most people retire at 60 or 65, so the chances are an error has been made if an age of 90 is specified in one of our employees' personnel records. But DMS can check only that the data consists of a number of not more than two digits; you would have to use the DMS selection facilities to extract records of doubtful validity if you wanted to check the accuracy of your data.

## Displaying data on the screen

When you need to retrieve an individual record by its key, then KEY is the function to choose. However, you will often want to access your data in other ways. DMS allows you to display records on the screen by either scrolling through the file record by record or by going to particular parts of the file if it has been appropriately sorted first. You can also pre-select parts of the file, so that you may, for instance, look only at records for staff in a particular department, or houses in specified areas. But this sorting and selecting must be done before you begin the display process; if you decide that your selection is inadequate — say you find there are not very many five-bedroomed houses in the area you have chosen, and you'd like to look at those with four and six bedrooms as well — then you must quit the SCREEN program which displays data, go back to the SELECT function and set up another selection, invoke the SORT function again, and finally display the newly selected part of the file.

## Reporting on data

To get printed reports, there is a special function called REPORT which allows

you to design formatted reports. You can specify particular ways of laying the report out on the page if you wish, or ask for one of the standard DMS layouts. The report may consist of lists of records or of totals and summaries, or both; in either case you may ask for reporting on selected fields only. The totals may cover the whole set of data in use, or may be accumulated over parts of it. For instance, you may have data about staff in different departments in each office, and have several regional offices. You could set up DMS to accumulate totals by department, by region and overall. Up to three levels of accumulation are allowed (this is really a sorting restriction — see below).

While DMS gives you considerable flexibility over text layout and inclusion of headings, it is rather hard to change the layout once you have set it up, as all specifications of position are done with reference to absolute column and row positions. So if you decide you want to add a field into the report to the left of several other fields, you must, if you are using your own layout, respecify the positions of all the other fields — you can't just say 'move all the remaining columns over ten places'.

## Selecting sets of records

Both REPORT and SCREEN allow you to inspect pre-defined selections of records. You must set up a selection file containing your choices before you go to the display programs. Up to eight selections are allowed, and these are grouped into four pairs. So you can ask to select all houses with, say, 'three or four bedrooms' and 'central heating and double-glazing' and 'three acres in Stockport' or 'one acre in Wilmslow'. Character fields may be tested for equality, or for being in a particular range; you may restrict your search to part of the field, and you may ask to check if the test characters are anywhere within the field if the search string is shorter than the field you are searching. Numeric fields may also be tested for being greater than or less than the test number. The number or character string you are searching for may be a constant which you put in the selection set, or a constant put in from the keyboard when the selection is actually made by SCREEN, SORT or other DMS processing function. Or you may compare two fields in the same record: you might, for instance, want to check whether a customer's current debt to you exceeds his credit rating.

## Sorting records

DMS allows you to sort your data before you print or display it. You may sort on up to three fields at any one time and for character fields you may use all or part of a field, but the total number of characters in all the sort parameters must not exceed 30 characters. The whole file may be sorted, or parts of it chosen by the SELECT function. Sorting is always in ascending order. DMS does not actually sort the data file but produces an index file pointing to the records in the right order for this particular sort. While sorting, a work file is used; DMS gives you

the opportunity to put this on a separate disk from the data to speed things up.

If you change your data file after you have run SORT, your next use of these criteria may give you wrong results. Because DMS does not sort the actual data file, you will only have problems if you have changed data in fields which were used for sorting or for selection by that run of SORT.

## Calculations

I've mentioned the calculating facilities for giving totals on reports. DMS has two other functions which can manipulate the data. One is used in TRANSACT, to do calculations on data as it is input. The other is the PROCESS function, by which you can do quite substantial amounts of arithmetic on your data, either to make one field in the record store the result of calculations on other fields, or to update fields by applying constants. For instance, you could automatically increase all your prices by 10 percent by setting up a PROCESS run to carry out such a calculation on every record. In any one run, you may have up to eight processing statements, each up to 100 characters long. You may also use accumulators provided by DMS, to build up results as you go along; these may relate to individual records, or be accumulated over all records. You may use PROCESS on the whole data file or select parts of it, but you cannot make the calculations themselves dependent on the values of individual fields within a record.

One rather limiting feature of PROCESS is that calculations may use the usual arithmetic functions except brackets. So you have to be very careful about the precedence rules to get your results right — and this may give you some rather verbose rules which limit the extent to which you can exploit the full scope of this function.

## Security

DMS allows password protection on individual files. However, this is only effective if you use DMS in an orderly way — after use, if you just hit system reset instead of using the menu command to leave DMS the current data file remains open when you next load DMS. As mentioned above, quite extensive protection on both reading and updating is given by TRANSACT. DMS also allows you to check what you are doing by logging all transactions on the printer if you wish. So, if you need to back-track because you have made a mistake, you at least have a printed record of what you've done, although a disk record would be even more helpful because it can be read by the computer as well as by the user.

## Tailoring

There is a sense in which all data management systems can be tailored, because they can be adapted to different kinds of data. By this I mean tailoring the user image for particular purposes (that is, adapting the way the package looks to the user) and also tailoring the facilities provided — the ability, for instance, to add a processing routine to provide a function not in the



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# DMS UNDER CP/M

package. DMS has rather limited facilities for tailoring the user image, provided mainly by the TRANSACT function already described, to make both the form of updating and the way individual records are displayed conform more closely to the user's requirements. DMS does not provide the ability to include extra functions, supplied by user-written programs, within the system. But it does enable the user to copy data from a DMS data file into an ordinary sequential file, which can then be read by another program, and there are special facilities to enable you to write a file which can be read by the Wordstar Mail-Merge facility — unfortunately I didn't get a chance to try that out. There is also a utility to copy sequential files back to DMS data files.

## Ease of use

DMS is intended for people with little or no computing experience; it aims to lead them gently into familiarity with the package. The user image of the screen displays and prompts meets this aim (by and large). The overall menu-driven approach is easy to understand, though it would be helpful if the commands were more mnemonic. For instance, the individual functions are presented in roughly the order they might be used, and are labelled alphabetically within that order: the CREATE function is activated by pressing the letter B, the KEY function by pressing the letter C, and so on — C for CREATE and K for KEY would have saved me (and the beginning user I talked to) several mistakes! The layout of the menus within the functions is also poor in places.

Error messages and warnings are usually fairly clear. DMS never left me wondering what it was up to — when an operation took more than a few seconds a message was displayed to say what was going on. But recovering from one's logical errors is sometimes more tedious — for instance, the SORT and SELECT functions create specification files which, once set up, cannot be edited — you can only start again. The specification files for the REPORT function can be amended in a very limited way but you can't add extra requests to an existing specification.

Once you get beyond the novice stage, the user image is less helpful. There seems to be no way to speed up the specifications and commands once you become sufficiently experienced with the package to do without detailed prompts, which become very tedious quite quickly. Of course, it is vital for a package to help the novice as much as possible — but a good system should cater for the experienced user too.

The documentation is also of rather mixed quality. I got on rather better once I'd changed the PET manual I was sent for one which described the CP/M software which came with it! But even then, I found the approach taken

tended to fall between two stools. As is usual with such manuals, DMS is described in terms of the individual facilities it provides — CREATE, SORT, TRANSACT and so on. This made it quite difficult to see just what DMS was doing with my data. For instance, it was only by experimenting with the software that I could tell that the sorting routines create indexes rather than actually sorting the data file; this may make a substantial difference to the number of times the index must be recreated to keep it up to date. It would have been much better if the data model had been simply explained early on. This is particularly important where divisions between functions — for instance between TRANSACT and SCREEN — appear rather arbitrary.

On the other hand, there was insufficient attention paid to the problems of applying DMS in real life. Some sample files are provided with the package, which is a real help, but the manual could and should have been a lot more helpful in answering some of the 'How do I ...' questions users ask when trying to implement a real application. This is especially important with a package like DMS, where the user is largely dependent on the supplier for training and guidance. This may include some help in learning about DMS but it is most unlikely to include a detailed analysis of even one application. Such help is, of course, available from several sources for a fee, and there is much to be said for budgeting for some training when buying a package like DMS.

## Stability and reliability

There are over 1000 DMS users, although many of these use the PET rather than the CP/M version. This makes it likely that most major bugs have been ironed out, although one must always be on the lookout for oddities. If things do go wrong, the fact that Comsoft is a British company

should help to get problems fixed quickly.

DMS is being steadily improved. I am told that new versions are intended to be compatible with existing ones and are distributed to existing users for a small handling charge. I also understand that a users' group is about to be formed.

## Costs

The CP/M version of DMS costs £400 — a substantial sum in comparison with some of its competitors and more than twice the price of the PET version (mainly because the large number of different CP/M systems supposedly makes it more difficult to maintain the CP/M version). It needs about 380k of disk space for the whole system, not including any data files. Ideally you should have enough disk store to keep all of DMS on one disk drive; since you do not need all of DMS online at once, you could spread it over more than one disk if you have minifloppy disks; but this could be a real nuisance.

Like many packages, the dealer sample packs allow only small test files to be set up; in the case of DMS a maximum of five data records is allowed in sample files. So you may find it hard to get a realistic demonstration of processing times. Later in this series, we shall be publishing Benchtests on the packages reviewed, so that you can get some idea about how the major data management packages compare for processing times.

## Conclusions

DMS provides quite a wide range of facilities for creating and accessing data held in a single file. It is rather expensive compared with some of its competitors; in subsequent reviews, you will have a chance to see whether the price is justified by facilities and performance.

END



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# HIGH DENSITY VDU CARD

**Brian Hawkins continues his article on building a VDU with a look at the software.**

Last month I described the principles, hardware design and construction of a high-density VDU card. This month we'll cover the assembler language driver routines to enable the VDU card to be interfaced to an 8080/8085/Z80 processor-based system to give a professional quality, full cursor control display screen.

## Functional description

The function of the screen handler or driver routines is to control the placing of ASCII data to the display RAM and to correctly respond to certain screen control ASCII characters. This allows the user's main program to simply pass various parameters to, and call as a subroutine, the driver routines which take care of the detailed functions of the control of the display screen. There are a number of ASCII character codes that are used for control purposes instead of display characters, and the driver routines will respond to these codes and carry out the required function:

- i) Clear screen (0CH) clears the screen and resets the cursor to the top left hand corner;
- ii) Cursor advance code (09H) advances the cursor along a line;
- iii) Backspace cursor (08H) moves the cursor to the left along a line;
- iv) Cursor up (1AH) moves the cursor up one line;
- v) Cursor down (0AH) moves the cursor down one line;
- vi) Carriage return (0DH) fills the rest of the current line with spaces and resets the cursor to the start of the next line.

The cursor's position on the screen is

indicated by the character displayed at that position being video inverted, so that, for example, for new text entry to the screen the cursor appears as a solid rectangular block (ie, the video inverse of a space). For editing existing text, if the cursor was at a position displaying a character it would appear as a black character inside a white or green block. The cursor control codes enable the cursor to be moved about within the confines of the displayed screen area; when a screen boundary is reached the driver routines will ignore further commands that try to move the cursor outside the screen area.

All other ASCII codes from 00H to 7FH cause display characters to be written to the current cursor position and the cursor advanced to the next position. When the cursor reaches the end of a line a carriage return and line feed command will automatically reset the cursor to the start of the next line. In a similar fashion, when the last character of the last line is reached the driver routine automatically scrolls the screen up one line, clears the last line, and resets the cursor to the start of it.

Figure 1 shows how the display memory map is organised. In my prototype system, the base address of the 4k memory block was set at F000H. The diagram shows that the map is not continuous, and so one of the main functions of the driver routine is to turn this into a continuous map (ie, so that the start of line 1, for example, will appear to the host system after the end of line 0). The software does this by keeping the current cursor position stored as two variables, a character position and a line number, and operating on these two variables to keep the cursor within the displayed memory area. The variables required by

the driver routines are in fact stored in a section of the non-displayed memory of the high density VDU card.

## Detailed software operation

The screen driver software consists of a number of routines and subroutines written in 8080/8085/Z80 assembler code (400 bytes of code).

The main driver routine is called CHAROP and its function is as a single character output subroutine; this is the main software interface between the host machine's software and the VDU card. CHAROP should be called by the host machine's software with the ASCII character that is to be displayed (or an ASCII command character) in the accumulator. On entry to the subroutine the processor's current status and registers are pushed onto the stack and then the ASCII code in the accumulator is tested to see if it is a display character

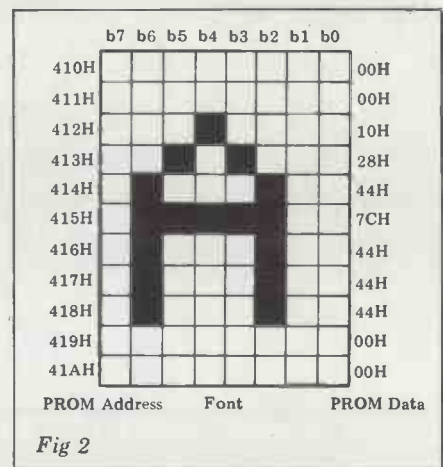


Fig 2

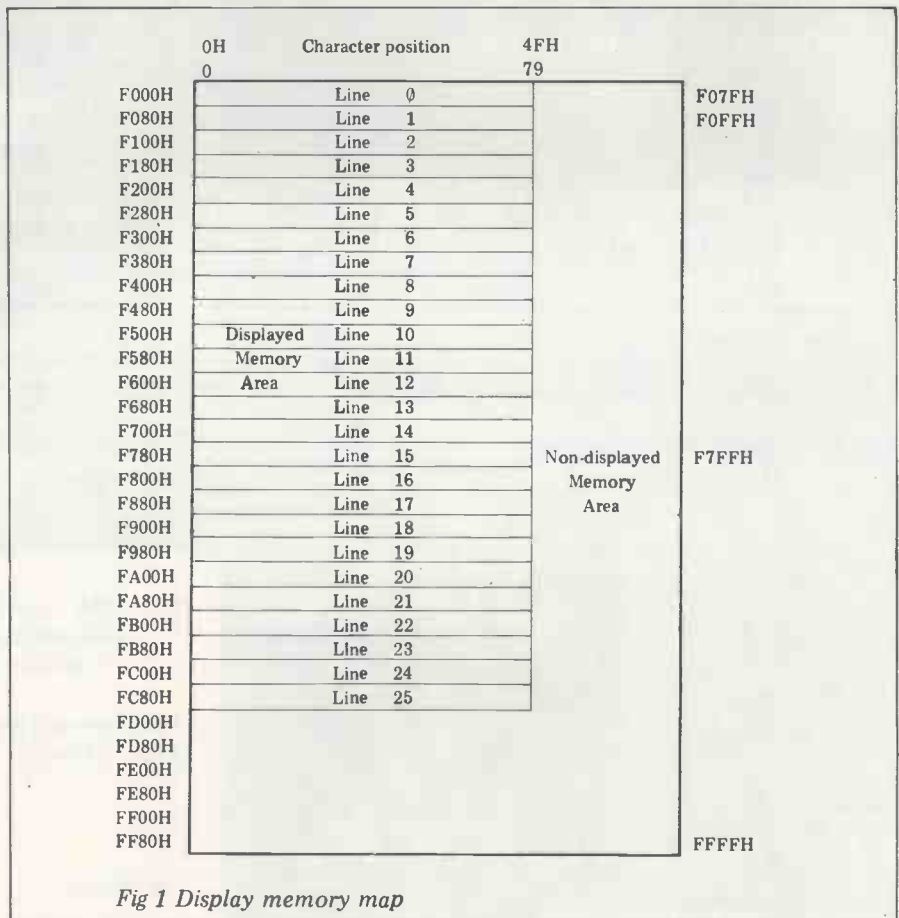


Fig 1 Display memory map



or one of the command characters previously described.

If the ASCII character in the accumulator is a normal display code, the next step is to copy the character to the B register and then to call the subroutine INVCLC. The function of the INVCLC (invert video at current line and character position) subroutine is to find the display memory address that corresponds to the current line number and character and then to invert the video at that position. At this point in the CHAROP routine this subroutine has the effect of removing the cursor from the screen and returning with the memory address of the current cursor position in the H and L index register. The next operation is to write ASCII code in the B register to the memory byte whose address is contained in H and L (MOV M,B). The subroutine CURINC, cursor increment, is then called. This subroutine function is to increment the current cursor position to the next permissible location. The subroutine INVCLC is then called to replace the cursor back onto the screen and finally the processor's status and registers are 'popped' off the stack before returning from the CHAROP subroutine to the user's program. If, on the other hand, a control code is sent to the CHAROP subroutine, a number of other sections of code will be implemented.

1. Carriage return '0DH'. Program flow jumps to the label CARRET; the first step is to remove the cursor from the screen by calling INVCLV. The next step is to calculate the memory address corresponding to the current cursor position by calling FNDLOC. An ASCII 20H (Space) is then written to memory and the position number is then examined to see if it is zero (i.e. we have reached the start of a new line); if this is not the case, program flow jumps to CAR1 and the above steps are repeated. If, however, the condition is satisfied, the cursor is restored to the screen by calling INVCLC and the CHAROP subroutine is left by jumping to RETCH. In this way, when a carriage return code is sent the driver routine fills the rest of the current line with spaces and resets the cursor to the start of the next line.
2. Cursor Advance '09H'. Program flow jumps to the label CURADV and again the first step is to remove the cursor from the screen by calling INVCLC. The character position number CHARNO is then examined to see if it is '4FH'. If it is, the cursor has reached the end of a line and no action is taken, the cursor then being replaced and the subroutine exited from. If, however, we are not at the end of a line the character number is incremented and the cursor replaced, and the subroutine left by jumping to RETCH.
3. Backspace cursor '08H'. Program flow jumps to the label BACKSP and the cursor removed from the screen. As in the last case the character number is examined but this time for the start of a line. If this is the case no further action is taken, the cursor is restored and the routine left via RETCH. If the cursor has not reached the start of the line, however, the character number is

ASCII code	Character	PROM address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00	NUL	00X																
01	□	01X	FF	81	81	81	81	81	81	81	81	81	FF					
02	◆	02X			10	38	7C	FE	7C	38	10							
03	▲	03X				10	10	38	38	7C	7C	FE	FE					
04	■	04X				7C	7C	7C	7C									
05	×	05X			82	44	28	10	28	44	82							
06	●	06X			38	7C	FE	FE	FE	7C	38							
07	BEL	07X	18	18	3C	3C	3C	3C	3C	3C	7E							
08	←	08X						20	40	FF	40	20						
09	→	09X					04	02	FF	02	04							
0A	↓	0AX	10	10	10	10	10	10	10	92	54	38	10					
0B	↵	0BX				3E	1C	FC	1C	3E								
0C	↶	0CX	F0	C0		A0	90	08	04	02	01							
0D	↷	0DX				7C	38	3F	38	7C								
0E	↸	0EX	10	10	54	7C	7C	7C	44									
0F	↹	0FX				44	7C	7C	7C	54	10	10						
10	↻	10X				F8	20	71	7F	72								
11	↼	11X				1F	04	4E	FE	8E								
12	↽	12X			0C	18	31	FE	31	18	0C							
13	↾	13X			20	18	8C	7F	8C	18	30							
14	↿	14X	10	10	38	38	38	38	38	7C	7C	7C	44					
15	⊠	15X	CC	CC	33	33	CC	CC	33	33	CC	CC	33					
16	⊡	16X	38	38	38	10	38	54	92	38	28	44	44					
17	⊢	17X	55	FF	55	FF	55	FF	55	FF	55	FF	55					
18	⊣	18X	24	24	FF	24	24	FF	24	24	FF	24	24					
19	⊤	19X	FF	99	99	99	99	FF	99	99	99	99	FF					
1A	↑	1AX	10	38	54	92	10	10	10	10	10	10	10					
1B	□	1BX	FF	81	81	81	99	99	99	81	81	81	FF					
1C	◁	1CX			08	10	20	10	08	20	10	08						
1D	≠	1DX					40	7C	10	7C	04							
1E	▷	1EX			20	10	08	10	20	08	10	20						
1F	⊕	1FX	3C	24	24	E7	81	81	81	E7	24	24	3C					

Fig 3(a) Character font (all unmarked bytes are 00H)

ASCII code	Character	PROM address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
20	'Space'	20X																
21	!	21X			10	10	10	10			10							
22	"	22X			28	28												
23	#	23X			28	28	7C	28	7C	28	28							
24	\$	24X			10	3C	50	70	1C	14	78	10						
25	%	25X		20	52	24	08	10	24	4A	04							
26	&	26X			30	48	50	20	54	48	34							
27	'	27X			18	18	20											
28	(	28X			08	10	20	20	20	10	08							
29	)	29X			20	10	08	08	08	10	20							
2A	*	2AX			10	54	38	7C	38	54	10							
2B	+	2BX			10	10	10	7C	10	10	10							
2C	,	2CX								18	18	20						
2D	-	2DX							7C									
2E	.	2EX								18	18							
2F	/	2FX			04	04	08	10	20	40	40							
30	0	30X			38	44	4C	54	64	44	38							
31	1	21X			10	30	10	10	10	10	38							
32	2	32X			38	44	04	08	10	20	7C							
33	3	33X			38	44	04	18	04	44	38							
34	4	34X			08	18	28	48	7C	08	08							
35	5	35X			7C	40	78	44	04	44	38							
36	6	36X			18	20	40	78	44	44	38							
37	7	37X			7C	44	08	10	20	20	20							
38	8	38X			38	44	44	38	44	44	38							
39	9	39X			38	44	44	3C	04	08	30							
3A	:	3AX					18	18		18	18							
3B	;	3BX					18	18		18	18	20						
3C	<	3CX					08	10	20	10	08							
3D	=	3DX							7C	7C								
3E	>	3EX					20	10	08	10	20							
3F	?	3FX			30	48	08	30	20		20							

Fig 3(b) Character font

4. Line feed (cursor down) '0AH'. Program flow jumps to LFEED. This is similar to the last two cases except that this time the line number is decremented (hence moving the cursor back one space), the cursor restored to the screen by calling INVCLC and the routine left via RETCH.
5. Cursor up '1AH'. Program flow jumps to CUP, and the routine is similar to that for cursor down except that the line number is decremented unless the cursor is at the top of the screen already.
6. Clear screen '0CH'. Program flow

# HIGH DENSITY VDU CARD

jumps to the label CLRSCN. The subroutine CSCRN is called and this routine clears the screen by filling the screen with ASCII spaces and zeros the line and character number variables CHARNO and LINENO. The cursor is then replaced onto the screen and the routine left by jumping to RETCH.

Other Subroutines are:

Initialise screen (INSCRN) subroutines. This initialises the various screen pointers, clears the screen and set the cursor up in the home position. It should be called by the host systems' software as part of the system initialisation procedure routine.

Find screen memory location (FNDLOC) subroutine. This takes the current line and character number from the variables CHARNO and LINENO and from them calculates the corresponding display memory address (see Figure 1). This address is placed in the index register H and L and control is then returned to the caller.

Invert video at current line and character position (INVCLC) subroutine. This first finds the display memory address corresponding to the current line and character numbers by calling FNDLOC. The routine then fetches the memory byte stored at that address and inverts the top bit; this has the effect of video inverting the character cell from white on black to black on white (or vice versa).

Cursor increment (CURINC) subroutine. This increments the current cursor position held in the two variables CHARNO and LINENO. When called, this routine increments the character position in CHARNO and then checks to see if it needs to start a new line (see Figure 1) by comparing with '50H'. If this is the case, the character number is reset to zero (ie, the start of a line) and the line number LINENO is incremented. The line number is itself then checked to see if the end of the page has been reached; if this is the case the subroutine called SCROLL is called to scroll the whole display screen up one line to allow text entry to continue.

Scroll screen subroutine. This has the effect of moving line 1 to line 0, line 2 to line 1 . . . line 25 to line 24, and clearing the last line, line 25; thus the complete screen is scrolled up one line. To do this a scroll line number and scroll character number SCHARN & SLINEN are used so as to leave the normal character and line numbers unaffected by this routine.

Fill screen (FSCRN) subroutine. This fills the complete screen area with the character whose ASCII code is in the accumulator when the routine is called. Its main function is in the clear screen routine which clears the screen by filling it with ASCII space characters, but it could be used to create the background for a graphics type game, for example.

Clear screen (CSCRN) subroutine. This subroutine clears the screen by loading the accumulator with '20H' (ASCII space) and calling FSCRN.

As described in part one, the character font uses a 2716 EPROM to store 128 characters corresponding to the ASCII codes '00H' to '7FH'. A character cell consists of 11 rows of

eight columns. Figure 2, for example, shows the character font and PROM data pattern for an 'A'; this demonstrates how to code the PROM data for any required font pattern. Figures 3a, b, c, and d give a listing of the data for the standard ASCII character set plus some example graphics characters (Figure 3a).

## Conclusion

These two articles have described a flexible low-cost high-density VDU

interface card that may be added to most of the popular systems on the market today. The addition of this unit will help to upgrade a system to that of a much more expensive professional machine at a cost that will allow more computing power to more people — which after all is what personal computing is all about.

*A full software listing plus circuit diagrams will be published next month.*

ASCII code	Character	PROM address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
40	@	40X			1C	22	4E	54	4C	20	1C							
41	A	41X		10	28	44	7C	44	44	44								
42	B	42X		78	24	24	38	24	24	78								
43	C	43X		38	44	40	40	40	44	38								
44	D	44X		78	24	24	24	24	24	78								
45	E	45X		7C	40	40	78	40	40	7C								
46	F	46X		7C	40	40	78	40	40	7C								
47	G	47X		38	44	40	5C	44	44	38								
48	H	48X		44	44	44	7C	44	44	44								
49	I	49X		38	10	10	10	10	10	38								
4A	J	4AX		1C	08	08	08	08	48	30								
4B	K	4BX		44	48	50	60	50	48	44								
4C	L	4CX		40	40	40	40	40	40	7C								
4D	M	4DX		44	6C	54	54	44	44	44								
4E	N	4EX		44	44	64	54	4C	44	44								
4F	O	4FX		10	28	44	44	44	28	10								
50	P	50X		78	44	44	78	40	40	40								
51	Q	51X		38	44	44	44	44	4C	3C								
52	R	52X		78	44	44	78	50	48	44								
53	S	53X		38	44	40	38	04	44	38								
54	T	54X		7C	10	10	10	10	10	10								
55	U	55X		44	44	44	44	44	44	38								
56	V	56X		44	44	44	28	28	10	10								
57	W	57X		44	44	44	54	54	6C	44								
58	X	58X		44	44	28	10	28	44	44								
59	Y	59X		44	44	28	10	10	10	10								
5A	Z	5AX		7C	04	08	10	20	40	7C								
5B	[	5BX		38	20	20	20	20	20	38								
5C	\	5CX		40	20	10	08	04										
5D		5DX		1C	04	04	04	04	04	1C								
5E	↑	5EX		10	38	54	10	10	10	10								
5F	—	5FX									FF							

Fig 3(c) Character font

ASCII code	Character	PROM address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
60	,	60X			18	18	08											
61	a	61X					30	08	38	48	34							
62	b	62X			40	40	58	64	44	64	58							
63	c	63X					38	44	40	44	38							
64	d	64X		04	04	34	4C	44	4C	34								
65	e	65X					38	44	7C	40	38							
66	f	66X		08	14	10	38	10	10	10								
67	g	67X					34	4C	4C	34	04	44	38					
68	h	68X		40	40	58	64	44	44	44								
69	i	69X		10		30	10	10	10	38								
6A	j	6AX		08		18	08	08	08	08	48	30						
6B	k	6BX		40	40	48	50	60	50	48								
6C	l	6CX		18	08	08	08	08	08	1C								
6D	m	6DX					6C	54	54	54	44							
6E	n	6EX					58	64	44	44	44							
6F	o	6FX					38	44	44	44	38							
70	p	70X					58	64	44	64	58	40	40					
71	q	71X					34	4C	44	4C	34	04	06					
72	r	72X					58	64	40	40	40							
73	s	73X					38	40	38	04	78							
74	t	74X			10	38	10	10	14	08								
75	u	75X					44	44	44	4C	34							
76	v	76X					44	44	44	28	10							
77	w	77X					44	54	54	54	28							
78	x	78X					44	28	10	28	44							
79	y	79X					44	44	44	4C	34	04	38					
7A	z	7AX					7C	08	10	20	7C							
7B	{	7BX			08	10	10	20	10	10	08							
7C		7CX	10	10	10	10	10	10	10	10	10	10	10					
7D	}	7DX			20	10	10	08	10	10	20							
7E	~	7EX					20	54	80									
7F	␣	7FX	C0	A0	C0	A0	BC	CC	0D	2F	16	05	05					

Fig 3(d) Character font



# "Give me one good reason why I should choose a VIC 20 home computer."



**1.** VIC is outstanding value for money. No other colour home computer can give so much for under £200.

**2.** Total standard memory 25K made up of 20K ROM and 5K RAM.

**3.** Fully expandable to 32K of user RAM.

**4.** Microsoft Basic interpreter as standard.

**5.** Accessible machine language as standard.

**6.** Connects direct to monitor or standard television.

**7.** Full size typewriter-style keyboard.

**8.** Full colour and sound.

**9.** All colours directly controllable from the keyboard.

**10.** 62 predefined graphic characters direct from the keyboard.

**11.** Full set of upper and lower case characters.

**12.** 512 displayable characters direct from the keyboard.

**13.** High resolution graphics capability built into the machine.

**14.** Programmable function keys.

**15.** Automatic repeat on cursor function keys.

**16.** User-definable input/output port.

**17.** Machine bus port for memory expansion and ROM software.

**18.** Standard interfaces for hardware peripherals.

**19.** VIC 20 is truly expandable into a highly sophisticated computer system. The comprehensive list of accessories includes the following:

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- Single drive 5¼" floppy disk unit (170 K bytes capacity).
- 80-column dot matrix printer.
- 3K, 8K and 16K RAM expansion cartridges.
- Programming aid packs, including a high resolution graphics cartridge, a machine code monitor cartridge and a programmers' aid cartridge.
- Memory expansion board.
- Plug-in conversion box for a full 32K, 40-column x 25 lines VIC including Prestel compatibility.
- Prestel/Tantel interface package.
- RS 232C communication cartridge.
- IEEE/488 interface cartridge.
- Joysticks, light pens, paddles and motor controllers.

**20.** Full range of software for home, education, business and entertainment on disk, cassette and cartridge.

**21.** Books, manuals and learning aids from Teach Yourself Basic to the VIC programmers' reference guide (a must for advanced programmers).

**22.** Full support for VIC owners – their own magazine 'VIC Computing' as well as a national network of VIC user groups.

**23.** National dealer network providing full service and support to VIC owners.

**24.** Expertise and experience – Commodore are world leaders in microcomputer and silicon chip technology.

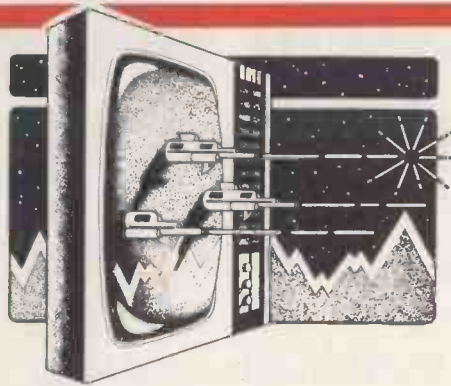
**25.** Commodore is the leading supplier of micro-computers in the UK to business, schools, industry and the home.

**26.** VIC 20 is the best-selling colour home computer in the UK.

How many reasons was it you wanted?

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**The best home computer in the world.**

# SCREENPLAY



The advances in computer-controlled video games over the past five years or so are breathtaking. A limited number of (mainly textual) computer games had been available to large computer users for many years, but the computing power required prohibited their use by the general public. In the mid-'70s, as the price of components fell and video techniques improved, the first stand-alone video games appeared, seemingly overnight, in arcades and bars throughout the western world. It started with those tennis games, where each player had a flat paddle (sometimes two) with which to return a simple bouncing ball. A slight sophistication of this was the popular 'Breakout', with the ball being used to knock out bricks from a horizontal wall. Then came Space Invaders, which rapidly achieved such notoriety that its name is now often (erroneously) used to describe the entire *genre*.

As Space Invaders and all its descendent forms took over the arcades, the paddle games became available on cheap modules plugging into a domestic TV. For a while, microcomputers could offer only fairly limited textual stuff (like Hangman), but with the advent of cheap graphics they, too, began to run sophisticated and colourful video games. Now the gap between home computers

## In this new series Dick Olney reviews the games software for popular home computers. This month the Texas Instruments 99/4A

and TV video game modules has started to evaporate and may very soon disappear altogether. After all, if a unit has the power to run complex games programs, why not make that power available to the user?

Over the coming months I shall be looking with a critical eye at the games which home computers have to offer. Although many of the arcade originals like Space Invaders are now available on micros, the arcade games will remain some way ahead of their living room counterparts, if only because it makes sound economic sense for whoever owns

the software copyright. For this reason I intend to look also at some of the best of these games.

## Hardware

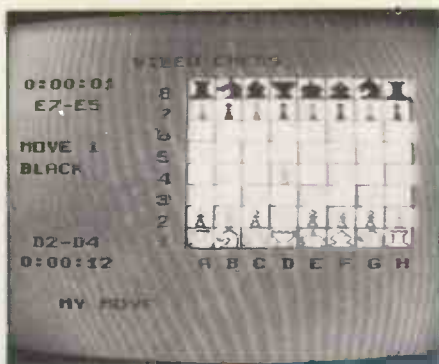
We start this month with the Texas Instruments 99/4A, a compact and attractive microcomputer (see the Benchtest elsewhere in this issue) which, at £300 for the basic system, is aimed directly at the home market. It interfaces to a domestic TV though an external PAL modulator (the original machine only worked on American TVs), giving good — though not high resolution — colour graphics. Up to four disk drives can be attached but these aren't necessary to run the games software, which is supplied in plug-in ROM packs called 'Command Modules'. The machine is built around the 9900 16-bit processor and carries 16k of RAM (expandable to 48k).

Many of the games either require or are enhanced by ownership of 8-way joysticks which will cost you around £30. The system has an external power supply and with all the bits and pieces you'll find a lot of loose wires trailing about. Even a slight tug on one of these and your game may be abruptly terminated; so if you've got kids then beware.



Chris McEwan





**GAME:** Video Chess  
**PRICE:** £49.95  
**SUPPLIER:** TI

This is the most expensive game TI supplies. After plugging in the module, selecting from the initial menu, and watching some oversized pieces move around part of a board accompanied by a little tune, you are presented with six options. The first two involve playing a game against the computer; either going straight into a beginner's game or choosing your own skill level. The program plays at three levels — described as beginner, novice and intermediate — and you can instruct it to use normal, defensive or aggressive tactics. The vertical plane representation of the board took a little getting used to, as did the Cartesian co-ordinates used to move, but it is fairly easy to get the hang of.

You can be assured of a very competent game of chess at all levels, although after a few games some rather interesting features become apparent. Rooks are given a very high priority, which is all very reasonable, but the TI chess seems to have an almost neurotic obsession with them. It is also a little too paranoid about its Queen, so that this piece is rarely exploited fully, and it generally ignores attempts by opposing pawns to reach the top of the board. Having said this, I should point out that I am not the world's best chess player! As the description of skill levels suggests, any really good chess player can be sure of beating the TI every time. Of course, nobody wants to play any game which they consistently lose but I do feel that we should at least have the option of a slightly more formidable opponent.

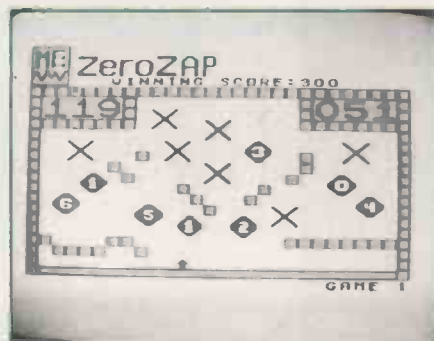
There are some nice touches which should prove of particular interest to learner chess players. The computer can swap sides at any time during a game and — associated with this ability — can always be persuaded to suggest a good move for you (yes — it always carries out its own suggestions if called on to do so). Pieces can be changed around at will during a game and any move can be replayed if desired.

Other options include setting up

problems — that is positioning the pieces as if in the middle of a game — and using the board with two human players. Personally, if I'm playing another person, I'd rather use a normal chessboard but the problems setup is very good indeed. Another feature was the option to play up to eight simultaneous games against the machine, though you'll need plenty of time on your hands to fully appreciate this. There is also an option to load games to and from cassette, but I was unable to test this.

Despite its limitation in skill level, the TI Video Chess is a well-presented package which provides you with a competent chess partner. Its high price is balanced out by the proven lasting interest generated by the game of chess, but it is definitely more suited to a casual chess player than to a chess-fanatic.

**PRESENTATION:** \*\*\*\*\*  
**SPECIAL FEATURES:** \*\*\*\*  
**PLAYING SKILL:** \*\*\*  
**VALUE FOR MONEY:** \*\*\*\*

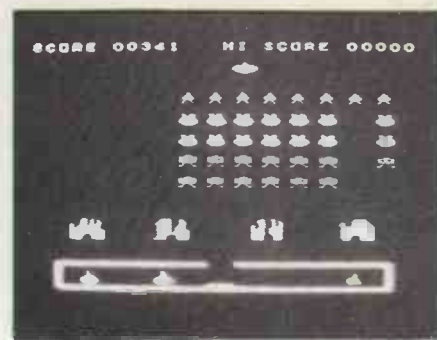


**GAME:** Zero Zap  
**PRICE:** £19.95  
**SUPPLIER:** TI (Produced by Milton Bradley)

This is a sort of pinball game in which you fire a small arrow upwards into a configuration of crosses, diamonds and small squares. Each shape causes the arrow to rebound in a different direction, with the crosses changing to diamonds if hit and vice versa. Only diamonds score points and each one displays a value between zero and nine. The name of the game derives from the fact that if your arrow hits a zero diamond it 'dies' and your go terminates; otherwise the arrow continues until it hits the base line. Three different configurations are offered. There appears to be a facility for designing new ones, but I couldn't get it to work. Zero Zap has an intriguing quality not unlike those executives games with balls on strings moving under the influence of various magnetic forces. It is somehow relaxing

and comforting to watch, if a little mindless to play.

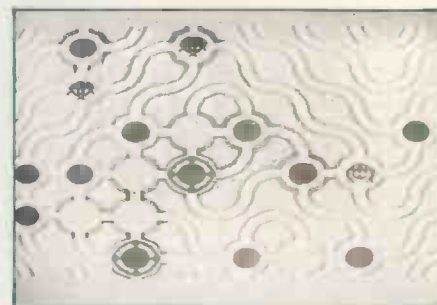
**ADDICTIVE QUALITY:** \*\*  
**USE OF GRAPHICS:** \*\*\*\*  
**RESPONSE SPEED:** N/A  
**VALUE FOR MONEY:** \*



**GAME:** TI Invaders  
**PRICE:** £39.00  
**SUPPLIER:** TI

As you've probably guessed, this is Texas Instruments' version of Space Invaders. It should be available soon and is very slick, although strangely it only allows one-player games. Good use is made of the graphics by the colour scheme, and the program runs fast and fluently. I long ago tired of this game in the arcades, but having such a good version in my living room did rekindle my interest. If you haven't already spent your quota in ten pences then you'll probably find this module good value for money.

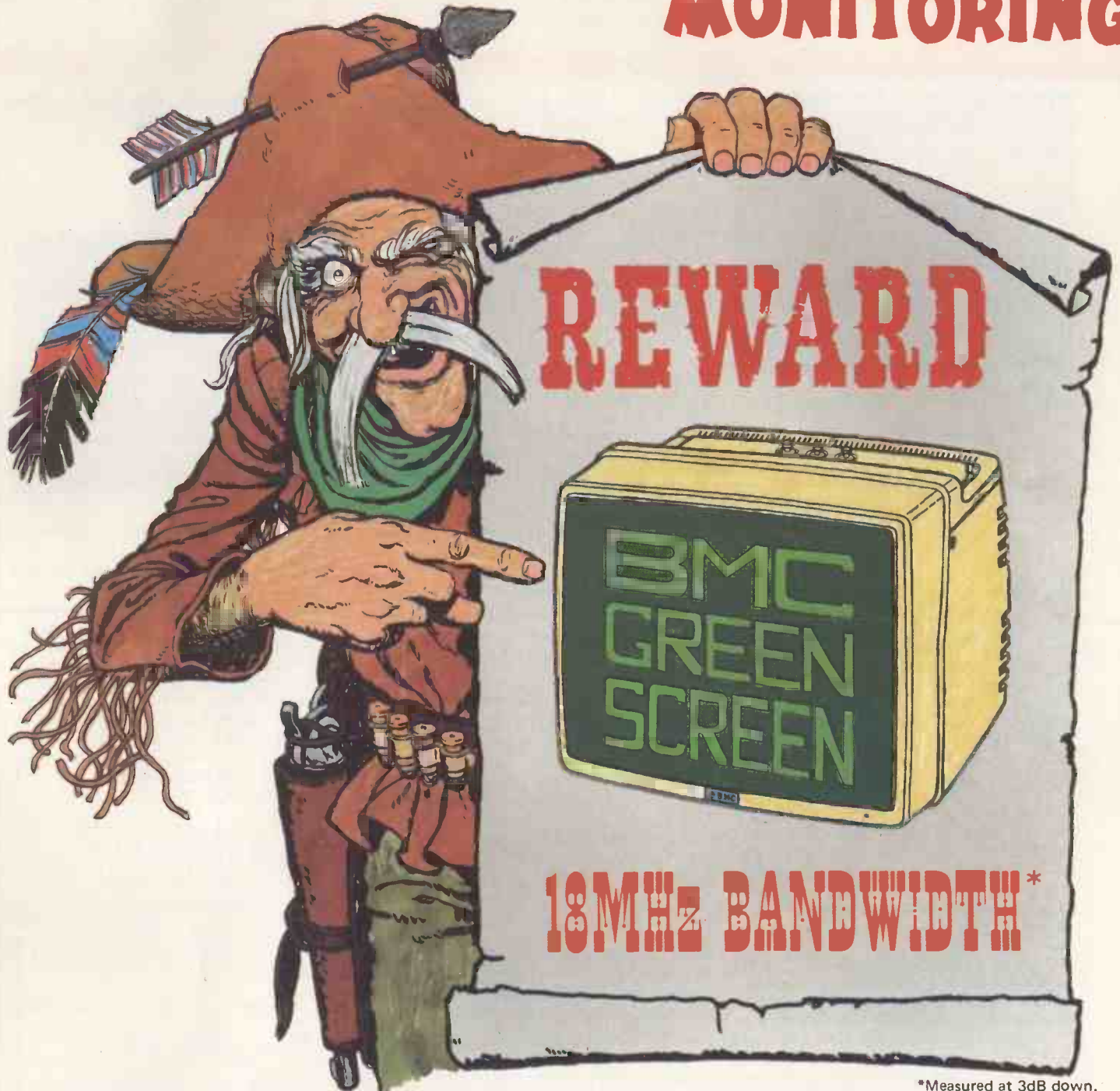
**ADDICTIVE QUALITY:** \*\*\*\*\*  
**USE OF GRAPHICS:** \*\*\*\*\*  
**RESPONSE SPEED:** \*\*\*\*  
**VALUE FOR MONEY:** \*\*\*\*



**GAME:** Hunt The Wumpus  
**PRICE:** £19.95  
**SUPPLIER:** TI

Many versions of this game can be found on various computers. It involves moving a little man (woman?) around the screen which gradually reveals a maze of caverns, one of which is inhabited by the carnivorous Wumpus. Indications are given when you are two caverns away from the aforementioned or one away from a deadly slime pit. Some caverns may also contain bats

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which occasionally transport you to random portions in the maze. When you have located the Wumpus, you fire an arrow up the tunnel towards the cavern in which you think he's hiding (having positioned yourself in an adjacent cavern). If you miss him — or if you stumble into his lair by mistake — the Wumpus wakes up and eats you, so you've only got one try. Three different complexities of maze are possible as well as express (missing out tunnels) and blindfold (the maze disappears behind you) versions. Your character can be moved via the keyboard or using the joysticks, and can travel in four directions. The game is a lot of fun for a while but I'm not sure how long it would hold my interest. I loved the slime pit graphics!

**ADDICTIVE QUALITY:** \*\*  
**USE OF GRAPHICS:** \*\*\*\*  
**RESPONSE TIME:** N/A  
**VALUE FOR MONEY:** \*\*\*



**GAME:** Tombstone City  
**PRICE:** £39.00  
**SUPPLIER:** TI

This game has the irritating feature of using the 8-way joysticks for 4-way motion. Fortunately, there is also the option of using the arrow keys (E, S, D, and X) which I actually found easier. You control a small triangle, described as a schooner, which can fire missiles at hostile little monsters called, 'morgs' and at balls of tumbleweed. The former turn into 'saguards' if hit; these look like tombstones and obstruct movement. The schooner can take refuge inside a square grid of corridors in the centre of the screen. Saguards will block the exits to this area, however, so care must be taken not to seal

GOTO page 192

## ARCADE ACE



Inevitably the arcade game I have chosen to kick off with is my personal favourite; the complex 'Defender'. Generally, I begin to lose interest in games soon after my score ceases to improve (though I'm not sure which way this relationship works), but I've found 'Defender' an inexhaustible source of amusement. The playing object looks like a jet fighter and moves both horizontally and vertically. Vertical movement is controlled by a simple two-way joystick, and horizontal movement via a 'thrust button'. There is also a reverse button which turns the craft round, so you really do have complete control over it. At the bottom of the screen there is an outline of mountains, presumably representing the surface of a planet, but this does not restrict your movement.

The main screen shows only a section of the action and this is complemented by a small scan screen at the top showing the entire playing area. There are ten humanoids scattered around the planet's surface, and your main task is to prevent these being kidnapped by yellow

splodges called 'Landers'. The fire button gives a rapid and continuous beam from the front of your craft and to supplement this you are also supplied with a limited number of 'smart bombs', which kill all aliens on the main screen. The landers try pick up the humanoids and carry them to the top of the screen. If successful, they turn into 'mutants' which give you a lot of trouble. If you shoot a lander while it is attempting this, you can pick up the humanoid and deposit it back on the planet, for which you gain 1000 points. When all the aliens have been destroyed you are given a bonus for remaining humanoids and a fresh attack wave begins.

In the second and subsequent attack waves a varied selection of aliens is thrown against you. 'Bombers' are little purple squares pursuing a kind of sine wave course in packs of three or more and leaving deadly mines in their wake (luckily these mines are only active for a limited period). 'Pods' are little glistening orbs which, when hit, release a random number of 'swarmers'. The swarmers, as their name suggests, tend to stick together, and are like fast moving orange pips. If you take too long over an attack wave, then 'baiters' appear; they look like little flying saucers and are very difficult to shoot down. I should add that all of these except pods and bombers are constantly firing missiles at you.

If all your humanoids are destroyed (either by landers or your shooting them by mistake) then the planet surface disappears and all landers turn into mutants which mount a concerted and sustained attack on your craft. You start with three ships and three smart bombs and get an extra one of each for every 10,000 points. This means that the game could, theoretically, go on for ever; but in practice the real experts seem

to knock up a maximum of around 250,000.

The positioning of the various controls can vary, but usually your left hand controls the joystick and reverse button, whilst your right hand is responsible for the thrust, fire and smart bomb buttons. One other feature is a hyperspace button which randomly transports your ship to a new position in the playing area. This is fairly hazardous and — partly because the button is out of reach of both hands — I have yet to integrate this function into my game, though many people use it reasonably effectively in cases of extreme panic.

The graphics and sound effects are superb, but the real joy of this game is the extensive control which you have over your ship. The incredibly rapid responses of the machine make for a fast-moving and exciting battle, and the varied nature of the aliens and their modes of attack call for complex tactical manoeuvres. The only drawback to all this is that it takes some time (and a very large number of ten pences) before you really play a satisfying game. I look forward to the time when games of this speed and quality are available on home units.



**BENCHTEST**  
BUSINESS SYSTEM

# THE SOFT MACHINE

## HP-125

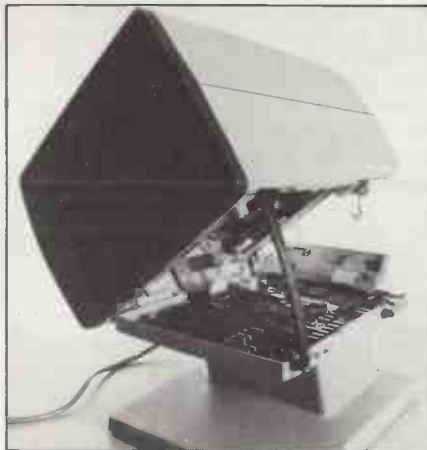
Dick Pountain gets to grips with HP's  
classy business micro

Digital Research must have found 1981 a most satisfactory year indeed. Prior to 1980 it would have been fair to describe its best-known product, CP/M, as one of the leading microcomputer operating systems; nevertheless, it still had competition from this DOS and that DOS. In 1981, however, CP/M became unquestionably *the* operating system for commercial users, largely through the actions of three firms: IBM, Xerox and Hewlett-Packard. None of these firms are exactly wet behind the ears where computers are concerned; all three were entering the business micro market for the first time and all three decided to offer fealty to the new sovereign, CP/M.

The only problem with all this is that, though it has lots of nice aids for the programmer (like assembler-debugger-disassembler and file handling routines), CP/M is about as friendly to the end-user as a praying mantis. As far as most businessmen are concerned DDT is a fly spray and PIPs are something you spit out. One of the prominent features of most successful CP/M software packages, like the word processor I'm writing this on, is that they keep you as far away as they can from the operating system by wallpapering it over with their own mnemonic command codes; even then it's usually not far enough.

Hewlett-Packard has an enviable, Rolls-Royce like reputation for supplying high quality goods at high quality prices. It is no surprise, therefore, to discover that having (wisely) decided to swim with the tide and adopt CP/M for its new business micro, the HP-125, it felt obliged to knock some of the rough edges off. This has been accomplished not by altering the op-system itself but by carefully designed hardware aids such that an end user can use the machine for months without ever seeing A>.

At a minimum system price of £4,800

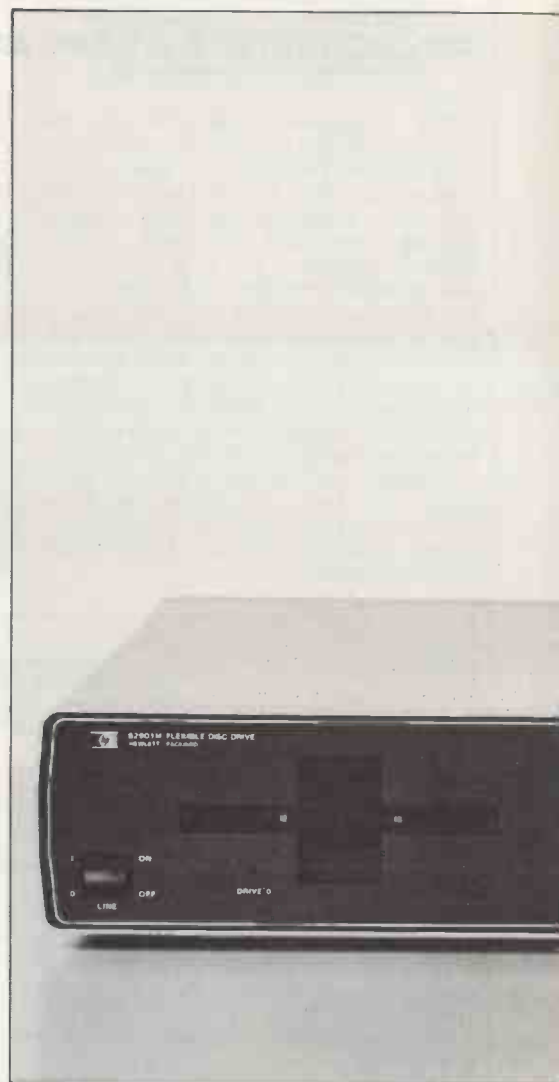


*Under the hood*

the 125 is not bargain-basement stuff, and a principal object of this test was to find out what could justify spending such a sum when an ostensibly equal system can be had for well under £3,000.

### Hardware

The HP-125 comes in a package which, in conformity with the current trend, features a remote keyboard (as do the IBM and Sirius). The processor and VDU are housed in a separate pedestal which is adapted from HP's own 2621 terminal design. This high-quality ABS moulding opens sideways upon slackening two screws and props open like a car hood, revealing a single main board which is removed in a trice from its four 'pop' fasteners. This board contains the two Z80A processors and 80k of RAM, of which 16k is reserved for the terminal functions. In addition there are five ROMs (32k in all) containing the firmware which supports the 125's fancy features. One of these may be replaced with optional foreign language character



*The integral thermal printer*

sets. The machine is in fact designed as two entities, the computer and the terminal, each with its own processor and memory. The front end requires the computer to send it standard HP escape codes just as if it were a remote terminal; the two can even be (logically) disconnected. The closely packed electronics are kept cool by a quiet fan in the base which blows air up the pedestal column and out through louvres in the top; as the intake is under the foot it is as well not to stand the 125 on a shag-pile rug.

The 12 in CRT displays in untrendy black and white. The resolution is





*The key group at top left contains the 125s secret weapon*

a very high 720 x 360 dots which permits the use of well-formed characters on a larger than usual 9 x 15 matrix, making for excellent readability. The screen holds the standard 80 x 24 characters though in fact 26 lines are displayed, the bottom two being permanently reserved for the soft key function labels — of which more later. The other unusual feature of the screen is that the display buffer holds 120 lines of text or five screens-full; the screen is treated as a window into this longer document and can be scrolled up or down either one line or one page at a time by four special keys.

Set in the top of the case on the machine I tested was the optional internal printer, a thermal device which takes rolls of friction feed 8½in paper and produces clear blue characters at a commendable 100 cps. It is permanently online and can be selected from the keyboard for listings, screen dumps and the like, though it is definitely not intended for serious word processing.

The keyboard is connected at the back of the case via a rather short stiff cable; a coiled connector would have allowed freer mobility when used on the knee. The 97 keys are of

excellent quality and feel, are fully debounced with n-key roll-over, and all have auto repeat. Apart from the main Qwerty block there are numeric pad, cursor key, edit key, help key, and soft key blocks. The cursor controls are four-way plus 'home'; edit controls are character or line delete and insert, and clear from present cursor position to the end of screen memory (clear screen is achieved by preceding this key with 'home'). ROLL UP/DOWN and NEXT/PREV PAGE control scrolling through screen memory. My only complaint about the keyboard is that the CAPS lock has no light or other signal to show that it's engaged.

The rear of the pedestal proffers two RS232C ports for peripherals and communications and one HP-IB (more familiar as IEEE-488, though Hewlett-Packard did invent it) port through which the disk drives and HP printers connect. The supplied connector cable for this interface has plugs which carry a second socket so that they can be stacked up, which allows daisy chain or parallel arrangement of peripherals or a mixture. You could have eight disk drives daisy-chained with a printer and a plotter in parallel all on the one socket; since each HP peripheral can be set to a unique 'device address' no recognition problem will arise.

Both 5in and 8in disk drives are available, though the test was carried out with the dual 5in. Each type occupies a separate housing which in the

# BENCHTEST

## BUSINESS SYSTEM

case of the 8in drives is enormous, rivalling the gargantuan TRS-80 II drives in sheer bulk. The 5in disks hold 256k per drive (double density, double sided, soft sectored) which is respectable if not remarkable nowadays. The 8in drives hold 1 Mbyte each in a choice of two formats; IBM standard or HP's own which is similar but with two tracks reserved; if on initialisation a duff sector is detected, that track is closed and one of the spares substituted, a 'big computer' technique not used until now on a micro. Both disk types allow selection of 'stagger' during initialisation — that is the degree of interleaving of consecutive read/write sectors. A smart programmer can speed disk access by setting this to match the processing time required between accesses in a particular application.

## Firmware

Since it is largely the superb terminal facilities which stop the 125 being just another 64k CP/M machine I shall devote a whole section to them. They fall into three main categories: Help features, Operation Modes and Test routines.

The keyboard has eight soft keys, f1 to f8, below which are three keys marked AIDS, MODES and USER KEYS. On the CRT screen the bottom two rows contain eight reverse field windows which describe the function currently allocated to each key and are placed exactly above their own keys. In the central gap appear two numbers which announce the cursor's position in the whole 120-line screen memory. If USER KEY is pressed, the keys are handed over to user programmed definitions like the soft keys on many other computers. These definitions are entered and edited by pressing SHIFT USER KEY which displays a menu of all the assignments. Labels of up to 16 characters are permitted for key functions.

When AIDS or MODES are pressed, however, control of the soft keys is handed over to firmware routines in ROM which allow selection of all the terminal features. These routines are written in a very ingenious way using a 'tree' search structure so that the eight keys can provide a host of functions. For instance, depressing AIDS displays six headings over the f-keys; printer control, margins/tabs/cols, service keys, enhance select, load op sys and config. Load op. sys. performs a reboot but any of the other options will display another menu of key assignments from which a further selection is made. For instance, pressing 'enhance select' produces the options 'remove enhance', 'enhance char.' and 'enhance line'. These apply whichever enhancement is selected (reverse video, underline, dim, flashing or any combination) to the screen. These sub-menus are carefully designed so that the most used function is on the same key which

selected the menu; once you are familiar with the system a quick double stab at the key is all that's required. 'Config' displays a whole-screen menu which allows setting of all the terminal parameters such as enhance mode, port status, communications protocols and baud rate, device selection and even keyboard click on/off and mains frequency. These parameters are set by moving the cursor to the correct place and using the soft keys for option selection; unfortunately the cursor is only a small flashing underline which is easily lost in the dense menu. The configuration is stored in a small CMOS memory which retains its contents under battery power so that it need not be reset every session; curiously, the USER key definitions are not included in this excellent scheme.

The MODES key works in a similar fashion but now what is being selected is the mode of operation. The three fundamental modes are LOCAL OP SYS, REMOTE and LOCAL. Local op. sys. hands control to CP/M and via it to applications programs or a language interpreter. Remote mode turns the 125 into a dumb terminal of a host computer, using the 16k of RAM set aside for this purpose. Communication may be direct via the RS232 (at baud rates from 110 to 9600) or a modem and telephone link. Data transferred in this mode may be logged on the internal, or any other printer. The Config utility is used to set up suitable protocols including various handshake modes and parity checks. Local mode is entered by disabling both Remote and Local Op Sys (both are toggles which display an asterisk in their window when enabled) and turns the 125 into a rather expensive electric typewriter. All input goes into screen memory only, but can be fully edited and sent to the internal printer by using the ENTER key instead of return. This is handy if a small document needs typing which doesn't justify loading up a word processor.

This brings me on to the first items on the MODES menu: MODIFY LINE and MODIFY ALL. The editing keys, in fact, only work on screen contents unless MODIFY ALL is engaged, in which case the alterations are sent to CP/M; editing is screen oriented using the cursor. MODIFY LINE allows editing of one line at a time. Neither of these keys has any effect in local mode of course and care must be taken to disable them while running Basic programs since Break and Control-C will not work with them engaged.

Another MODES utility is DISPLAY FUNCTIONS; this causes all escape and

control codes to be displayed as symbols and not executed. When defining soft keys this is marvellous as, say, a carriage return can be simply typed as a normal character at the end of an instruction, eg. RUN<CR>.

The last category of firmware aids is that of hardware tests — of which the 125 has an unprecedented number built-in.

POWER ON test is performed automatically on switching on but it can be forced at any time via the AIDS key. It consists of a test of both processors, all RAM and ROM, and peripheral controllers; after 15 seconds a report will indicate test passed or give an error code identifying the components which failed.

TERMINAL TEST is initiated through either MODES or AIDS-service keys and performs a non-destructive test of the CP/M processor, terminal RAM, firmware ROMs and internal printer if present. A separate PRINTER test is also available under 'service keys'. DATACOMM TEST tests the communication ports but requires a modem or test hood to be connected. Finally, IDENTIFY ROMS prints on the screen the serial numbers of the five ROMs fitted and includes a code saying which version they are; this is mainly intended for HP service engineers in future years, when a proliferation of ROMs may be in circulation. These must surely be the most comprehensive diagnostic routine ever supplied on a micro and bring us a little closer to the conveniences enjoyed by the mini and mainframe fraternities. The only failure I experienced during this review was on the terminal test; I had been fiddling with the printer and hadn't shut the lid properly; this was immediately picked up as 'Internal Printer error'.

It is harder to describe the Help features of the 125 than to use them. After a couple hours of practice it becomes second nature to stab the function keys and you begin to wonder how you ever managed without them.

## Software

The attraction of CP/M to a manufacturer like Hewlett-Packard is, of course, that a substantial amount of commercially proven software exists to run under it. However, having devoted so much care and attention to the friendly firmware, it would be a little crass to provide bog-standard packages which cannot exploit the 125's features. Realising this, HP has bought the rights to some well-known and accepted software and had it modified to suit.



Note stacking connector for IEEE (HP-IB) port.



CP/M itself (version 2.2) has several functions added, including a reader status call and output to an HP-IB device. Another interesting addition is call 125 which enables 'keycode mode', in which the terminal portion intercepts a keystroke on its way to CP/M and allows its redefinition under program control.

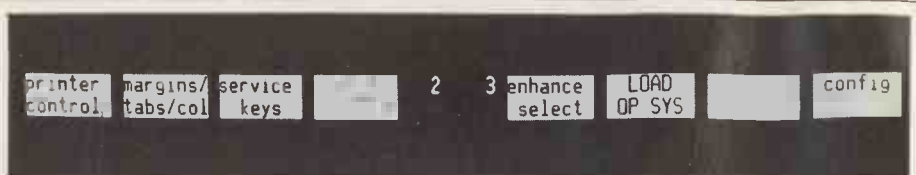
On booting CP/M (automatic on power-up from drive 0) a Welcome menu appears which has all the applications programs on the current disk assigned to soft keys; pressing the appropriate key loads and runs the program. The last option is 'exit to CP/M', which is why my earlier jest about never having to see the prompt A> could easily come true. It is heartening to see that HP has provided its own error messages, which are displayed in screen lines 25 and 26. No more 'BDOS error on A' nonsense, but plain English (American?).

Five applications are available at present, and these are supplied on separate master disks. The user installs them as required on a work disk using a routine accessed from the Welcome menu which ties the program to this menu and to a soft key. A program called Utility/125 is included which formats up to eight disks simultaneously using a menu of options. A utility for installing applications is also included. This also copies disks, consolidating files as it does so; 39k of free space was increased to 65k after its use. Formatting a 5in disk took three and a half minutes and copying 191k three minutes, which is not fast; formatting an 8in disk seemed to take forever.

Basic/125 is at root Microsoft's Basic 80 version 5.2 with the addition of facilities to incorporate the soft keys via escape sequences and to use overlays. It occupies 36k (CP/M included) of RAM, leaving the user 28k. Arithmetic is single 7-digit or double 16-digit precision, random and sequential files are supported, and several nice aids like auto line number, renumber and trace are provided along with IF ... THEN ... ELSE ... and WHILE ... WEND. The 125's superior editing overrides the rather spartan Basic-80 line editor (you remember, the one that makes you edit lines you can't see). Unfortunately, the Microsoft editor must be used for lines which occupy more than a single screen line. While Basic is running all the AIDS and MODES are available, as are the user keys, which can be assigned for single stroke entry of reserved words.

There are no new instructions in HP's implementation of Basic-80; the special hardware features are all got at by sending Escape sequences. In particular, there are no graphics statements; he who would light pixels will have to go into machine code. The soft keys (in USER mode) can be defined from a Basic program by defining a function which sends the correct string of ESC codes; this is covered in the Basic/125 manual and a complete list of codes is in the system reference manual.

The only real atrocity I found in Basic/125 is that attempting to save to a write-protected disk causes a fatal error, requiring a reboot with loss of your program. Given the general mach-



ine philosophy, couldn't this have been trapped so as to return you to Basic command level with a suitable (ie, sensible), error message?

Graphics/125 is a comprehensive set of plotting routines which can produce bar charts, pie charts and X-Y graphs with linear or logarithmic axes on an HP Plotter (7225B or 9872C); it will not work without a plotter connected and does not display on screen or printer but it can plot in eight colours, add legends, grids and seven types of shading, 'explode' slices from pie charts and produce overhead projection slides. Data entry and formatting is very easy using a screen menu and the soft keys, but lack of a plotter prevented me from performing an actual run. A very important feature is that it interfaces with Visicalc/125 by its capacity to load DIF files; it can also if required load WORD/125 files.

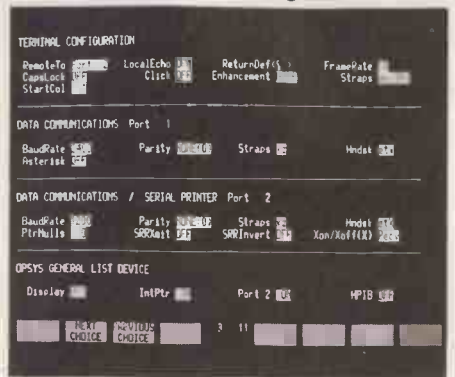
Visicalc/125 is the self-same 'Top of the Pops' program from Personal Software adapted for the first time for Z80+CP/M operation; why HP chose this expensive route rather than a CP/M ready lookalike such as Supercalc I can't say, though the mere name itself strikes a certain chord nowadays. It appears to run faster than its Apple equivalent, thanks to the separate I/O processor (the Benchmarks do not adequately reflect this bonus). This is the only application which makes no use of the soft keys; standard Visicalc codes are used and AIDS and MODES are disabled.

Word/125 is in fact Lexisoft's Spellbinder, which several trusted colleagues prefer to the more popular Wordstar though this was my first encounter with it. Certainly in this implementation, with maximum use made of the soft keys, it is a superbly fluent word-processor and creditably rapid in its response times, again thanks to the second processor. Virtually all the commands have been assigned to the soft keys using three levels of access where necessary, like AIDS. For instance, to highlight a character involves three quick taps of a single key. Side-ways scrolling allows 160 chars per line. Mailing list, label printing, line numbering and boiler plating are all supported.

Link/125, the fifth program, makes the 125 into an intelligent terminal for an HP 3000 minicomputer, allowing two-way file transfer and interrogation of a remote database by QUERY files. Not having an HP 3000 about my person I didn't try it, though predictably it works through a menu and soft key selection.

Although this is all that is currently available with the HP trademark, Lifeboat Associates in the US is stocking a large range of programming tools like Macro-80 and the ZSID debugger plus various Pascals, Cobols, Basic compilers, Fortran and Algol-80 and database packages DBMS and dbase II. Presumably these do not make use of the special terminal features.

### The keys to understanding



### The 'config' menu

## Expansion and potential

The HP-125 (called the Business Assistant in HP brochures) has been designed quite unambiguously and single-mindedly as a business computer. The customer whom HP probably had in mind is the largish firm, which perhaps already has a DP department (preferably with HP hardware) but has decided to move with the times and provide personal application computers for key staff which can if needed communicate with the big stuff. In short, it is an ideal management tool.

It is, however, a quite suitable machine for the small business which is far-sighted (and liquid) enough to spend more than might appear necessary in order to ensure reliability, good service and user convenience. It is certainly the most user-friendly machine I've ever used, though the programmer is not catered for quite so cosily. The existing software is of high quality but the various Ledger and Data Retrieval packages needed by the smaller business do not yet exist.

This brings me to my only serious reservation about the machine. To justify paying the high cost of this machine you need to run software which utilises its hardware niceties to the full; this to some extent neutralises the advantage of choosing CP/M unless a steady supply of such software can be guaranteed.

The 125 lacks the graphic flexibility and the maths capability to appeal to scientific users who are in any case already catered for very well in the HP catalogue. It is quite simply too expensive to appeal to educationalists or hobbyists.

The basic system can be extended to include eight disk drives which would represent 8 Mbytes on line if they were all 8in. Single master drives and single or double slave drives are available in both sizes. At £4,000 for a dual 8in master drive 8Mb is horrifically expensive, and someone with that storage requirement will probably wait for winchesters to become available. I suspect two 5in or two 8in will be the most common installation.

GOTO page 190

## Vincent Tsang tests TI's relaunched home micro, the 99/4A.

Way back in 1978, Texas Instruments, the giant of the electronics industry, announced (with all the attendant rumours) that it was going to enter the personal computer market. The plan then was to bring out an upward compatible range of personal and home computers.

As you now know, what arrived was the TI-99/4 Home Computer in 1979, and, although it worked competently, it was nothing particularly outstanding — it was over-priced, especially with the mandatory US standard colour TV, and it was generally regarded as a damp squib.

Texas Instruments has now brought out the second version of its home computer, the TI-99/4A. An in-joke in the electronics industry is that components with a subscript 'A' are the versions that have finally been made to work properly! Perhaps it is a little unkind and unfair to apply this quip here, but has Texas Instruments finally got it right?

The TI-99/4 and the TI-99/4A have always been sold as home computers and named as such; no attempts have been made to promote them as anything else (eg, as a business computer, as is so often the case). One of the most significant changes in the move to the 'A' version is non-technical, but nevertheless a vast improvement, and that is the price — at around £299 including VAT. (It is interesting that machines designated as 'home computers' are now priced inclusive of VAT.) This puts it squarely into competition with computers such as the

VIC, Atom, Tandy Color Computer etc.

### Hardware

The TI-99/4A arrived well packed with a whole host of peripherals and accessories in a very large cardboard box. The items supplied for test were the TI-99/4A main console unit, and its power supply, a PAL modulator, a speech synthesiser unit, a disk controller unit with one minifloppy disk drive, an RS232 serial interface unit, a thermal printer, a cassette lead and various plug-in ROM cartridges called 'Solid State Command Modules'. These modules included TI Extended Basic, disk manager, speech editor, terminal emulator I, household money management, video chess, blackjack and poker, addition and subtraction 1, and Teach Yourself Basic on disk.

As you can see, there's quite a number of items supplied, and to keep this Benchtest manageable I will concentrate on a few and briefly report on the others.

Unpacking and setting up the main console unit was no problem. Texas Instruments had thoughtfully provided a leaflet entitled 'Read This First' to give simple instructions on setting up and getting started. Unfortunately the sheets supplied were for the original 99/4 and not for the 'A' version, so there were a few points which did not tie up, but at least none were damaging or dangerous. The correct setting-up procedures were in fact in the TI-99/4A User's Reference Guide and no

doubt Texas will correct this oversight.

The main console unit's casing is virtually identical in shape and size to the original 99/4, being approximately 37.5cm wide, 26cm deep, and 7cm high, taking up a base area about the size of this magazine opened out. The casing material is black plastic with a brushed aluminium fascia (with a slight bronzed tint). The most noticeable difference from the 99/4 is the typewriter-style keyboard, which is of standard pitch but looks more compact. The layout is qwerty, with only 48 keys in all, so some of the punctuation marks are in non-conventional positions and are accessed by a FunCTioN key as opposed to the normal SHIFT, which could become annoying. The punctuation marks (as well as the cursor keys) accessed by the FunCTioN key are inconveniently marked on the lower side face of the keys, but there is an alpha lock key which does latch in the down position. But more disappointing is the feel to the keyboard, which is spongy and seemed heavy — so much so that, without realising it, I found that I had reverted to two finger and one thumb typing and could not manage to type fast with all fingers. To the right of the keyboard is a recessed area with a spring-covered slot to accept the command modules (plug-in ROM cartridges). All in all, the main console unit seemed very attractive to my eyes and would not look out of place on the shelf or even on the coffee table at home.

Unfortunately the same can't be said of the ugly power supply unit,





# AN REVAMP

which is wedge-shaped (to match the sloping front of the main console, I suppose) but is black and looks like a sewing machine foot pedal and is best kept hidden out of sight! The other unit which had to be attached to the console was the PAL modulator which enables the 99/4A to work with a standard 625 line UK colour or monochrome TV. The black metal box is attached to the console by a reasonably long cable; the box connects to the TV by a short co-axial lead.

On opening up the main console unit you find that there are three boards packed quite tightly; for keyboard, power regulation and the main CPU. The main CPU board is well shielded in a sheet metal casing to conform to the US FCC regulations. Removing and opening the shielding (which is a feat in its own right) reveals the enormous 64-legged TMS 9900 chip in plastic packaging, a cluster of 4116 dynamic RAMs and a couple of Motorola 6810s (128 x 8 static RAMs — which I assume are used for system store as well as for the 9900's CRU — control register unit for I/O). The board looked well laid out but there was no spare room for any internal memory expansion (perhaps just as well, considering the difficulty in dismantling to get to the unit).

The TI-99/4A worked competently; there was virtually no difference between this and the original TI-99/4 (reviewed in *PCW* vol 3 no 5, May 1980) except that the second option on the main menu on start-up no longer exists; ie, the unique 'Equation

Calculator' is no longer available. The display on my colour TV was steady and the clarity was good, due mainly to the large characters (which tend to look a little clumsy). The character set under TI Basic is now 32 to 127 (decimal) inclusive in ASCII, which should include lower-case alphabets, but instead they are displayed on the screen as small capitals — a pity. There are also control codes in the range 129–159 dec, but these are not the conventional ASCII codes (the function keys take up some of the conventional ASCII control codes).

The screen can display 29 columns of 24 lines under TI Basic; the user's guide, however, says that there are only 28 print positions, which is also correct, because the first column is only used for the prompt character '>'. In graphics mode, the display is capable of 32 columns by 24 lines. Sixteen sets of eight graphics characters can be user-defined over the standard ASCII codes (ie, 32 to 127 dec), plus the range 128 to 159 dec. Each graphics character is in an 8 x 8 matrix, making the screen resolution in graphics mode 256 x 192. There are 16 colours, and the screen, character and character background can be defined by sets. The colours include transparent, which allows shapes to appear to walk 'behind' other shapes. Graphics screens have a border all round to allow for fall-off in edge definition on TV sets.

Peripherals and accessories are connected mainly by an edge connector behind a sliding shutter on the right

side of the console. Each accessory has a well-shielded edge connector socket on its left to mate with the console's edge connector, as well as its own right-hand edge connector behind a similar sliding shutter, allowing accessories to be connected in a tandem fashion. Connection and cascading the accessories was straightforward, with very little chance of error. With only one or two accessories attached the system still looks quite reasonable as the units are well matched cosmetically, but with three or more the set-up begins to look silly as well as occupying quite a wide area. I could not find anything in the documentation on any limits to the number of accessories one can connect in cascade, and the only rule appears to be to connect the speech synthesiser (if you have one) as the first item. The apparent unlimited length of attachments, apart from being physically cumbersome, could give some room for worry in terms of signal fan-out and shielding. On opening up two other accessories, I found that the signals were conducted through the units by a sort of 'motherboard', and both this and the logic boards were as well shielded as in the main console.

The accessories are the same as ones produced for the 99/4. The most interesting item is the speech synthesiser, which has a vocabulary of approximately 373 words including some phrases, numbers — represented both numerically as well as by the actual words — and the alphabet. The alphabet is 'spoken' as the names of the letters



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AN MSA COMPANY



# TEXAN REVAMP



*Console is neat and pretty*



*Disk drive and controller*



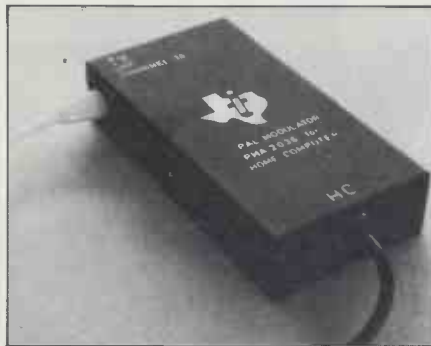
*Box of tricks for communication*



*A selection of software modules*



*Power supply is obtrusive*



*No more US TVs needed*



*Speech synth has limited vocabulary*

and not as the phonetics, which makes construction of words not already included in the vocabulary very difficult. I believe that the components used are those in the 'Speak and Spell' game. It would have been much better to have the phonetic alphabet as well as some of the more commonly used combinations such as 'ch', 'th', 'ing', etc. As it is, making up some words from a combination of the existing vocabulary is a very contrived effort and the results sound so, too. Apparently Texas has a new Emulator Command Module which should be able to give an unlimited vocabulary, but this was not supplied for the test.

The TI-99/4(A) Disk Controller module can control up to three mini-floppy disk drives, recording single sided, single density disks with a capacity of approx 90 kbytes per disk. The Disk Controller and each disk drive require a separate mains lead (as do most of the accessories) which makes for a high number of spaghetti-like mains leads on an expanded system. The disk drive connects to the controller by a ribbon cable with an edge connector

socket on the end; there's also a similar connector in the middle of the cable with an adaptor board to allow another drive to be daisy-chained.

Although the edge connector on the disk controller unit for the drives had a polarity cut-out in it, there was no polarity key in the connector socket on the drive's cable — and there was no mention in the manuals of which way the connectors should be aligned. The connectors could, in fact, be joined either way. The correct way was to have the cable coming upwards from the connector, which can be deduced by careful scrutiny of the diagram shown in the manual; of course, if the polarity pin was in the connector there would have been no problems. The drive supplied sounded very noisy, but it worked with no problems and with reasonable access times. Supplied with the controller was a command module, 'Disk Manager', which gives an operating environment for the disk system (but not quite to an operating system standard).

A thermal printer is also connected in the same manner to the system. This item I found very unimpressive, mainly

because of the print quality — or the lack of it. There appeared to be a strip toward the middle of the 9cm wide thermal paper where the matrix of the characters printed did not come out well. The printer prints 32 characters across the roll paper, and seemed of reasonable speed despite the fact it was rated at only 30 cps. There is a default character set of 128 characters and this time there is lower-case (although without descenders) and there are 32 pre-defined graphics characters using ASCII codes of 0 — 31 dec. User-defined characters can also be printed in code 32 — 159 dec, but these are restricted to a 5x7 dot matrix. A good point for the printer is that it is quite quiet.

The cassette cable supplied is again the same as the one for the original 99/4. It connects to the main console by DIN-type plug, and at the other end there are connectors for two cassette recorders; one of these is allowed to record and playback and the second is for recording only. The connectors are standard mini jacks which fit the microphone and earphone sockets of most commonly available cassette recorders.

# THE PET COMPANION

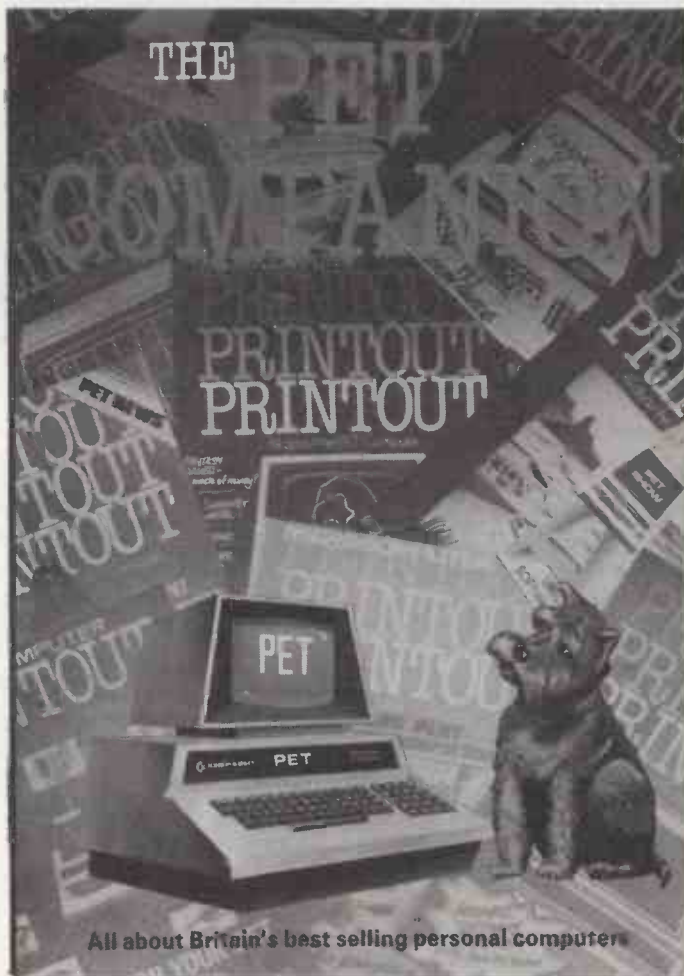
"It is imperative that we receive a totally unbiased and objective review" said the Editor, handing me a 14p stamp for postage of my review. This apparently being his definition of "joining a First-Class Team", I determined to do just that.

For anyone like myself, who has read each and every copy of *MicroComputer Printout* since it first appeared, there will be nothing new apart from the adverts. However, that having been said, it contains a lot of useful half-remembered information that earlier readers will find more convenient in one volume rather than spending half a day leafing through back-numbers and invariably getting distracted by other morsels.

The *PET Companion* is most certainly a unique and valuable addition to the library of any post 1980 owner, not only providing the aforementioned information, but giving a useful over-view of the PET scene development, as well as an insight into some of the long-standing dialogue currently appearing in *MicroComputer Printout*.

*MicroComputer Printout* has never been an 'Idiots Guide' or a 'Machine-Code Special' but has carefully trodden the middle ground for the majority whilst also being broad-based enough for the extremes. Thus the 'PET Companion' is ideal for beginner and experienced user alike. I refuse to say 'beginner and expert' because I still feel there is much to be discovered, and there ain't no such animal as an expert, although *MicroComputer Printout* and readers have done much, and possibly most, to guide many in this direction, bringing something entirely fresh on many occasions to provide a helping hand in the mass (mess?) of infor-

The *PET Companion* is a compilation of programming hints and tips, news, reviews and articles on PET programming from the 1979 & 1980 issues of *MicroComputer Printout* magazine. Paul Walford, a reader with no previous connection with the magazine, reviewed it.



'The PET Companion' is available from Printout Publications Ltd., P.O. Box 2, Goring, Reading. The price is £9.95 post free in the UK, £12 Overseas, and \$25 USA. Cheques, Postal and International Money Orders are accepted. Credit card orders are accepted for Visa and Access/Mastercard/Eurocard holders, by post or over the telephone on 0635-201131.

mation and mis-information.

The only really serious criticism I would make of *The PET Companion* is that, in reprinting past material in the form in which it is presented, it could be misleading to newer readers who may not realise the age of some of the information, particularly regarding products. For example, many people could well be chasing Petsoft programs that no longer exist or are being distributed through another software house now. On the other hand, many could assume that Pic-Chip has no U.K. distributor whereas it has been distributed by Supersoft for some considerable time now, and many dealers have it in stock. I feel that the blank leaf inside the cover could have been usefully employed to hammer home the point that product info as presented may well not be strictly accurate at the time of purchase.

On the purely personal side, I would have liked to have seen the various contributor's columns presented together, in chronological order, but there are doubtless many who would disagree with that. Following the predictions, and sometimes unnerving accuracy of *Inside Trader* can be a most entertaining pastime.

In conclusion, I would regard *The PET Companion* as an indispensable guide for the newer owner, and very useful for the older hands not blessed with an elephantine memory.

'*MicroComputer Printout*' is the monthly magazine for newcomers to computing. It is written in plain English and costs £11.40 for a years subscription. Sample copy £1 post free from P.O. Box 2, Goring, Reading RG8 9LN.



# TEXAN REVAMP

For each recorder there were provisions for remote start/stop control via sub-mini jacks, again the most commonly used fitting on domestic recorders. I tested the cassette interface/cable with a really cheap and fairly poor cassette recorder (which I keep specifically for equipment testing) but with good quality recording cassette tape. This combination worked well with the TI-99/4A once the volume level had been adjusted. I was impressed by the acceptable range of the volume level — it was around halfway (which was as recommended in the user's guide) with a tolerance in level adjustment of about a quarter each way. On playback a reasonably muted sound of the tape is relayed via the TV's speaker — a nice touch to give users confidence. There was detailed prompting from TI Basic when the cassette was called up by the SAVE and OLD commands, which I found a little pedantic, but it has the advantage of leaving very little chance of operating error.

A serial RS232 interface was also supplied for test. It connects to the main console or in cascade with another accessory by the same method as described for the others. The interface requires (yet another) mains lead, and provides two serial ports via standard D-type connectors. The interface used only seven out of the 25 pins, which is obviously a sub-set of the full RS232C spec. The ports are configured as for a computer/processor (ie, pin 2 is signal in, pin 3 signal out, 6 data set ready, 20 data terminal ready). Baud rates are from 110 to 9600 and these, as well as the number of data bits, parity, stop bits, null characters, checking of parity, echo (half/full duplex), are all selectable

by programming in TI Basic. There are also options to suppress carriage return and/or linefeed. For quick use there are default values for all the options (the default baud rate was 300). The command module — Terminal Emulator I — was designed to set up these options by commands and prompting. Also, as the name implies, it turns the TI-99/4A into a terminal. The set-up could then input via the RS232 interface and relay data to disk, cassette, thermal printer or out via the other RS232 port.

## TI Basic

The main console works under TI Basic when there are no command modules plugged in. The version for this TI-99/4A looks identical to the one on the original 99/4. Running the standard Benchmarks show the timings are virtually the same as the PCW Benchtest of the 99/4. Although the Benchmarks looked slow in comparison with most modern home computers, on balance the numeric accuracy and range is high, being accurate to 13 digits and with a range of  $\pm 1 \times 10^{+/-128}$ . This is as accurate as, and with a wider range than, even top of the line scientific calculators. The Basic is also quite comprehensive for setting up graphics; it has many sub-programs. This is evidence against reading too much into Benchmarks alone, without reference to the features and power of the language. A nice touch, retained from the original, is that in command and program entry mode the screen is a cyan colour; when a program is running the screen colour turns to green, then reverts to cyan once the program execution is stopped.

## TI Extended Basic

TI Extended Basic was supplied on a Command Module, which added an extra 36k bytes of ROM to the TI-99/4A. The TI-99/4A has 16k RAM as standard, expandable to 48k; there is 26k of ROM. Now, add the 36k of ROM and you have a possible total memory of 110 kbytes, whereas the normal maximum addressing range of the TMS 9900 is only 64k. The large memory is achieved by memory paging so there are quite a few command modules which are not accessible by TI Basic. TI Extended Basic retains all the features of TI Basic and adds around 40 extra commands or sub-programs. There are also enhanced or added features such as higher dimensions for arrays (up to seven from three), better and more informative error handling, protection on SAVE and LISTING, and others.

The most significant addition is the programming of 'sprites', which are programmable moving characters. These sprites provide very smooth movement on the screen, in contrast to the usual erratic jumping. Some 28 independent moving characters can be defined; all with different (or the same) velocities and directions (defined by horizontal and vertical components of velocity) and all on the screen at the same time. 'Internal' movements of a defined sprite character (eg, in a character 'walking', the movements of its arms and legs) can be achieved by changing in a PATTERN sub program, without having to redefine the whole sprite. Sprites are given priority, with the lowest number having the highest priority

on the screen, so that when two sprites are coincident the higher priority covers the other. Sprites also pass over other (fixed) graphics characters on the screen. The MAGNIFY sub-program can enlarge all the sprites so that the moving objects can change size easily. I was very, very impressed. Two of the three sample programs listed in the Extended Basic manual for illustrating the use of sprites can give you an idea of the power of this feature. One of the programs generated several (up to 28) star-shaped objects on the screen which emerged from a first central 'star' in five colours, and all moved in different directions at different speeds on a black screen. The result was spectacular, but all this required only eight lines of Extended Basic! The other program was not as spectacular, but those of you who program moving graphics/animation will appreciate what could be involved in setting up the following sequence: two different coloured people walk across the screen, both swinging arms and legs; one of them walks through a stationary barrier while the other jumps over it. The jumping person walks faster and eventually catches the other, whereupon they are both reduced in size and continue to walk (when they reach one end of the screen they reappear at the other end) until the faster figure catches up again; it then disappears, leaving the other figure walking until the screen edge is reached and the program ends. Only 55 lines of Extended Basic were required for the whole sequence.

## Other Modules

The Disk Manager module was supplied with the disk controller unit, as mentioned earlier. It provides commands or functions related to the disk system which are either not possible or inconvenient under TI Basic. A sort of enquiry and change environment is provided, allowing the expected functions for disk handling such as initialising disks, copying/backing up disks, directory, renaming, deleting, and protecting files. And there were some destructive and non-destructive (to existing files, that is!) disk tests. The only remarkable item was that the disk initialisation process took well over four minutes, whereas the manual says it takes about one. The disks I used were a couple of Verbatim disks and it didn't matter whether I specified 40 or 35 track initialisation.

The Speech Editor command module allows direct access to the speech synthesiser unit without having to execute the TI Basic commands of CALL SAY. One merely has to type in the required words with the correct separators/punctuations, press ENTER and the words displayed on the screen are spoken through the TV's speaker (that is, if all the words used are valid ones in the synthesiser's vocabulary—as mentioned, on the basic unit this was rather restricted). Unrecognised words are beeped and flashed at the bottom of the screen. One method which I found useful is to use ENTER on each word as it is inputted on the screen, followed immediately by a required separator; this way each word is confirmed, and correction by editing is only needed on the last word/phrase entered.

### T1 BASIC WORDS

ABS	END	RANDOMIZE
ASC	EOF	READ
ATN	EXP	REM
BREAK	FOR-TO-STEP	RESEQUENCE
BYE	GCHAR	RESTORE-with files
CALL CHAR	GOSUB	RESTORE-with DATA
CALL CLEAR	GOTO	RETURN
CALL COLOR	HCHAR	RND
CALL GCHAR	IF-THEN-ELSE	RUN
CALL HCHAR	INPUT-with files	SAVE
CALL JOYST	INPUT-with keyboard	SCREEN
CALL KEY	INT	SEGS
CALL SCREEN	JOYST	SGN
CALL SOUND	KEY	SIN
CALL VCHAR	LEN	SND
CHAR	LET	SOUND
CHRS	LIST	SQR
CLEAR	LOG	STOP
CLOSE	NEW	STRS
COLOR	NEXT	TAB
CONTINUE	NUMBER	TAN
COS	OLD	TRACE
DATA	ON-GOSUB	UNBREAK
DEF	ON-GOTO	UNTRACE
DELETE	OPEN	VAL
DIMS	OPTION BASE	VCHAR
DISPLAY	POS	
EDIT	PRINT-with files	
	PRINT-with screen	

### T1 EXTENDED BASIC WORDS

ABS	INIT	PRINT USING
ACCEPT	INPUT	RANDOMIZE
ASC	INPUT (with files)	READ
ATN	INT	REC
BREAK	JOYST	REM
BYE	KEY	RESEQUENCE
CALL	LEN	RESTORE
CHAR	LET	RETURN (with GOSUB)
CHARPAT	LINK	RETURN (with ON ERROR)
CHARSET	LINPUT	
CHRS	LIST	RPTS
CLEAR	LOAD	RUN
CLOSE	LOCATE	SAVE
COINC	LOG	SAV
COLOR	MAGNIFY	SCREEN
CONTINUE	MAX	SEGS
COS	MERGE	SGN
DATA	MIN	SIZE
DEF	MOTION	SND
DELETE	NEW	SOUND
DELSPRITE	NEXT	SPCET
DIM	NUMBER	SPRITE
DISPLAY	OLD	SQR
DISPLAY...USING	ON BREAK	STOP
DISTANCE	ON ERROR	STRS
END	ON GOSUB	SUB
EOF	ON GOTO	SUBEND
ERR	ON WARNING	SUBEXIT
EXP	OPEN	TAN
FOR-TO-STEP	OPTION BASE	TRACE
GCHAR	PATTERN	UNBREAK
GOSUB	PEEK	UNTRACE
GOTO	PI	VAL
HCHAR	POS	VCHAR
IF-THEN-ELSE	POSITION	
IMAGE	PRINT	VERSION



# TEXAN REVAMP

The rest of the command modules and software supplied were not tested in detail due to the lack of both time and space. Nevertheless, here is a very brief account of each.

**Household Money Management** — I looked at this in detail on the original 99/4 and this time round I found no significant changes — even the manual was the same. The module does what its name suggests; it sets up a budget account which allows cross referencing of up to 34 active categories (although up to 99 categories are available for you to select the active categories). Information regarding the budget can be displayed in tabular form or by coloured bar charts (useful for seeing trends). Detailed instructions are given in the manual for saving and backing up data, which is good, although only cassette was given as the recording device; I don't see any reason why disks could not be used though.

**Video Chess, Blackjack and Poker** are obviously games and are what the titles say. I am not expert or enthusiastic enough to give any valid comments on these, but I would venture to say that the Video Chess probably plays a reasonable beginner's game, as I had to resign when playing the beginner game in a late night session!

**Addition and Subtraction 1** is a teaching program using colour graphics for illustrations, designed for youngsters. I was not very impressed with the disk-based Teach Yourself Basic course. It is basically a book on disks, lot of text with some interactive examples (good), but with no way of controlling your own rate of progress or skipping sections within 'chapters' — there is much to be said for the genuine random access of a conventional book.

## Documentation

As you'd expect from Texas, almost all the documentation was of a high standard. Most was suitable for someone starting out, as well as for quick reference. This is really what's needed, and I hope other manufacturers will take a lesson from this. The exception is that some of the manual needs updating from the 99/4 to the 'A' version, although once the new function keys have been noted there's very little change from the original 99/4. Also, as already mentioned, the 'Read This First' leaflet requires immediate updating as it would give a bad first impression of the system and the documentation. The only real criticism is the lack of machine/hardware details (for example, a memory map) and explanation of the way the CRU is structured for the computer would be useful. As it was, and with the lack of facilities to get down to machine code level (although there is apparently an assembler available but not supplied), I was unable to get a memory map for the 99/4A.

## Users

The TI-99/4A is aimed at the home user and hobbyist (I say the latter with reservations) and it is promoted as such. The reservation on hobbyists is the fact that the TI-99/4A works at quite a high level and was not really intended to be

used at machine code level; for example, absent are the usual PEEK, POKE and USR (or USER) commands, thus making any user modification/customising to the operation of the TI-99/4A almost impossible. Also the good construction but difficult dismantling does not encourage any hardware changes (which I suppose Texas would call 'tampering!').

But, having said that, the TI-99/4A is very suitable for those who do want to work at a high level with Basic (and Pascal is promised), and I would recommend anyone interested in moving graphics or animation to use it with the Extended Basic for a much easier life!

## Competition

The new price of the 99/4A puts it into the bracket of the new home computers such as the VIC, Tandy Color Computer, the Atom, and even the BBC Computer. In terms of money, the VIC is the cheapest of this group even when expanded up to 21k RAM; VIC colour graphics are about the same as the 99/4A in terms of resolution and the Basic is faster in the Benchmarks although not necessarily more powerful or accurate. The BBC Computer is more powerful in terms of facilities offered in the Model B form, and it has much higher resolution graphics and much better expansion capabilities. But the TI-99/4A is the only one with sprites (with Extended TI Basic) and at the moment is the only one with convenient speech synthesis (probably only worthwhile with the speech emulator command module).

## Prices and availability

Most items tested are already available, since the accessories were produced for the original 99/4. At the time of writing (January '82) I could not get information on the actual shipping of the TI-99/4A unit as the department at Texas was still all on leave!

The price for the TI-99/4A main console is reasonable and competitive; the accessories, although again reasonable, tend toward the high side.

TI-99/4A around	£299
Speech Synthesizer	£99
Disk Controller	£199
Disk Drive	£399
32k RAM expansion	£299
Thermal Printer	£269
RS232 Interface	£149
Wired Remote Controls	£30
Cassette Cable	£10
Command Modules or plug-in ROMs	

vary in price according to program, range is approx £17 to £50 (no price for Extended Basic).

All priced inclusive of VAT.

## Conclusions

Despite the chequered history of the 99/4, I liked the TI-99/4A — especially for the Sprite facilities in Extended Basic.

All accessories and command modules worked without fuss, even if they may not have been the best I have come across. The exception was the thermal printer and I can see no advantage of this printer over a cheaper type like the ZX-81 or the ones for the new Casio pocket computer. The problem-free operation is the sort of high standard users expect and want.

Documentation was generally excellent and users should not accept less from other manufacturers.

Speech synthesis was novel but restrictive in the basic unit; it would probably be much better value with the speech emulator command module, provided this plug-in ROM is not priced too high.

The most significant improvements to the 'A' version over the original are the price and the keyboard (which is more robust and suitable for home use — it was extensively tested by my three year-old son!).

Whether I would buy one at the price is debatable; it is reasonable value for money even in comparison with the latest home computers, but the facilities offered (and the lack of low level access) are probably not what I would look for in a computer. Nevertheless, for the moment the sprite facility and the speech synthesis make the TI-99/4A something special, and it may be just what you are looking for.

END

### Benchmark Timings

for TI Basic (timings in seconds)

BM1	3.0	BM5	26.2
BM2	9.0	BM6	61.9
BM3	24.0	BM7	84.6
BM4	24.8	BM8	38.4

for extended Basic

BM1	6.5	BM5	42.0
BM2	18.5	BM6	98.4
BM3	40.0	BM7	140.3
BM4	40.1	BM8	24.0

(note despite the fact Extended Basic runs slower than TI Basic, BM8 actually runs faster with Extended.)

## Technical specifications

CPU	: TMS 9900 16-bit micro
ROM	: Internal 26K (TI Basic takes 14K), command modules can add up to an extra 36K
RAM	: 16K internal, using 4116 dynamics. Expandable with an extra 32K,
Keyboard	: Typewriter style with 48 keys
Display	: Uses domestic TV, gives 29 x 24 lines under TI Basic, 32 x 24 (or 256 x 192 resolution) plus three layers of 16 colours in graphics. (under Terminal Emulator I the screen is 40 ch x 24 lines)
Cassette Ports	: Domestic audio recorder : Edge connector for accessories (can connect in daisy chain), cassette, and for remote controls.





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programme search facility to make data storage and retrieval super-fast.



A typewriter-style keyboard incorporates characters and symbols plus a numeric key-pad and ten user-definable keys for fast and simple operation.

BASIC is, of course, provided with Z-80 Assembler Packages, PASCAL and a BASIC compiler.

### Floppy Disk Drive.

A twin Floppy Disk Drive unit can be added which will give you 560 bytes of storage on double-sided, double-density disks.



### Comprehensive Documentation.

Each MZ80B comes complete with a full set of documentation including an owners' manual giving full circuit diagrams, a monitor reference manual and programming manuals.

PCW/3/82

### Interfaces

RS-232C and IEEE Interfaces are available from January 1982 allowing the MZ80B to communicate with scientific instruments and other peripherals.

### CP/M\*2.2

CP/M\* is also available making a wide range of packages immediately available including wordprocessing, financial modelling, data base management to mention but a few. CP/M\* also increases the disk capacity to 680K.

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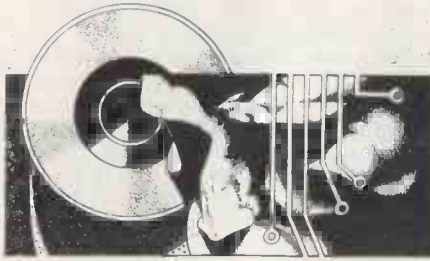
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# FRAMES OF REFERENCE



## A DP MANAGER'S GUIDE TO MICROS

By Alan Wood

All but the smallest companies with no computers are constrained by the systems they have already implemented. A medium-sized organisation with a turnover of £50 million will have a mainframe for its accounting system, and, perhaps, a mini for order processing and stock control. Large organisations will have a mish-mash of mainframes, minis, data entry systems and, nowadays, some dedicated word processing systems. Both medium and large companies are subscribing to one or more timesharing services. Much of what has taken several years to implement on mainframes may only now be showing a return. The minis in place, typically for interactive order processing, should have provided a quicker payback.

Computer systems in situ and paying for themselves are best left well alone. The better areas for microcomputers are: completely new systems in the office; applications around the inaccessible fringe of big data processing systems; and timesharing replacement tasks. Tackling these areas will be a prelude to more complete distribution of computers to desktops as powerful micros take hold and link into communication networks and big file systems. When planning future strategy for these systems, it is essential to review the current computing constraints and resources of the company. In particular: mainframe computing; minicomputing; timesharing; word and other processing; communications networks; existing computing expertise; and DP policy and company systems.

### Mainframe computing

The introduction of microcomputers into a large company with its own mainframe computer will accelerate some of the trends established when minicomputers were introduced.

Some of the current mainframe tasks can be replaced by microcomputer systems. More frequently, however, the tasks performed on micros will be those

that never got high enough on the priority list or simply were not economically justified on mainframes. Consequently, it is expected that microcomputing will result in a better understanding and enthusiasm for computing

## PART 3 MICROS IN MAINFRAME COMPANY

in general, resulting in a growth in demand for all types of computing. Further dispersal of applications on micros can also free mainframes clogged with smaller tasks allowing them to respond better to major company systems.

Mainframe computing will, however, change. Users with limited processing power and storage capacities locally will be seeking to access large central databases. The choice of microcomputer is not significantly affected by the current mainframe, but the choice of mainframe applications will be affected by the increasing capability of microcomputers. The strategy established for mainframe computing should be reviewed so that a general computing strategy to meet future company needs reflects the capabilities and costs of micro technology.

Gradually the incumbent mainframe manufacturers are being forced to come up with their answer to the ubiquitous microcomputer. Of the mainframe suppliers, IBM and ICL have already produced some reply and Univac, Honeywell and the others cannot be too far away — unless they are totally deaf to the strident calls of the new tech-

nology. So far, IBM's Personal Computer offers nothing new except the IBM label on an Intel chip and industry standard software, the acknowledgment of which is the most significant feature of IBM's micro. ICL on the other hand has brought out several machines which don't relate to its existing product line, to one another, or to the industry standards. Why it should think these products will make ICL number one in micros in the UK is baffling. IBM has clearly understood the trends and requirements much better and, given this reading and the IBM name, it is bound to sell in volume. But IBM has not provided an easy answer for computing management. It has only produced a personal computer, the lowest animal in the micro world, and there is no sign yet of a powerful multi-user micro and no local area network. It seems unlikely that either of these products will be seen for some time, if they ever appear at all. Powerful micro systems would seriously undermine IBM's existing product line and it has not tooled up to provide early and much cheaper replacement products. The ICL Perq looks promising since it could offer 16-bit distributed power at low cost, provided ICL recruits some systems houses to build software and makes it widely usable and widely available.

### Minicomputing

Much of the comment on mainframe computing applies also to minicomputing: Smaller minis will be replaced with large micros, much as large 'minis' have come to replace older mainframes. Micros are rapidly becoming more powerful, and the overlap with small minis is already significant. Expertise gained in minicomputing is directly applicable to large microcomputers. The term 'micro' and 'mini' will become less significant. Intel has already introduced the term 'mainframemicro' with the launch of its 32-bit, 3-chip processor. The 16-bit 'minimicros' will be soon as

# FRAMES OF REFERENCE

commonplace as PETs and Apples — indeed those machines are soon to have 16-bit processors of their own.

The mini manufacturers, already showing a reduction in growth compared to the breakneck pace of the '70s, are beginning to respond with their micro offerings. Some have read the market well, while others have made the mistakes evident in some mainframe suppliers. DEC has had a micro, the LSI 11, for as long as anyone. The range based on this chip has been very successful, right up to the PDP 11/23 multi-user system. Data General also had the microNova for some while. Both the DEC and Data General micros are old 16-bit technology — not as compact, as cheap or nearly as powerful as the new 16-bit chips which are now displacing them.

Data General has recently moved into the Desktop micro market with a relaunch of the MicroNova in new packaging, the Enterprise. It has laboured for over two years to bring the machine to market with its own software, while the market has been rapidly moving away from it to industry standard software. DG seems to have misread microcomputing as badly as it completely missed the word processing and office automation market into which Wang rocketed. Hewlett-Packard, on the other hand, seems all set to provide a full line from the personal computer with industry standard software, the HP125, right up to its big mainframe replacement machines. The HP125 provides the very successful industry standard operating system, CP/M, over 100 CP/M packages and Visicalc. Endorsement by HP and IBMs of the independent software producers is the equivalent of hi-fi manufacturers making sure pop records can be played on their machines.

## Timesharing

The displacement of timesharing services is one of the most rewarding applications for microcomputers. As more packages become available on more powerful micros, this trend will accelerate. Financial modelling, linear programming and PERT are three common applications for today's micros.

Many timesharing systems are personal systems, involving a large amount of interaction with the user. Such applications are ideally suited to a microcomputer. Microcomputer solutions will usually be cheaper, will give a faster, less frustrating response and will allow the user total control over his system. A local microcomputer can also be used to access the wealth of programs and databases on timesharing machines, thus extending the use of the facility. The programming skills required to develop microcomputer systems are similar to those for timesharing systems, ie, programming in Basic, APL and Fortran.

A number of timesharing companies have already started to offer micro front ends to their services. They are recognising the inevitable — if you can't beat them you'd best join them. The microcomputer can cut down the cost

of data entry on timesharing services, as well as providing local computing capability off-line for word and numeric processing. The 16-bit micros are complete replacement machines for all but the highly specialised number crunching and big database timesharing services. With one megabyte of 16-bit RAM and a 10 MHz processor, you can perform some vast calculations and, since it will not cost you in connect or CPU time, you can always leave your desktop mini-micro on all night to perform heavy-weight jobs. The chart comparing old and new 16-bit machines gives you an indication of the power of the new machines.

## Word and other processing

Many people are using micros as word processing machines. Others purchase dedicated, purpose-built word processors, which in any case are based on micro chips. In the near future they will require both types of machine to communicate with each other as part of an electronic mail system. Viewdata services are gradually gaining ground as information providers to the larger company. Yet again, the ubiquitous microcomputer can be used as a viewdata terminal by plugging in the appropriate software and hardware. Word processing on microcomputers is not as simple or as sophisticated as on dedicated word processors. Sophistication is not so important since, as on fancy calculators, the clever features that sell the machine are seldom used. The simplicity factor is important, especially if you are dealing with typing pool word processing. WordStar, the most popular word-processor on CP/M micros, is not 'user friendly' compared to the dedicated word processor. WordStar will work on a standard VDU and can be configured to run on all the popular makes of VDU. This means that the same VDU can be used for standard data processing and the normal cursor control features are available to the programmer. But it also means that the commands appear on the screen and there are no one-step function keys as with the dedicated word processor. Because of the popularity of the WordStar, VDU suppliers are now producing WordStar options on their keyboards to make the package simpler and quicker to use.

There is no simple rule-of-thumb for choosing between a dedicated and a microcomputer word processor. If the application is 75 per cent word processing, you will be better off with a dedicated machine. If the application is part data processing and part word processing, a microcomputer is the solution. However, if you look at the office of tomorrow linked into computing and communications, general purpose microcomputers are likely to provide more flexibility. For example, a two-station microcomputer could service an executive and secretary, where the one is performing financial planning, the other word processing and both are sharing an electronic filing cabinet. The combination of information management with

numeric word processing is becoming increasingly common. On the same station, the office team could also link into private viewdata and have a mainframe connection. Recognising these trends, Wang has recently put the CP/M operating system on the Wangwriter to provide access to the CP/M software bank. Digital Research has also implemented CP/M on the IBM Display-writer.

## Communications network

The demands of all the new computing are going to overburden existing communication networks. The requirements for voice, fax, video and data transmission both within buildings and to and from remote locations are creating demands for much more sophisticated and much faster communications channels. Micros are just adding to the load and bringing the demands forward by placing computers in the hands of more and more users who want to communicate with one another. A variety of architectures is being developed to meet these demands, one of the most significant in microcomputing being local area networks.

Like microcomputers themselves, local networks vary enormously in sophistication. The simplest provide a means of slaving a number of micros off a master machine and sharing data storage. A second level provides fast site communications and the capability to string hundreds of devices around a building, effectively replacing the multi-user minicomputer. At a higher level still come those universal networking and data management systems which provide for the intermixing and interchange of data between otherwise incompatible mainframes, minis, word-processors, micros and other digital devices.

## Existing computing expertise

This is the most important current resource to consider. Computer departments have established a wealth of expertise over the years and it is a considerable company asset. Much of what has been learnt in mainframe and minicomputing is valid for microcomputing, although the better computer departments question the relevance of this experience to the latest technology. Skills must be updated on micros, and additional expertise in hardware engineering should be added. But computer departments can become better equipped to support microcomputing than any other department. In establishing a rationale for microcomputing, it will be especially important to consider existing software skills and programming languages.

New computing is changing the role of management service and computer managers. More and more they have to function as consultants and contract negotiators, steering the organisation through the maze of technology and buying in most of the software and complete systems needed to satisfy their requirements. The job is becoming less a line management, recruitment and staff motivation function and more a super-



consultant and purchasing management position. The trend began with mini-computers and is accelerated by micro technology. Some of the actions which flow from the changes are to: ensure you have a consulting function available to your department; design a software strategy that takes advantage of packages from software manufacturers on mainframes, minis and micros; develop and disperse in the direction of software availability and suitability; buy in turnkey systems rather than build new technology teams; and pursue self-education with a technology update and training in purchasing as a minimum.

## DP policy

The introduction and application of microcomputers should fit within a revised DP policy which relates current and future technology to the present and future needs of the organisation.

It is important to draw a clear distinction between company systems — those that are integral to the company's business — and personal systems — those that are peculiar to one or more individuals. For example, micros have been very successfully deployed for goods receiving, warehouse stock location local stock control, and branch information processing. These are all company systems, frequently with multiple sites. They must be controlled from a central point. Time-sharing replacement systems — modelling, for example — are often personal systems, an extension to an individual's skill. If the individual leaves the company, his successor may employ different techniques to achieve the same results. Personal systems should be approached with the same passion for central control associated with company systems. A very fruitful route for future planning is the development of company packages on micros that can be used on many sites. Company packages can greatly increase efficiency, keep development costs down and avoid re-invention of solutions to the same problems. Provided as turnkey systems to users, they are one pointer to the future role of data processing departments.

## Other factors

When developing a strategy for micro-computing, each organisation should establish a list of significant factors affecting such a policy.

1. Company environment: As well as computing resources and constraints, there are company constraints; the implementation of microcomputing has to take into account the company environment. The nature of the business is clearly important; for example, a manufacturing business has different microcomputing requirements from those of a service industry.

## The American Educational Tour

Every computer professional should spend 3-4 weeks on a technology update. This tour should concentrate on:

1. Your mainframe supplier's future developments and timing.
2. The leading mini suppliers: DEC, Hewlett Packard, Wang.
3. A semiconductor manufacturer: Intel.
4. The technology universities: Stanford, MIT.
5. The software manufacturers: Digital Research, Microsoft, MSA.
6. New architecture companies: Tandem, 3 Com, Xerox.
7. Exhibitions: Comdex: NCC, West Coast Computer Faire.
8. Random trips in Silicon Valley to recommended sites.

The company structure has a strong influence on the manner in which micro-computers are introduced and should be carefully considered. It is vital that control of microcomputing be situated at the right place in the company structure. The new technology will have a profound effect on the company as a whole and the computer department in particular. Important changes of this nature invariably lead to problems of internal politics with different departments seeking control. Microcomputing will have a strong influence on future company policies for several aspects of the company's business. For example, it is likely that turnkey micro systems will lead to staff retraining and redeployment. The planning of future staffing must be integral to the introduction of new technology. Like other computer systems before them, micros are at their best and are most frequently used in areas where business is expanding. Put in the hands of interested users, the new technology will create a base of new products and services as well as improve productivity.

2. Users' attitude towards DP: It would be unrealistic to assume that all users are favourably disposed towards DP departments. Disappointments with previous computing, frustrations over delays and costs, and naivety about computing generally, allied to continual press and TV bombardment about the micro revolution, will lead some users to seek their own solutions which can be expensive to the company as a whole. The establishment and promotion of a professional microcomputer service by DP departments will go a long way towards ensuring that the optimum use is made of microcomputer technology. DP departments should be aware that many user managers will have budget authority to spend the capital sums to acquire a micro, as will engineers, technicians and scientists. It will not usually be possible for DP to establish a monopoly on micro supply and application. However, the need for advice and support services from DP will grow and an increase in user independence should encourage healthy mutual respect. It is vital that DP gears up to provide a rapid response to user needs, especially through purchase of

turnkey systems. Response times normally associated with mainframe systems (six to 18 months) will frustrate users further and understandably encourage them to seek satisfaction elsewhere.

3. Software and services: While hardware costs continue to fall, manpower costs are rising with inflation. Increasingly, software development and services will represent the highest cost in a total system. But the naive user does not understand software and relates cost to hardware prices. In microcomputing, software and associated services are rarely less than the hardware and frequently three times more than the hardware cost. It is vital to tap available expertise, using good development aids and packages wherever possible. Computer departments have a very important role to play in protecting users and the company from making expensive software mistakes.

4. Security of suppliers: The micro industry is young and volatile. The first microcomputers came on the market in 1975. Some companies have become established in sectors of the market, a few have come and gone already. There is no one dominant manufacturer: no IBM or DEC. However, there is much more software and hardware conformity in microcomputing than in mainframe and mini computing because the industry is a component industry. The common international hardware and software standards should be adopted. They will provide independence from any one supplier and give a wide range of choice in products.

5. Maintenance and day-to-day operation: In looking at any new development in computing, the promise of the technology frequently overshadows the more mundane but vital aspect of reliability, maintenance and day-to-day operation. DP departments are well equipped to advise their users on the importance of these aspects since they apply equally in microcomputing as to mainframe and minis. An important element in choosing equipment is the availability of maintenance and spare parts. Equipment which is supported under complete system maintenance contracts by established companies is advised.

6. Component industry: As already mentioned, the microcomputer industry is predominantly a component industry. This has developed partly by chance and partly by necessity. Most of the manufacturers started off in a small way. Some significant companies today, eg, Apple, Dynabyte, started in someone's garage only a few years ago. Many were hobbyists and technicians who obtained relatively modest private

## Micro Options to Conventional Systems

1. Systems economically justifiable on new low cost technology.
2. Systems with data volumes in the 100k — 100M range.
3. Terminal systems with stand alone capability.
4. Systems with 1-16 users.
5. Local area network replacement for minis.
6. Timesharing replacement for numeric applications.
7. Mixed processing systems, data, information and word processing.



# FRAMES OF REFERENCE

financial backing to produce specialist printed circuit boards. Other private companies went into business putting these boards together to form microcomputers. Even at chip level, it is a component industry with board manufacturers using a selection of chips from a variety of manufacturers. Through necessity, hardware standards developed and the industry is growing into adulthood. The flexibility, robustness and economies of scale resulting from a component industry with good hardware standards has resulted in a healthy industry in which non-component companies (such as IBM, ICL, Burroughs etc), are less competitive. Micro companies are still relatively small and some will undoubtedly go out of business. When selecting microcomputers it is therefore essential to carefully consider the financial standing and reputation of the manufacturer. It is also necessary to buy in expertise because front-line support is limited in comparison with that provided by mainframe and mini manufacturers.

7. Communications and policy for convergence: Communication is a subject frequently raised in the same breath as microcomputing, especially in large companies with dispersed computing facilities. Today it is practical to use a microcomputer as a terminal and to transfer files from one microcomputer to another. A number of communications software manufacturers have emerged and IBM 2780/3780 and 3270 protocols are generally available to turn Z80 microcomputers into very cheap emulators. Emulation software for other popular machines is arriving on the market, and some users will develop their own emulators for distributed micro systems with mainframe connections. However, microcomputers are justified most frequently as linkless terminals where communication is not required or where a postal floppy disk service is perfectly adequate. There is a growing demand for a means of interconnecting not simply micros and minis but other devices, eg, word processors, fax machines, viewdata services. It is important that the impact of these demands on existing communication networks is considered and a strategy to meet future requirements established.

8. Future technologies: Micro-

computer technology is changing rapidly. Companies will often wish to take advantage of the latest technology but should be careful about pioneering new products in operational systems. Continuously keeping near the forefront of technology can be costly if it means replacing equipment every year and expanding the range of supported systems. It is possible to adopt new technologies inexpensively by using relatively well-proven products. The position of microcomputing a year ago was that there were proven, operational, single-user systems performing calculations and data processing tasks. Today there are proven multi-user systems with substantial cheap storage and communications capability. In a year's time proven technology will be available to facilitate the convergence of disparate computer architecture and the exchange of data between many different devices. The gateway to these technologies is in standard software, CP/M, MP/M, Unix, MBasic, CIS-Cobol and Pascal — a point that is repeated to ensure that the software media is the message.

Provided they are identified as prototypes, a valuable contribution can be made from experimental systems, and large departments should have a research and development budget to test new products. Communication and convergence products can be taken on now in controlled experiments which can add considerably to subsequent computing capability and economics. One reason US technology is in advance of the UK is that ultra-conservative management here makes much less provision for research and development in their budgets.

## Summary of possibilities

A later chapter explores the applications for the general-purpose microcomputer but a summary at this stage will help put this powerful and versatile machine into the context of existing computer resources and constraints.

1. Options to mainframe systems.

- Low priority systems: Systems not economically justified on mainframes and/or those that never appear high enough on the priority list to be implemented.

- Replacement of creaking systems that need major overhaul.

- Low data volume systems. Systems with file sizes from 100k to 100Mb.

- Terminal systems with stand-alone capability. Systems primarily used for local processing with occasional need to access/update mainframe files.

- Extensions of big systems to lower levels in the company, eg, depot stock recording.

2. Options to minicomputer systems.

- Similar options to mainframe systems.
- More affordable 'minicomputer'.

Systems with 2-16 users.

- Local area network alternative to multi-user minis.

3. Options to timesharing systems

- Replacement of numeric applications, financial planning, PERT.

- Replacement of lower data volume systems.

- Use as data entry devices to cut connect costs.

- Terminal systems with stand-alone capability.

- Local area network with timesharing capability.

4. Options to word processing and other systems.

- Alternative to dedicated word processors.

- Suited to combined data processing and word processing applications.

- Alternative to dedicated viewdata terminals.

- Local area networks with electronic mail capability.

5. Relevance of existing expertise.

- User timesharing skills apply, eg, Basic, APL, Fortran.

- DP development skills apply, eg, ANSI Cobol availability.

## The third commandment of microcomputing

Thou shalt not be inhibited by the limitations of today's microcomputers. Even as they are being discussed, the inadequacies of the current generation of microcomputers are being made good in subsequent generations. The summary of possibilities describes some options created by today's 8-bit and 16-bit machines. The emergence of commercially available 32-bit devices in two years' time will dramatically enhance the application of micro technology, especially as it combines with new video, communications and storage technologies. Companies planning a five-year computing strategy must be aware of those possibilities and make decisions that will provide a pathway from 8-bit to 16-bit to 32-bit machines. It is essential for management to investigate developments in the different fields of computing.

Management service executives should spend several weeks in the USA visiting leading semiconductor, mainframe, mini, micro, peripheral, communication system and software suppliers. Such a trip will be a revelation: no words can have the impact of actually seeing the new products that the microchip is siring. The sophistication of the products and the speed with which factories mushroom to produce them is stunning even for those close to the technology.

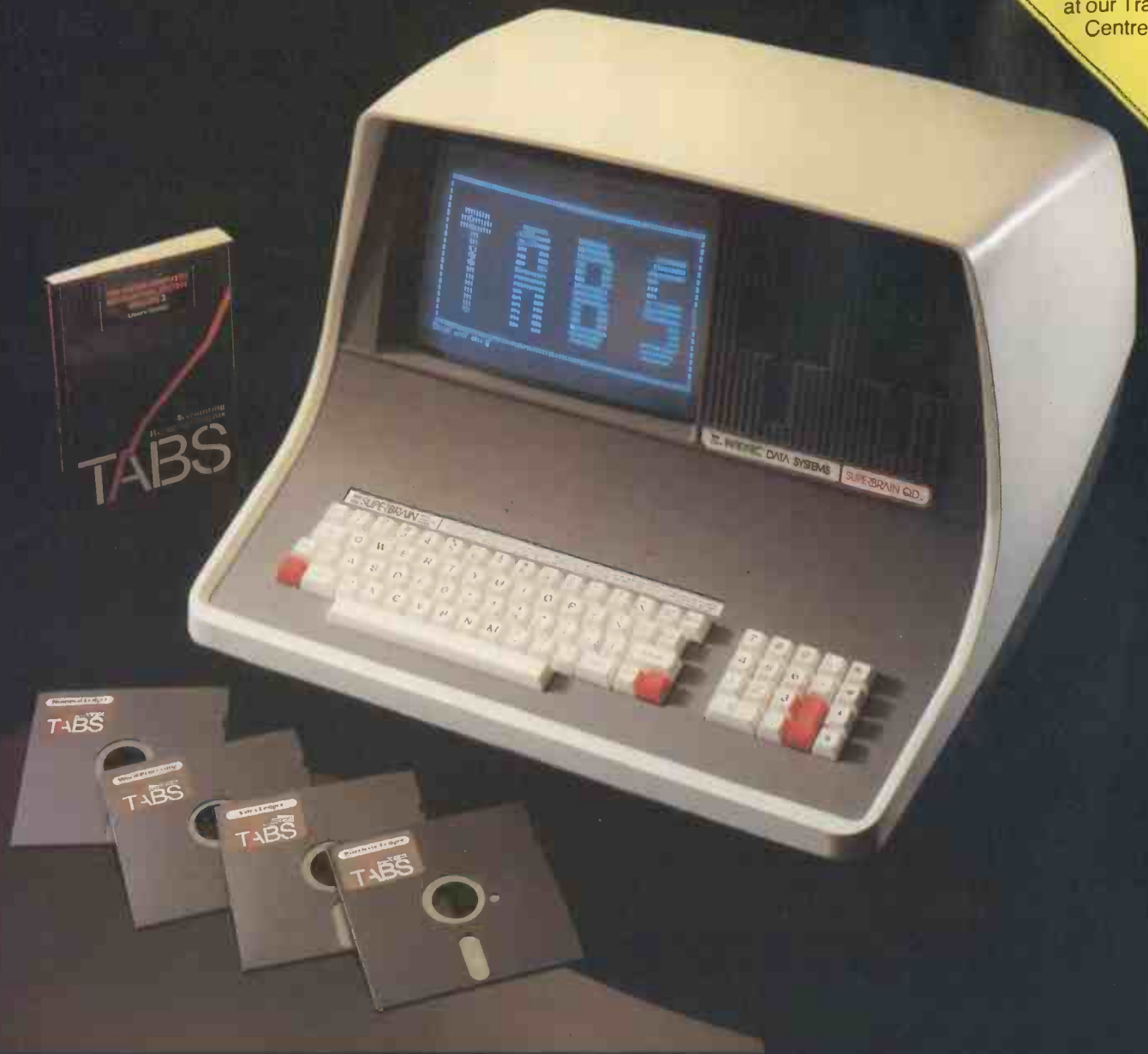
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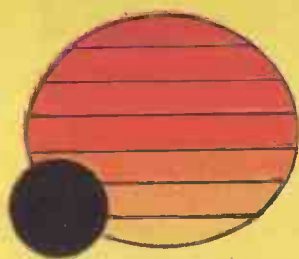
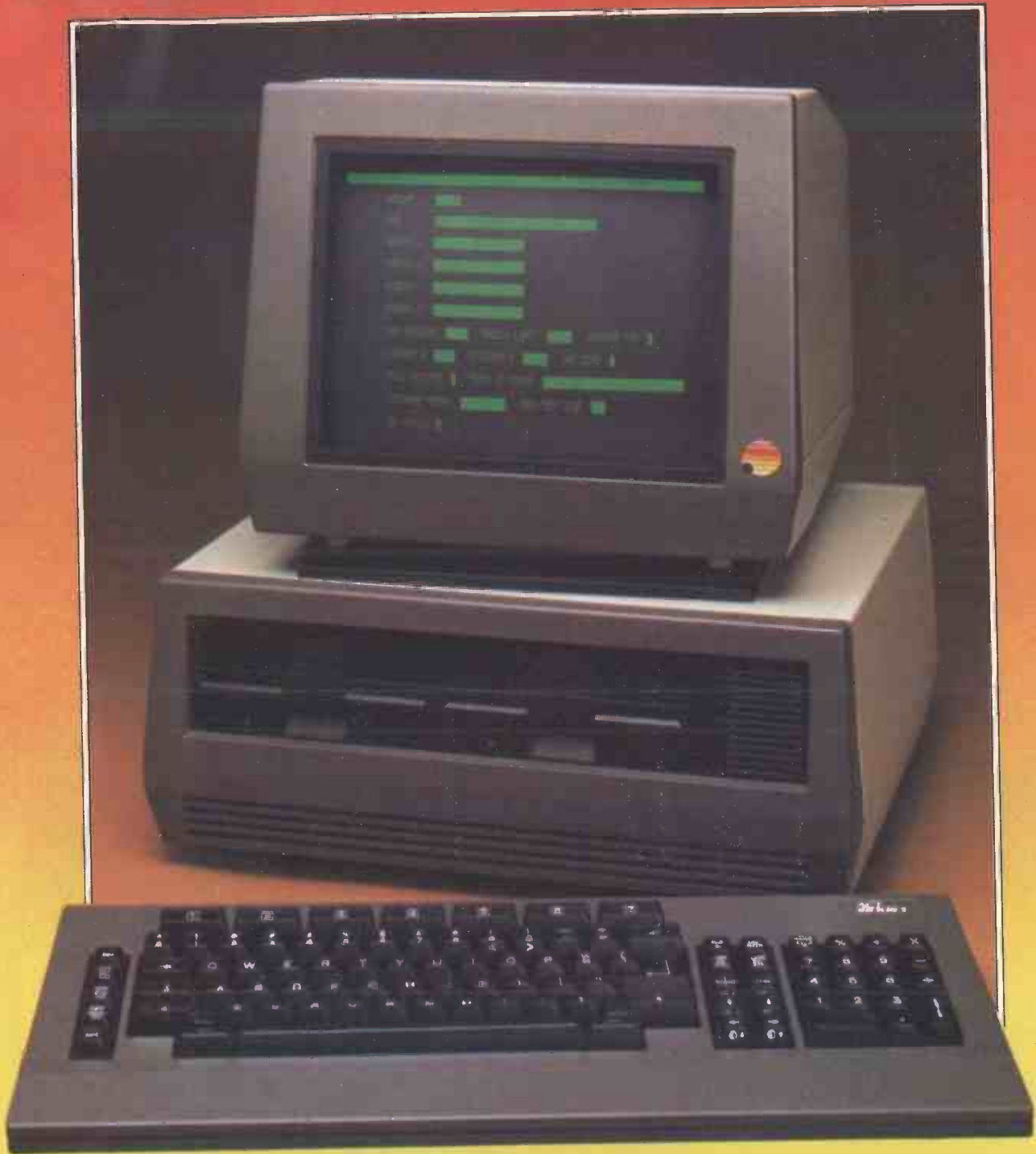
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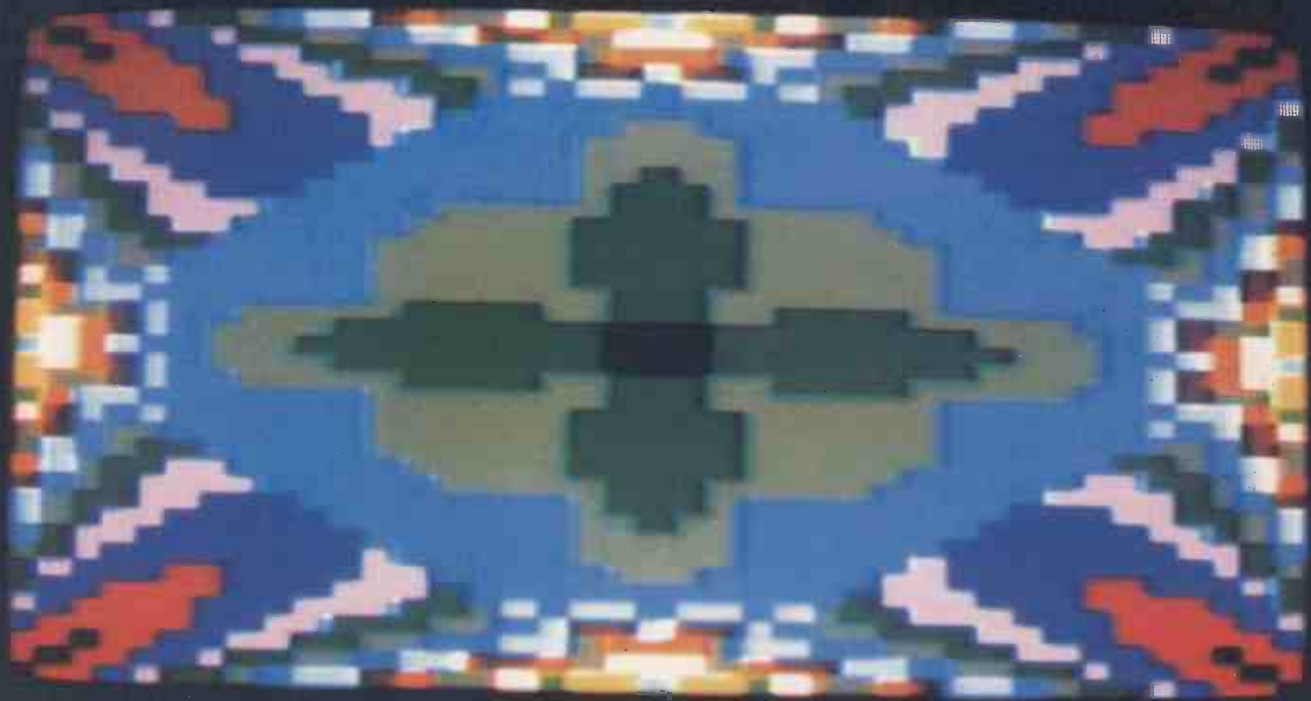
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# ELECTRONIC DEMOCRACY THE DISTAFF SIDE

By Ian Lloyd M.P.

In my last article I discussed the possible impact of interactive cable television which, in the QUBE system already installed and active in Columbus (Ohio) and a number of other US cities, is likely to spread very rapidly throughout the developed world. When I wrote that article I was not aware that Robert Atkins, the MP for Preston North has been successful in the ballot for motions for discussion in private members' time on Friday, and that the House would have an early opportunity for a fairly general and interesting debate on the broader aspects of information technology. In that debate I had an opportunity to describe QUBE very briefly and to put down one or two warning markers. It is on these markers that I would like to expand in this article.

My first warning to the House was that I very much doubted whether any Government of any party would be able to prevent the spread of interactive television. The only effective restraint, as I see it, will be the cost of a cable network. Kenneth Baker has told me he expects that this will probably be the largest single capital investment ever undertaken in either sector in the United Kingdom. Wiring every house, office building, village and town with fibre-optics will certainly require expenditure on much the same scale as the railway system in the 19th century and North Sea oil in the second half. So governments will be able to prepare and adapt reasonably slowly as the investment takes place. There will, however, come a time when the 'critical mass' is present, and in political terms that will be when what the statisticians define as a 'stratified sample' of the population has interactive television. That will take place sooner than we expect but it will, of course, require the existence of sets in all social classes, economic groups, urban areas and geographical regions of the UK. What then?

Those whose political views and instincts tend naturally to the populist version of democracy (all the people, every issue, every time) will then demand the use of the electronic AGORA. Tony Benn (or his successor) will argue powerfully that if it can be done it should be done and they will seek, in my judgement, to discredit the validity of decisions for which approval is sought in any other way.

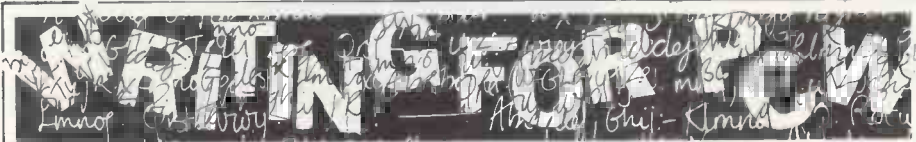
The dangers and problems are probably best revealed by considering a similar example of such a decision. Should we or should we not build more nuclear power stations? These are the questions (among others) which would have to be answered. First, how long is the debate to continue — one month, one year or longer? Second, who is to have access to the system? The political parties, the CEEB, the nuclear industry, Friends of the Earth, the mayors of affected towns, villages or communities, industrialists who will have to meet higher energy costs, alternative energy lobbyists, academics, journalists, trade unions — to name the more obvious claimants. Assume that this is settled without immense controversy (unlikely). In what order are their arguments to appear, how long is each to have on the air, is every presenter to have the right of reply, who will close the debate? Assume that these questions are settled without controversy (most unlikely). We then enter even more formidable lists of controversy.

Is every accessibly and appropriately equipped viewer to have a vote? Of course, say the populists. But what about those who acquired their sets the day before the vote and might therefore be presumed not to have listened to all the arguments? Is the vote to take place in the morning, midday, afternoon, or evening? If pm is chosen, will it be after the 'Dallas' of the day or before? How will the organisers ensure that some

votes are not cast by children (although it is of course arguable that some 15-year-old enthusiasts will understand 10 percent of the jargon of the argument!). Will organised groups dedicated to one or other outcome be permitted to arrange button-pushing parties (analogous to the attempts made in our more conventional elections to organise the votes in old people's homes)? What percentage response rate will validate the decision? And, finally, if the decision is perceived to be disastrous will it be allowed to stand? If it is not allowed to stand, how will a democratic government justify a different policy or executive decision?

These are some of the difficulties which I foresee. There may well be others. I hope that readers will think about this issue. I would like to know their ideas about what can be done to preserve *Parliamentary* democracy in such an environment, which is almost upon us. If we think these things out in advance we may have some hope of obtaining the best of both worlds; for both have something to offer. Parliamentary democracy can always be made to work better and be seen to be more effective as well as more responsive. But the great decision must, in my judgement, be made by an informed community, and my political experience tells me that on most issues, most of the time, most people don't want to be bothered. Equally, electronic democracy will not go away. It will be thrusting aggressive intruder at the table of power. It will alter the balance and nature of political power. The demagogue, in particular, will see and seize great opportunities. There is much at stake, including responsible government. By forethought it may just be possible to ensure that it is improved and not destroyed by Information Technology.

END



PCW welcomes approaches from would-be writers, even those who may never have appeared in print before. In this game it is often those with practical experience who have important things to say so we don't mind too much if their prose is less than perfect. Providing that submissions have a sensible structure and follow a logical sequence, we can take care of the polishing. Here are some tips:

If the article is already written, simply send it in, making sure that your name, address and phone number appear on both the article and the

covering letter. If you have submitted the same work to other magazines you should tell us — it would be embarrassing (to say the least) if the same article appeared in more than one.

If you have an idea for an article or a series, write us a letter outlining your ideas. A one or two page synopsis giving the proposed structure, sequence and content will give us a sound basis for discussion. Please give us a daytime phone number if possible.

If you have nothing specific in mind but feel qualified to conduct case studies, Benchtests or whatever then

drop us a line saying what you'd like to do and why you think you're qualified to do it. We're not particularly looking for strings of academic qualifications — experience carries just as much weight.

Dick Pountain is always on the lookout for interesting calculator features and we wouldn't mind seeing one or two readers getting on their soapboxes but remember: even articles such as this need a structure.

Reading PCW will give you a good idea of the style we prefer. You may notice that we try to avoid pomposity at one extreme and flippancy at the other (except in 'Chip Chat', that is).

Finally, have a look through back issue indexes and try not to re-invent any wheels. Oh, we almost forgot — PCW does pay for all published work.

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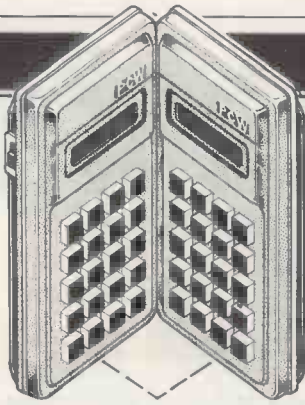
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# CALCULATOR CORNER

Compiled by Dick Pountain



## Hewlett-Packard in a loop

On first hearing, the notion of networking HP-41C programmable calculators sounds a little daft — calculators are almost by definition personal and private instruments. Nevertheless, Hewlett-Packard has just announced a new interface, HP-IL, which does just that, and on closer examination it is far from daft.

It was, of course, Hewlett-Packard which invented the HP-IB interface for its large computers, and this, under its better known name of IEEE, has become an international standard for instrument control. HP is therefore no newcomer to the art of interface design.

HP-IL (the IL stands for Interface Loop) is as the name suggests a closed loop, using two wires to connect up to 961 devices in series. The reason that it isn't daft is that HP has announced at the same time several new peripherals to go onto the loop, as well as an interface card, for the HP-85 micro.

The first remarkable thing about HP-IL is its transmission capability, namely that data can be moved up to 5 kb per second (in one direction), and the distance between devices may be up to 100 metres; this, don't forget, is with *battery-powered* devices! For comparison, the widely used RS232 serial interface only allows five feet between stations.

The loop is operated on a 'master-slave' basis, where one device is nominated as master and sends a command around the ring which is received and passed on by each device in turn until it arrives back at the master; only the device for which the command is intended will act upon it. This system allows error checking, since the master can see whether the command is the same as when originally sent. A polling system allows user programs to be quite unspecific about devices, needing to specify neither address nor device number. For instance, a PRINT instruction will send a command that looks for any printer on the loop and activates the first one it finds.

So what can you hang on such a loop and why? The new peripherals announced include a digital cassette recorder, a new thermal printer, two new memory expansions, a real-time clock unit and a digital multimeter, plus interface adaptors for the HP-85 and for measuring instruments.

The cassette recorder provides 131k of storage per micro-cassette, using digital rather than audio encoding for speed and reliability. Searching is performed at 30in/sec. Programs as well as data can be stored in named files, and a directory is kept as on a floppy disk.

The thermal printer is basically the same unit as the current HP-41C printer but with the interface logic built in to allow its HP-IL use.

Two RAM extensions called HP82180 and 82181 allow the expansion of an HP41 C/CV to 6.5k of continuous memory. The first-named module contains, in addition to 889 bytes of RAM, a set of extended memory functions in ROM, which enable transfers to be made between main RAM and the 82181 module, two of which (1666 bytes apiece) may be added. Thus the extended memory is not contiguous with the main RAM but is addressed as an external device using the new commands to set up files. File types supported are Program, Data and ASCII; this last being particularly useful for communicating with another computer such as the HP-80 series.

So what can you use HP-IL for? One obvious application is merely to allow attachment of the printer, cassette recorder and expansion memory to a single HP-41C. Another, more novel, is to include an instrument like the multimeter in the loop and control it from a 41C, processing its data output and storing it on tape or printing it. Using the real-time clock module this could be made to be an automatic

process, sampling at regular intervals without human intervention. Since all these peripherals are battery-operated, this could all happen just as well in the middle of a forest or desert as in the laboratory. In addition to HP's own multimeter a board has been produced to build into other instruments making them HP-IL compatible.

If you want to go the whole hog you can stick an HP-85 microcomputer into the loop so that data can be passed between one or more hand-held HP41Cs and the computer: the 41C thus becomes an intelligent data capture terminal. Obviously programs cannot be downloaded since the 41C doesn't speak Basic and vice versa; data must be sent in ASCII form.

HP intends HP-IL to become a permanent and extensive 'small systems' interface, and is planning to make all its future small products compatible with it. Rumoured for the near future is a video interface to allow the 41C to display on a CRT, and an HP-IL/RS232 connector.

With the introduction of this product the 41C/CV now more than lives up to the title of 'hand-held computer' and the system should prove a cost-effective solution to a variety of laboratory data-logging problems, especially where mains power is unreliable or unavailable. I look forward to testing some of this hardware in the near future and perhaps comparing it with the Panasonic HHC which is the only other hand-held system which approaches the HP's new found abilities. **END**



There wasn't room for the other 960 calculators in this picture.

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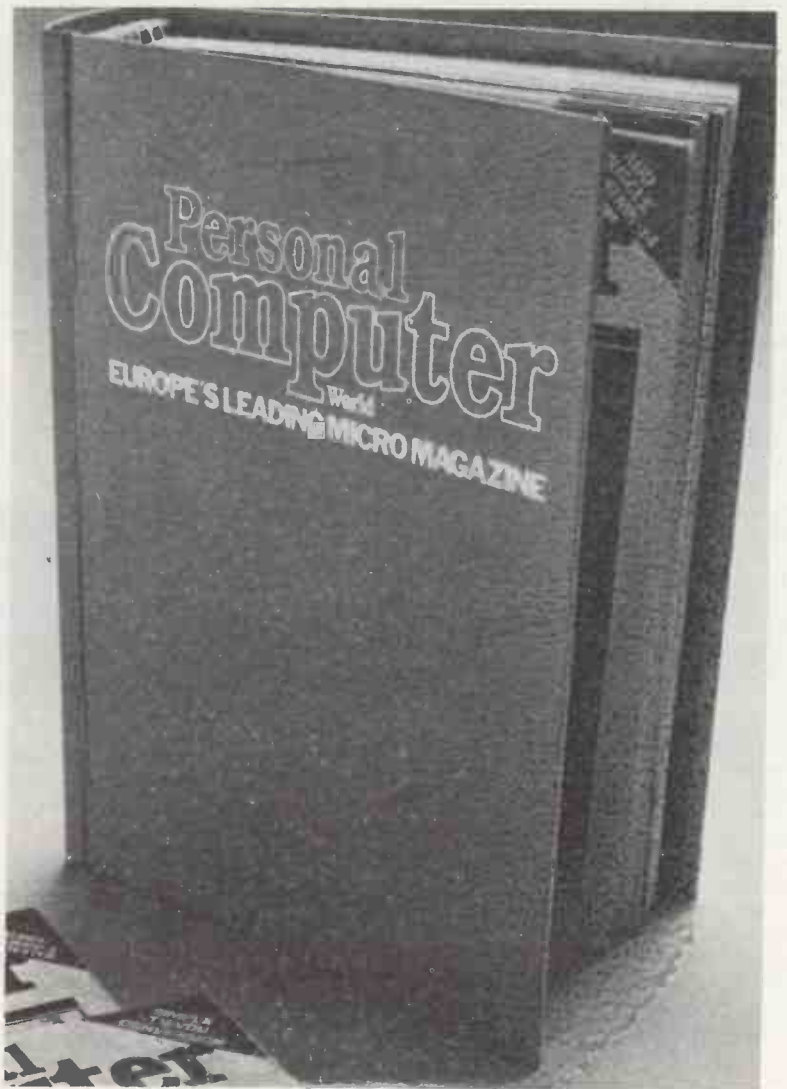
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Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80—if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

### 8K BASIC ROM

The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80—including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

### 16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 and the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.



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For ZX81 (and ZX80 with 8K BASIC ROM)

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**SNIPER**—you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

**METEORS**—your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

**LIFE**—J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

**WOLFPACK**—your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

**GOLF**—what's your handicap? It's a tricky course but you control the strength of your shots.

### Cassette 2—Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

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**TRAIN**—multiplication tests against the computer. The winner's train reaches the station first.

**FRACTIONS**—fractions explained at three levels of difficulty. A ten-question test completes the program.

**ADDSUB**—addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

**DIVISION**—with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

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**CODEBREAKER**—the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

**MAYDAY**—in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

### Cassette 5—Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

**MATHS**—tests arithmetic with three levels of difficulty, and gives your score out of 10.

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PCW 03

# THE NEW MIC

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# PCW SUBSET

This month we introduce another guest writer of 'Sub Set' from among our regular contributors to the series. In this fascinating set of routines Dave Barrow brings the means of handling shapes to any memory-mapped screen driven by a Z80 processor. Send in the most interesting effects you can devise through the use of these routines and, if you don't have a Z80 micro, lose no time in adapting these ideas to your favourite processor. Send your routines to: 'Sub Set', PCW, 14 Rathbone Place, London W1P 1DE

The general-purpose RAM file handling routine, DIFA, has wide application in all aspects of computing. As used here, in creative recreational computing, a file is either one shape table (with number of records, record length of 3 and records being the 3-byte vectors defining the shape) or one of the matrices for transformation (with number of records = 16, record length = 1 and records being the 1-byte entries to TFORM or the quicker but limited version QTFORM). In the index, DIFILE, holding 2-byte displacements from the DIFILE base address to the base addresses of the other files, the first two bytes are not used, as the displacement to file 1 is at the third and fourth bytes, the least significant byte to the displacement is given first at the lower addressed byte of DIFILE, followed by the most significant byte.

To the accompaniment of many groans, I invite you all

to take another look at the following.

## Tables

The 6502 has a couple of very powerful addressing modes — pre-indexed indirect and post-indexed indirect. The Z80 really can't match them, and so I wrote a routine, CMTA, which repositions HL at byte B of Table C when input HL points at the base address of a table of table base addresses. Alan has the CMTA Datasheet for anyone who has lots of single-byte-entry tables to deal with.

My first Datasheet, DIFA, although larger and slower than CMTA, is of more general use. Allowing up to 356-byte entries classifies it as a file-in-RAM handling routine rather than a table-handling routine, but it is for its reasonably efficient handling of matrix and shape tables that I have included it in this set.

## Datasheet

```
:= DIFA - Displacement Indexed File Addressing

;/ CLASS: 1
;/ TIME CRITICAL?: No
;/ DESCRIPTION: Main routine of a File/Table handling system.
                All files formatted: byte 1 = No. of Records
;
;/
                byte 2 = Length of Records
;/
                up to 256 Records.
;/
                The Index File (DIFILE) Records are the 2-byte displacements
;/
                calculated by FILE BASE ADDRESS minus DIFILE BASE ADDRESS.
;/ ACTION: POINT ← DIFILEBASE + (FILENUMBER * 2)
;/
                READ FILEDISP
;/
                POINT ← DIFILEBASE + FILEDISP
;/
                READ NUMOFRECS, RECLENGTH: INCREMENT POINT TO RECORD1
;/
                DECREMENT RECREQUEST
;/
                IF = 0 THEN END
;/
                ELSE POINT ← RECORD1 + (RECREQUEST * RECLENGTH)
;/
                END
;/ SUBR DEPENDENCE: None
;/ INTERFACES: None
;/ INPUT: HL = DIFILE.BASE ADDRESS
;/
                C = Requested File number
;/
                B = Requested Record number } OOH = 256
;/
                (HL) = First byte of Requested Record
;/ OUTPUT: B = Number of Records in File
;/
                C = Length of Record } OOH = 256
;/ REGS USED: HL B C
;/ STACK USE: 6 max.
;/ LENGTH: 43
;/ TIME STATES: Record 1: 168 Records 2 - 256: 555 to 603
;/ PROCESSOR: Z80
;
```

```
DIFA: PUSH AF ; F5
        PUSH HL ;save DIFILE BASE E5
        LD A,B ;save Record number 78
        LD B,B ;BC ← File number 05 00
        DEC C ;(making OOH in C into 00
        INC BC ;0100H in BC) 03
        ADD HL,BC ;point at displacement of File 09
        ADD HL,BC ;from DIFILE BASE 09
        LD C,(HL) ;get displacement 4E
        INC HL ;in 23
        LD B,(HL) ;BC and 46
        POP HL ;add to E1
        ADD HL,BC ;DIFILE BASE 09
        LD B,(HL) ;get number of records 46
        INC HL ;and 23
        LD C,(HL) ;length of Records and 4E
        INC HL ;point at Record 1, decrementing 23
        DEC A ;requested Record number to match 3D
        JR Z,END ;jump out if already there 28 14
        PUSH BC ;else C5
        PUSH HL ;multiply E5
        LD L,B ;requested Record number - 1 2E 00
        LD B,L ;by Record length 45
        DEC C ;getting result in HL 00
        INC BC ; 03
        LD H,A ; 67
        LD A,+B ; 3E 08
MUL: ADD HL,HL ; 29
        JR NC,CNT ; 30 01
        ADD HL,BC ; 09
CNT: DEC A ; 3D
        JR NZ,MUL ; 2D F9
        POP BC ;restore Record 1 Address and C1
        ADD HL,BC ;add to point HL at requested Record 09
        POP BC ;restore Number and Length C1
END: POP AF ; F1
        RET ; C9
```

Using displacements to address the files allows for easy relocation of the entire set of files/tables. Only one absolute address is required by DIFA — that of DIFILE base address.

One of the main advantages of video output is the ability to produce visually attractive, changeable, moving graphics displays. 'Sub Set', however, has not made much of a show in graphics routines — probably because graphics are awkward to deal with and are usually program-specific.

The graphics package comprising the other four Datasheets is designed to be general purpose and easy to use. It requires only that shape tables be utilized giving x,y

co-ordinates and an ASCII graphic value for each point. DRAW is written for a memory-mapped display with a 64-byte difference between lines and a maximum 64 characters per line, but can easily be adapted to other sizes. Because DRAW copies from an original shape table, multiple images can be entered in display RAM at different points whilst the original keeps its position in relation to the origin. Using signed numbers for the co-ordinates makes cut-off simple to program, as any negative value is actually greater than LINE or CHAR when using the unsigned Carry Flag result to jump out.

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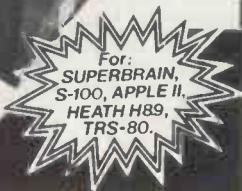
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# PCW SUBSET

## Datasheet

```

:=DRAW - Copy shape table figure to memory-mapped display
;/ CLASS: 1
;/ TIME CRITICAL?: No
;/ DESCRIPTION: Uses vectors and ASCII graphic character from a Shape table
;/ and an input translation vector to locate a figure on a
;/ memory-mapped-display. The origin is located at bottom
;/ left of the display.
;/ Line difference must be 64 bytes.
;/ ACTION: For each vector in shape table
;/ B ← LINE - (y + Ty)
;/ IF B < 0 OR B > LINE - 1 then next vector
;/ C ← x + Tx
;/ IF C < 0 OR C > CHAR - 1 then next vector
;/ BC ← TOP LEFT DISPLAY + B * 64 + C
;/ A ← ASCII GRAPHIC for VECTOR
;/ (BC) ← A
;/ SUBR DEPENDENCE: DIFA
;/ INTERFACES: None
;/ INPUT: HL = DIFILE (see DIFA)
;/ A = Shape Table number
;/ D } Translation vector (Tx)
;/ E } (Ty)
;/ OUTPUT: Figure copied to display
;/ HL = Table + 1
;/ DE unaltered
;/ A = ?
;/ REGS USED: HL AF DE
;/ STACK USE: 4 (10 including CALL DIFA)
;/ LENGTH: 48
;/ TIME STATES: 200 + 175 per char. drawn (82/108 per char. not drawn)
;/ PROCESSOR: Z80

```

```

LINE EQU NN ;number of display lines
CHAR EQU NN ;number of characters displayed per line
DISPL EQU NN ;low byte of Top Left Display Address
DISPH EQU NN ;high byte of Top Left Display Address

```

```

DRAW: PUSH BC ; CS
LD C,A ;point at Table A 4F
LD B,+1 ;first vector end 06 01
CALL DIFA ;get number of vectors in B CD XX XX
DRAW: PUSH BC ;save count C5
LD C,(HL) ;get x 4E
INC HL ; 23
LD A,(HL) ;get y 7E
INC HL ; 23
ADD A,E ;add Ty 83
CPL ;change into displacement 2F
ADD A,LINE ;from display top and C6 NN
JR NC,NXTP ;jump out if outside bounds 30 18
LD B,A ; 47
LD A,C ;get x in A 79
ADD A,D ;add Tx 82
CP CHAR ;test for inside side bounds FE NN
JR NC,NXTP ;jump out if not 30 11
RLCA ;BA ← B * 64 + A 07
RLCA ; 07
RR B ; CB 18
RRA ; 1F
RR B ; CB 18
RRA ; 1F
ADD A,DISPL ;add Top Left Display C6 NN
LD C,A ;address to displacement 4F
LD A,B ;to give 7B
ADC A,DISPH ;absolute address CE NN
LD B,A ;in BC 47
LD A,(HL) ;get ASCII Graphic 7E
LD (BC),A ;to display 02
NXTP: INC HL ;point to next vector 23
POP BC ;restore count C1
DJNZ DRAWL ; 10 D9
POP BC ; C1
RET ; C9

```

Because sine/cosine values for 0°, 90°, etc are -1, 0, +1, the matrix multiplication in TFORM is very quick. Figure 1 gives the most useful transformations with the encoded

matrices. Inputting a matrix table entry number instead of the actual encoded matrix allows for easier computation of the transformation required.

		Matrix coding for:	
		i) TFORM	ii) OTFORM
1	Rotate a c	45°	59 00
2		90°	08 2F
3		135°	9A 5C
4		180°	8E 7E
5		225°	A6 49
6		270°	E7 68
7		315°	65 18
8		360°	7D 3A
9	Reflect in	y = 0	8D 7A
A		y = x	07 2B
B		x = 0	7E 3E
C		y = -x	EB 6F
D	Shear that x ← x + y		75 38
E		x ← x - y	79 3D
F		y ← y - x	6D 1A
10		y ← y + x	5D 0A

## Datasheet

```

:= TFORM - Transformation of Shape Table figure
;/ CLASS: 1
;/ TIME CRITICAL?: No
;/ DESCRIPTION: Performs matrix multiplication using a 2 x 2 unitary value
;/ (-1, 0, +1) matrix on vectors in a Shape Table to effect
;/ rotation, reflection or shearing.
;/ The 8-bit encoded matrices have the bit-pair values:

```

```

;/ 10 = -1
;/ 11 = 0
;/ 00 = 0
;/ 01 = +1

```

```

;/ ACTION: Use DIFA to get matrix and print HL at Shape Table
;/ FOR EACH VECTOR
;/ C ← (HL)
;/ E ← (HL + 1)

```

$$\begin{pmatrix} (HL) \\ (HL+1) \end{pmatrix} \leftarrow \begin{pmatrix} 10 & 32 \\ 54 & 76 \end{pmatrix} \cdot \begin{pmatrix} C \\ E \end{pmatrix}$$

matrix bits

```

;/ SUBR DEPENDENCE: DIFA
;/ INTERFACES: None
;/ INPUT: HL = DIFILE (see DIFA)
;/ C = Matrix Table number
;/ B = Matrix Entry number
;/ A = Shape Table number
;/ OUTPUT: Shape transformed
;/ HL = Shape Table + 1
;/ BC = 0003H A = last y
;/ REGS USED: HL AF BC
;/ STACK USE: 4 (12 max. including CALL DIFA)
;/ LENGTH: 51
;/ TIME STATES: 435/822 - 870 depending on matrix (see DIFA)
;/ + 280 to 288 per vector
;/ PROCESSOR: Z80

```

```

TFORM: PUSH DE ; 05
PUSH HL ;save DIFILE E5
CALL DIFA ;get matrix CD XX XX
LD D,(HL) ;in D 56
POP HL ;restore DIFILE E1
LD C,A ;point at 4F
LD B,+1 ;first vector 06 01
CALL DIFA ;of Shape Table CD XX XX
TFL: PUSH BC ;save vector count and C5
LD B,+2 ;set count for two coordinates 06 02
LD C,(HL) ;get x 4E
INC HL ; 23
LD E,(HL) ;get y 5E
DEC HL ;point back at x 2B
COORD: XGR A ;β AF
RRC D ;plus -x/β/+x CB 0A
JR C,JMP1 ; 38 01

```

# PCW SUBSET

```

SUB C ; 91
JMP1: RRC D ; CB 0A
JR C,JMP2 ; 38 01
ADD A,C ; 81
JMP2: RRC D ;plus -y/2/+y CB 0A
JR C,JMP3 ; 38 01
SUB E ; 93
JMP3: RRC D ; CB 0A
JR C,JMP4 ; 38 01
ADD A,E ; 83
JMP4: LD (HL),A ;new x or y coordinate 77
INC HL ; 23
DJNZ COORD ; 10 E7
INC HL ;move past ASCII Graphic 23
POP BC ;restore vector count C1
DJNZ TFL ;repeat for all vectors 10 DC
POP DE ; D1
RET ; C9
    
```

TFORM allows for a matrix setting either or both coordinates to 0, which reduces the figure to a line or a point. The transformations in Figure 1 use only eight combinations of  $(-1, 0, +1)x + (-1, 0, +1)y$  and can be encoded in 3 + 3 bits. Bits 3 and 7 can be used to test the loop COORD. QTFORM is quicker by about 30 T. States per vector. The matrix codes are in Figure 1 and it is coded:

```

COORD: RRC D
JR C,YLD
LD A,C
RRC D
JR C,TNEG
    
```

```

ADD A,E
JR TNEG
YLD: LD A,E
RRC D
JR C,TNEG
SUB C
TNEG: RRC D
JR NC,BACK
BACK: LD (HL),A
INC HL
RRC D
JR C,COORD
    
```

TLATE moves a figure in Shape Table across the plane in relation to the origin. This is necessary for transformations about different points in the figure.

## Datasheet

```

;= TLATE - Translation of Shape Table figure by vector addition
; CLASS: 1
; TIME CRITICAL?: No
; DESCRIPTION: Moves a vector encoded figure in a Shape Table in relation
; to the origin.
; ACTION: FOR EACH VECTOR
; x ← x + Tx
; y ← y + Ty
; SUBr DEPENDENCE: DIFA
; INTERFACES: None
; INPUT: HL = DIFILE (see DIFA)
; A = Shape Table number
; (Tx)
; (Ty) = Translation vector
; OUTPUT: Figure translated
; HL = Shape Table + 1
; A = last vector y
; DE unaltered
; REGs USED: HL AF DE
; STACK USE: 2 (10 max. including CALL DIFA)
; LENGTH: 20
; TIME STATES: 200 + 67 per vector
; PROCESSOR: Z80
    
```

```

TLATE: PUSH BC ; C5
LD C,A ;point HL at Table A 4F
LD B,+1 ;first vector 06 01
CALL DIFA ; CD XX XX
TLTL: LD A,(HL) ;get x 7E
ADD A,D ;add Tx 82
LD (HL),A ;replace new x 77
INC HL ; 23
LD A,(HL) ;get y 7E
ADD A,E ;add Ty 83
LD (HL),A ;replace new y 77
INC HL ;move point to 23
    
```

```

INC HL ;next vector 23
DJNZ TLTL ;and repeat for all vectors 10 F5
POP BC ; C1
RET ; C9
    
```

The Senior Lecturers in Mathematics and CSE students among you will have noticed that not only do transformations 1, 3, 5 and 7 (Figure 1.) result in a rotation about the origin but also increase the size of the figure by a factor of  $\sqrt{2}$  linear. Two such rotations produce a twice linear scaling and so HALF will have to be called to re-obtain the original size.

## Datasheet

```

;= HALF - Half scaling (linear) of figure in Shape Table.
; CLASS: 1
; TIME CRITICAL?: No
; DESCRIPTION: Divides each coordinate by two thus effecting a half linear
; scaling of the figure with the origin as centre. Fractions
; are lost.
; ACTION: FOR EACH VECTOR
; SUBr DEPENDENCE: DIFA
; INTERFACES: None
; INPUT: HL = DIFILE (see DIFA)
; A = Shape Table number
; OUTPUT: Figure halved
; HL = Shape Table + 1
; A unaltered
; REGs USED: HL AF
; STACK USE: 2 (10 max. including CALL DIFA)
; LENGTH: 18
; TIME STATES: 200 + 61 per vector
; PROCESSOR: Z80
    
```



```

HALF: PUSH BC ; C5
LD C,A ;point HL at Table A 4F
LD B,+1 ;first vector 06 01
CALL DIFA ; CD XX XX
HLFL: SRA (HL) ;x ← x/2 CB 2E
INC HL ; 23
SRA (HL) ;y ← y/2 CB 2E
INC HL ;move point to 23
INC HL ;next vector 23
DJNZ HLFL ;and repeat for all vectors 10 F7
POP BC ; C1
RET ; C9
    
```

For explosive effects, substituting SLA (HL) for SRA (HL) in HALF produces DOUBLE with the same timing, etc. Any character of the figure which is situated at the origin will be unaffected.

(LD B,0 : DEC C : INC BC adjusts to correct 0100H), then any error test must allow for 00>FF.

## Aces high

DIFA doesn't have any error checking to guard against the requested File/ Record number being greater than the number of Files/Records. As 00H in DIFA stands for 256

The sequence DEC A : CP r : INC A will set the Carry Flag if  $0 < A \leq r$  and sets the Zero Flag if  $A = 0$ , but this does not meet the requirements. I'm sure Alan would like to receive the shortest/quickest solution which distinguishes  $A \leq r$  when 00H = 256, and any other useful test sequences. I certainly would.





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## UK101 MULTI MONITOR MOD

There must be many UK101 users like me who have more than one monitor, usually people who have uprated their computer and who still have the old chips. I prefer the old monitor with Nigel Climpson's screen editor (available from Technomatics in a 2716 EPROM) which is a beauty for editing, but occasionally I run a program which needs the new monitor. The EPROM and ROM have chip enable lines of opposite sense and, so that I can change chips, I've made the select logic switchable rather than solder in links. It's quite a simple operation; the tracks at W7 and W6 had to be cut and the centre pads connected to the left rather than the right, so a DPDT switch connected as Figure 1 allows both systems to be used.

The next thing to occur to me was that it's a shame to have to keep on removing chips every time I wanted to use the other system, so why not arrange to have both monitors available all the time? The fact that I'd already built switchable chip select logic into the machine made it very easy to do. All that was necessary was to mount the chips piggy-back, pin-to-pin spot soldered, and the new assembly inserted into the monitor socket.

Purists are not going to like this but *it works*. Do yourself a favour and use a socket soldered onto the chip you value less (you can't guarantee not making a mess of it, can you?) With both monitors in the same socket you'll now find on power up that you're running on whichever one has been selected.

If you change over monitors in the middle of a program, the computer will lock up, but a RESET followed by a warm start will usually allow you to carry on, although it's still a good idea to have a copy on tape as back-up.

I haven't tried it, but even if your monitors are both ROMs, and have the same chip select logic, you may be able to use a similar method, and mount them piggy-back but with the enable pins (18 & 20) bent out and connected through a DPDT switch to the select lines.

I dare say that with ambition and enough chips, someone will try building a tower of monitors — buffering, heat dissipation and case head-room allowing — but if you ruin your machine, don't blame me. No-one was more surprised than me when it worked!

David Hattams

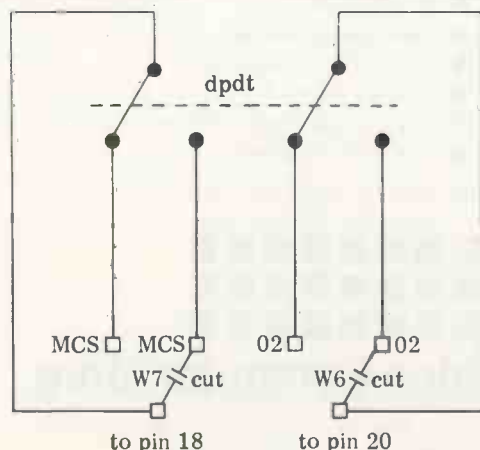


Fig 1 Monitor select switchable logic

## AERIAL COUPLING

Do you find it a nuisance having to unplug the TV aerial every time you want to plug in the computer? If so, then this simple coupling unit may be of use to you. It enables the TV to pick up sufficient signal from the computer without having to disconnect the aerial.

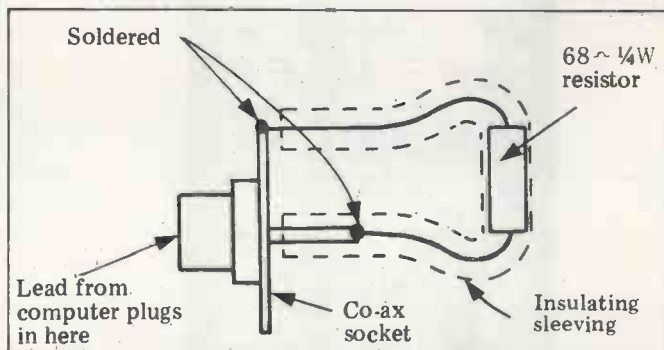
There are two ways in which it can be used. If your set has a small box on the back to convert the round co-ax lead from the aerial into the flat twin lead which actually goes to the aerial terminals of the set (as on many Japanese sets), then tape the unit onto the twin lead with the wires of the resistor running parallel with those of the lead. If you use an indoor aerial, place the unit against the aerial. It will be necessary to experiment to find the best position. With a 'toast-rack' type aerial, hanging it from one of the rods about 1/3 of the way from the

front and close to the centre line of the aerial seems quite good. In either case, if more signal is required, the leads of the resistor can be extended by up to a couple of inches each.

If you have an outside aerial, and the lead is co-ax all the way, then I am afraid that this particular unit is of no use to you.

Warnings 1) Do not place this coupling device within the TV, or make any direct connections to the inside of the set. 2) Since the aerial is still connected, a small amount of signal could be radiated from it. This might possibly cause interference to other sets if their aerials are close to yours or if you are fed from a communal aerial system. Position the unit so that the signal induced into the aerial/aerial lead is no more than that required to stop the picture being noisy.

P. Gascoyne



## ATOM GHOST MODS

If you tried to carry out the Atom Ghost RAM modifications in February's TJ's Workshop and couldn't get it to work, it's because the first version contained a few bugs. Here are the corrections: Disconnect IC22 pin 9 from IC20, pin 3 and connect it to PROMSEL. Disconnect IC21 and 22, pins 1 and 19 from IC20, pin 11 and connect them to ground. Disconnect IC19 pin 12 from RAMSEL and connect it to IC20, pin 3.

Pin 1 of IC20 should be disconnected from pin 21 of the connector and joined instead to a spare pin on the connector for the control bit. Disconnect pin  $\pm 1$  of IC24 from ground and link it to connector pin 29. Disconnect IC25 pins 2 and 5 from IC25 pin 8 and connect them to IC20 pin 3. Pin 8 of the on-board EPROM select wire links Now goes to the RAM/EPROM select bit.

Ron Yorston

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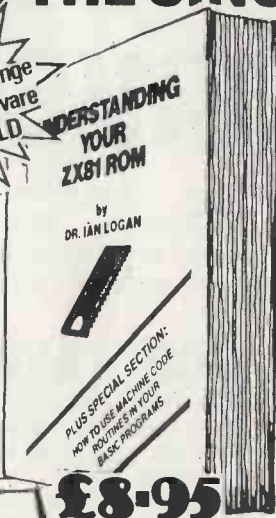
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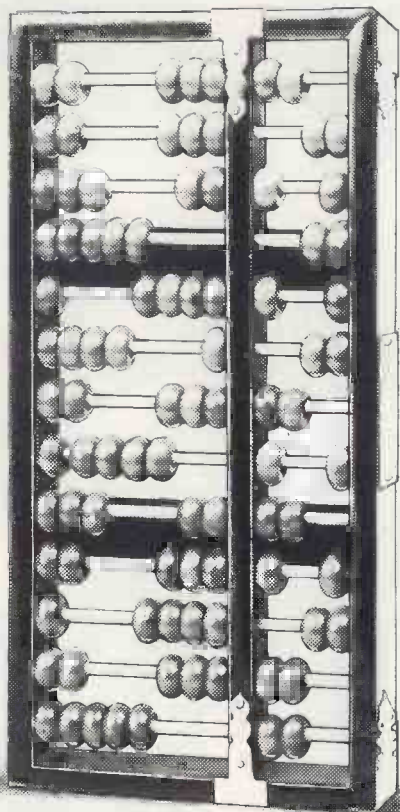
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## ATOM STRING SORT

Here's a handy utility which allows you to type in alphanumeric strings and then sorts them into order according to the ASCII code of each character.

Steve Moore

```

10 REM *****
20 REM * *
30 REM * ATOM SORT *
40 REM * *
50 REM *****
60 REM
70 REM
80 PRINT $12,$14
90 @=0; N=0
100 INPUT "How many strings? "S
110 IF S<=100 GOTO 140
120 PRINT "Not enough space"
130 GOTO 100
140 S=S-1
150 DIM PP(S),SS(S),X(-1)
160 REM *** GET STRING ***
170 PRINT N+1
180 INPUT $X
190 SS(N)=X
200 X=X+LEN(N)+1
210 IF X&#FFFF<#3C00 GOTO 240
220 PRINT "** * * OUT OF MEMORY * * *"
230 GOTO 400
240 I=0
250 REM *** TEST STRING ***
260 IF I=N PP(I)=N; GOTO 410
270 IF $SS(N)=$SS(PP(I)) GOTO 370
280 J=0
290 IF SS(N)?J<SS(PP(I))?J GOTO 370
300 IF SS(N)?J>SS(PP(I))?J GOTO 340
310 J=J+1
320 GOTO 290
330 REM *** INCR I ***
340 I=I+1
350 GOTO 250
360 REM *** INSERT STRING ***
370 FOR J=N TO I+1 STEP -1
380 PP(J)=PP(J-1)
390 NEXT J
400 PP(I)=N
410 REM *** INCR N ***
420 N=N+1
430 IF N<=S GOTO 170
440 REM *** PRINT STRINGS ***
450 FOR I=0 TO N-1
460 PRINT 'I+1,".", $SS(PP(I))
470 NEXT I;PRINT $15
480 END

```

## ATOM PRINT AT

This routine gives the Acorn Atom a PRINT AT facility similar to the one for the PET by David Viner, printed recently in TJ's Workshop.

The Basic Program must be typed in and run to load the machine code routine into memory. Whenever BREAK is pressed the routine must be re-enabled by: !#21A = #2800.

The PRINT AT facility is used by the command SHUT

[exp]; PRINT [message], where [exp] is a number or a variable and [message] is anything allowed in a normal PRINT statement. So, SHUT 15; PRINT "HI" will print HI in the centre of the top line. The value of [exp] must be from 0 to 511; values outside this range will give an ERROR 18 message.

Dennis May

```

10 P=#2800; [LDY 224; LDA(222),Y; EOR 225;
STA(222),Y; INX; LDA #42,X
20 ORA #33,X; BEQ P+3; BRK; LDA #24,X;
CMP @2; BCS P-5; ORA @128; STA 223
30 LDA #15,X; AND @31; STA 224; LDA #15,X;
AND @224; STA 222; RTS;}
40 !#21A=#2800; END

```

## UK 101 VARIABLES LIST

I have discovered that Microsoft Basic on the UK101 keeps a note of the position of its variable table in locations 7BH and 7CH (start) and 7DH and 7EH (end). A bit of judicious PEEKING was needed to see exactly what was there. It transpires that six bytes are set aside for each variable assigned in a program, two for the variable name (even if a variable name is only one character) and four for the value assigned to the variable — the number is held in floating point representation.

The conversion of floating point numbers in Basic is not my idea of fun but it seemed

that it would be useful to have a dump of all numeric variables used to date in a program. So you need a program, short enough to be typed in when required, which will list out the variables you have used so far (see Listing 1).

Martyn Croft

```

10 PRINT "VARIABLES USED"
20 FOR Z=(PEEK(124)*256+PEEK(123)) TO
(PEEK(126)*256+PEEK(125)-1) STEP 6
30 PRINT CHR$(PEEK(Z)); CHR$(PEEK(Z+1)), :
NEXT:END

```

## PET PRINTER REVISED

Having read 'TJ's Workshop' (PCW, November), I decided to try the PET program for producing lower case listings on a printer written by M Clampitt. I typed in the program, and stored the program I wanted listed on a cassette file and was then amazed to see meaningless strings of characters being printed. I don't know whether the program was designed for a Commodore

printer or not, but it certainly didn't work on the 3022 Tractor Printer that I tried it on.

After half an hour's work, however, I did manage to get the program to work. Here's a listing of the revised program.

David Alderson

```

100 rem lists on a commodore printer a program
101 rem saved in an ascii data file
110 poke 59468,14 : print "S"
130 input "Name of program ";z$
140 print : input "Double (d) or single (s) spacing ";y$
150 y$=left$(y$,1)
160 open 1,1,0 : open 4,4
180 print #4,chr$(17)z$ : z=$
190 get #1,a$
200 if st=64 or st=-128 then close 1 : close 4 : end
210 a=asc(a$)
240 if a=13 or a=141 then gosub 300
280 print #4,a$
285 if z>66 or (z>33 and y$<>"s") then z=0 : print #4,chr$(13)
290 goto 190
300 a$=chr$(13)+chr$(10)+chr$(17) : z=z+1
301 if y$<>"s" then a$=a$+a$
302 return

```

## DISK SECTOR I/O UNDER TRSDOS

The program described here is intended for any TRS-80 Model I disk system using the TRSDOS 2.3 operating system. It performs the simple but useful operation of replacing the diskette name on a diskette. Its main purpose here is to demonstrate the use of routines present in TRSDOS 2.3 to perform disk I/O between memory and specific disk sectors. These routines are not mentioned in the TRSDOS reference manual and so are described in Table 1.

Table 1: Addresses of Routines

Entry Point	Function of Routine
46DD	Read disk sector into memory.
46E6	Write user data to disk sector.
46EF	Write system data to disk sector

All of these routines have the same entry requirements which are specified in Table 2. On exit, register A contains a standard TRSDOS return code and the Z flag is set if there was no error.

Table 2: Entry Requirements

Register	Contents
C	Disk drive number
D	Track number.
E	Sector number.
HL	Address of buffer in memory.
B	Number of bytes to transfer (256 if zero).

Note that there are two similar routines which write data to a disk sector. The routine at 46EF is used only when writing data to directory sectors.

It causes a return code of 6 to be produced on subsequent reads of the sector, indicating to TRSDOS that it has read system data.

The program in Listing 1 uses the routines described above to change the diskette name of a diskette. Assuming that it has been assembled to produce a command file with the name DISKID/CMD, the program is used by specifying the new name after the command. For example: DISKID NEWNAME sets the diskette name to NEWNAME DISKID sets the diskette name to spaces.

In order to understand how the program works, the following information is needed:

1. On entry to the program, HL points to the part of the command line following the command. In this case it points to the new diskette name.
2. The program obtains the number of the directory track from the byte at offset 2 in sector 0 of track 0 (the boot sector). The directory is almost always on track 17.
3. The diskette name is stored in an eight byte field at offset D0 (hex) in sector 0 of the directory track (the GAT sector).

Finally, if you decide to try using these routines for other purposes (such as file recovery or password removal) make sure that the diskette that you use for debugging has been backed up!

David Bonham

## ZX80 TO ZX81 CONVERSION

The contribution by Alan Fowke in the December TJ's Workshop listed some useful tips to be considered when converting programs written for the ZX80 to run on the ZX81. But he missed two subtle differences which can play havoc with a program. On the ZX80 the initial element in an array is zero; on the ZX81 it is one. An array which has been dimensioned A(9) and filled in a loop starting with a statement: FOR I = 0 TO 9 has to be re-dimensioned A(10) and handled in loops using: FOR 1 = 1 TO

10. If this is not done then report code 3 will result (subscript out of range). The other difference is that the value of 'true' on the ZX80 is -1; on the ZX81 it is 1. This is important if you use logic statements to reduce the number of lines in a program. For example, the two lines:  
10 IF A <> 0 THEN LET B = 10  
20 IF A = 0 THEN LET B = 20  
can be replaced with:  
10 LET B = 10 - 10 \* (A=0)  
(ZX80) and 10 LET B = 10 + 10 \* (A=0) (ZX81)  
M. Ormerod

```

DISKID - A program to change the diskette name
Assemble using the MACRO-80 Assembler.

DISKID:  CSEG          HL          ;ORG nnn on other assemblers
        PUSH          HL          ;Save pointer to new name

        Read boot sector (track 0, sector 0) into memory ...

        LD  C,0          ;Select drive 0
        LD  D,C          ;Track 0
        LD  E,C          ;Sector 0
        LD  B,C          ;Read 256 bytes
        LD  HL,SECTOR    ;Space for boot sector
        CALL 46DDH       ;Read boot sector
        JR   NZ,DOSEERR  ;Make sure all went well

        Extract number of directory track from boot sector ...

        LD  A,(SECTOR+2) ;Get track number
        LD  D,A          ;Prepare to read directory

        Read GAT sector (sector 0) of directory track ...

        CALL 46DDH       ;Read sector
        CP  6            ;Return code should be 6
        JR   NZ,DIRRERR  ;since we read system data

        Now move the new diskette name from the command line into
        the GAT sector, padding with spaces as necessary ...

        EX  (SP),HL      ;Save HL, get command line
        PUSH DE          ;Save DE too
        LD  DE,SECTOR+ODOH ;Start of name field
        LD  B,8          ;Length of name field

COPYID: LD  A,(HL)       ;Next char from command line
        CP  13           ;Check for end of name
        JR   Z,MOVED
        LD  (DE),A       ;Place char in name field
        INC HL           ;Move on to the next
        INC DE           ;Character
        DJNZ COPYID     ;
        JR   NOMORE     ;Moved 8 chars so no padding

MOVED:  LD  A,"          ;Pad out rest of name field
FILLID: LD  (DE),A       ;with spaces
        INC DE
        DJNZ FILLID

        Write the modified GAT sector back to the directory
        (note that we are writing system data) ...

NOMORE: POP  DE          ;Restore track and sector
        POP  HL          ;Restore pointer to data
        CALL 46EFH       ;Write new sector

        If all went well, return to TRSDOS ...

        JP   Z,402DH

        Exit via the TRSDOS error handler if a DOS related error
        occurred ...

        OR  OCOH         ;Move in flags
        JP  4409H        ;Give error message

        Inform the user that we failed to find the directory
        where the boot sector said it was (!) ...

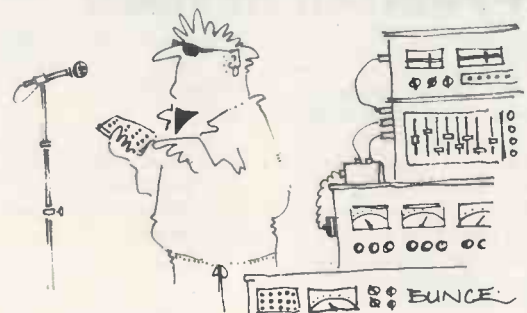
DIRERR: LD  HL,DIRTXT   ;Suitable message
        CALL 4467H       ;Output text
        JP  402DH       ;Then back to DOS

DIRTXT: DB  'DIRECTORY NOT FOUND',13

SECTOR EQU  S          ;Start of free space

        END  DISKID

```



'And for its next number ...'



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STATEMENTS	PRINT, INPUT, LET, GOTO, GOSUB/RETURN, FOR/NEXT IF/THEN	●	●	●	●	●	●	●
	STEP	●		●	●	●	●	●
	TAB	●			●	●	●	●
ARITHMETIC FUNCTIONS	ABS, RND	●	●	●	●	●	●	●
	INT	●			●	●	●	●
	ATN, COS, EXP, LOG, SGN, SIN, SQR, TAN ARCSIN, ARCOS	●			●	●		●
STRING FUNCTIONS	CHR\$	●	●		●	●		●
	LEN	●		●	●	●		●
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	FLOATING PT ±10 <sup>±38</sup>	●			●	●	●	●
NUMERIC VARIABLES	INTEGERS		●	●	●	●		●
	A-Z			●			●	
STRING VARIABLES	AA-ZØ				●	●		●
	An-Zn, n= any alphanumeric string	●	●					
NUMERIC ARRAYS	A\$ & B\$						●	
	A\$ to Z\$	●	●	●				
DISPLAY	An\$ to Zn\$ n= any alphanumeric character				●	●		●
	SINGLE DIMENSIONAL		●	●			●	
SPECIAL FEATURES	MULTI DIMENSIONAL	●			●	●		●
	ROWS	24	24	16	24	25	16	16
SPECIAL FEATURES	COLUMNS	32	32	32	40	40	64	64
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	HI RES GRAPHICS (>40000 pixels)			●	●			
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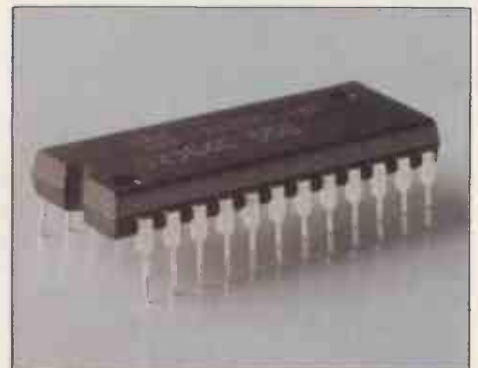
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## This month Alan Sutcliffe reveals a little known solution to the 'hidden surfaces' problem in graphics.

So far in Patterns I have written about abstract arrangements and designs. Representing reality—by which is meant the appearance of things—presents many problems that do not arise in making two-dimensional non-representational patterns. One such problem—or rather a whole group of problems—is to do with the removal of hidden lines and surfaces in showing a three-dimensional scene. What bits of the picture lie behind which other bits and so should not be drawn, or should be drawn and then overwritten by what lies in front of them?

How the problem presents itself and how it can be solved depends a lot on the type of output display used and the way objects are shown. When I did a short animated sequence of an imaginary landscape for the film 'Alien' a few years ago I was able to use a simple approach—there was no time for anything else. A vector graphics device was used, so the scene was made up of a set of straight lines. I chose to show the form of the land by having a series of more or less horizontal lines going across the screen, those further up representing points further away from the viewpoint. Any bump in a line appears as a hill, and any dip as a hollow. Figure 1 shows the method. Each line can only obscure those above (behind) it, and be obscured by those below (in front of) it. Each line represents a horizon up to that level.

The rules for drawing the lines should now be clear, given a set of three-dimensional coordinates for the terrain at a number of grid points, and the position of the viewpoint:

\* Calculate the first, bottom line, and draw it. Nothing is in front of this so it is all visible. It establishes a horizon.

\* Calculate the next line, and determine which parts of it, if any, fall below the horizon: ignore any that do and draw the rest. This establishes a new horizon. Repeat this last step until all the lines are drawn and the scene is complete.

There is an article in the June 1981 issue of *Creative Computing*, reprinted in *Video* in September 1981, that describes the method and the program in detail. The basis is obviously nearest first.

### Hidden surfaces

In a picture composed of areas rather than lines, a similar approach can be used. This is the form most suitable for most micro-systems. Plotting areas rather than lines has one big advantage: it is not necessary to compute just which parts of an area are hidden. If the areas are drawn in the order from furthest first to nearest last the plotting process takes care of this by overwriting any areas that are hidden.

This approach of drawing surfaces in the order of their distance from the point of view is often given as the best,

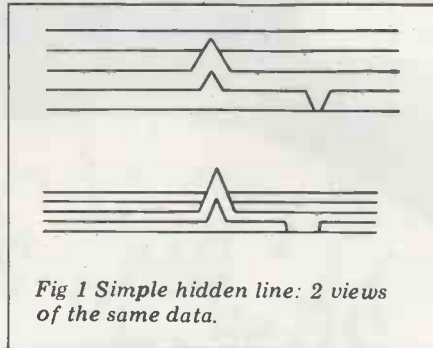


Fig 1 Simple hidden line: 2 views of the same data.

or even the only, way of solving the hidden surface problem. It is certainly not the only method, and it may not be the best. It has two possible disadvantages.

1. The order in which surfaces are to be plotted depends on the distance from the point of view, and so must be computed afresh for each new viewpoint.

2. The notion of which of two surfaces is nearer to a given point in three dimensions can be ambiguous: a long strip of surface may extend both nearer and further from the viewpoint than a small patch. It is then necessary to go into just which little bit of the long strip is in line with the small patch in the direct line of sight, and then which of these is nearer. That is complicated and time-consuming, and can entail drawing rays out from the viewpoint in all directions to see in which order they skewer the surfaces.

The rest of this article describes a way of dealing with hidden surfaces in which much or even all of the computation about the order of plotting the surfaces is independent of the viewpoint and can be carried out once and for all at the beginning of the program for each fixed scene—say the model of a city—rather than for each different viewpoint in an animated sequence.

This may seem contrary to your intuition—it certainly did to mine when I first found this method—and that may be one reason it does not seem to be much discussed. It is also what makes it particularly interesting. Even in the excellent 'Horizon' programme on American computer graphics shown on TV at Christmas, one of the foremost experts in California said that hidden surface removal depends on distance from the point of view. It does not.

### Assumptions and definitions

This part of the article deals with the background to the method, the theory, while next month I will present a program to implement it on a micro. First there are some assumptions and

definitions to give.

\* Each surface of the scene is flat, and lies entirely in one plane.

\* Each surface may have any shape of outline, and may even have holes in it, like windows in a wall.

\* Each surface is one-sided, that is it has a front and a back and can only be seen from the front.

\* If a surface is wanted that can be seen from both sides, like the inside and outside of a wall, then these sides must appear separately in the catalogue of surfaces: they will differ only in sign, + or -. Often it is enough to keep only the outside surfaces, as in the model of a city where the buildings do not have windows through which the insides can be seen (quite normal in architectural models), and where the city is only to be seen from outside the buildings—the view from inside a windowless block is pretty dull, anyway.

\* The sign of a surface may be thought of as indicating whether it faces towards or away from the origin of the coordinate system in which the model is stored. More of that when we come to details of the program.

I must also say a few words about what is *not* being dealt with in this article. Two important aspects are assumed to be dealt with by the program without giving details. They are perspective and 'clipping'—that is, what part of the scene visible from the viewpoint actually falls within the viewing window, assuming that a total 360° panorama is not being presented. These are both matters that depend on the point of view, and I am concerned with what can be sorted out before that is decided.

### A simple example

Here then, is the basis of the method: imagine two surfaces, a patch of ground and a wall nearby but not on the patch. Remember that both surfaces are one-sided and invisible from the back. The underside of the ground can be ignored because we are not going to look at the scene from below ground. So the patch of ground can never obscure any part of the wall. The wall may or may not obscure some part of the patch of ground, depending on which way it is facing. But it will always be safe to draw the ground first and then the wall, and the order of plotting will take care of any part of the patch of ground that is obscured by the wall.

But, you may say, these aren't all the possibilities—because the viewpoint is restricted to above ground. Assume a point of view below ground, then—down a well, for example. From here the patch of ground cannot be seen at all, so there is no question of it obscuring anything. What might obscure the wall is the underside of the ground—a

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different surface—or more likely the sides of the well. Thus, returning to the wall and patch of ground, the order of plotting them is determined once and for all, for any viewpoint. The steps needed for this simple case are as follows: Make the fixed list Ground, Wall, for all points of view.

As the scene is to be plotted, for each surface in turn and for each point of view, determine if the point of view is in front of the surface, if so draw it, otherwise ignore it.

The distance of the point of view from the wall and ground are not computed or considered at all. The determination of which side of a surface a point is on is simple: put the coordinates of the point in the equation of the surface, and test the sign of the result. For a one-sided surface this must then be multiplied by the sign of the surface, but if the equation is stored in the right form this will all be part of the same step. If the equation of a surface is  $x + 2y + 3z + 4 = 0$ , this can be taken as the equation of the upper surface; while that for the lower surface is simply  $-x - 2y - 3z - 4 = 0$ . The point (1,1,1) for example gives  $1+2+3+4 = 10$ , which is positive when substituted in the first surface, so it is in front of this. In the second equation it gives  $-10$ , and so is behind it.

A zero value would indicate that the point of view was in the same plane as the surface in question, and the convention is that the surface is then invisible, having no thickness. Zero is lumped with negative: in the plane but behind it. But this is taking us too far into the detail of implementing the method before its validity has been established.

## Analysis of cases

In many cases the order in which the surfaces are plotted does not matter at all. Consider a cube which is seen from the outside only. It has 6 one-sided surfaces. There is no point of view from which any of them obscures any other. All they can do is get in front of the backs of some of the other surfaces, but these are invisible anyway. So in a scene consisting of only a single cube the list of surfaces can be in any order. The same is true of any convex object, such as a near-sphere composed of hundreds of small facets each too small to see. Every outside surface is back-to-back with every other outside surface.

If the cube had windows and inside walls, and could be viewed from both

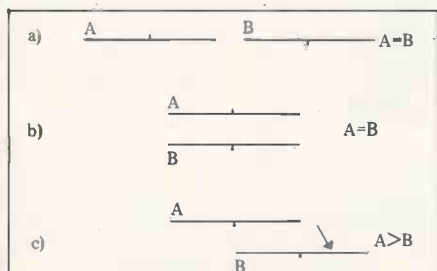


Fig 2 Two areas in the same plane or in parallel planes.

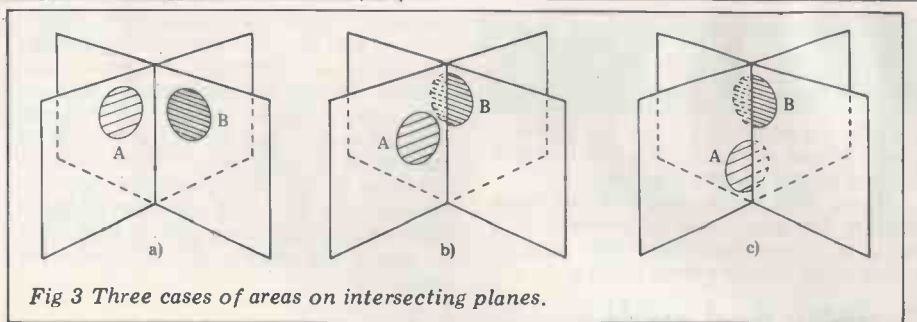


Fig 3 Three cases of areas on intersecting planes.

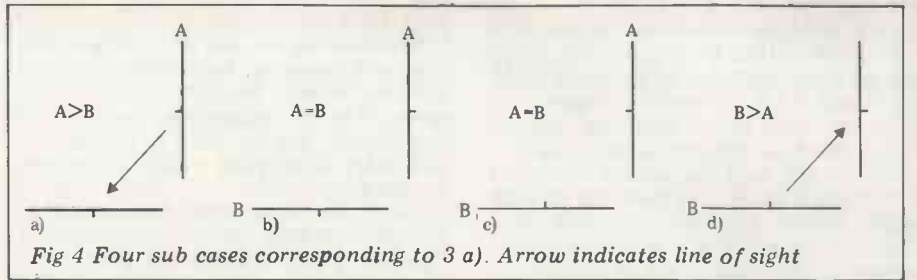


Fig 4 Four sub cases corresponding to 3 a). Arrow indicates line of sight

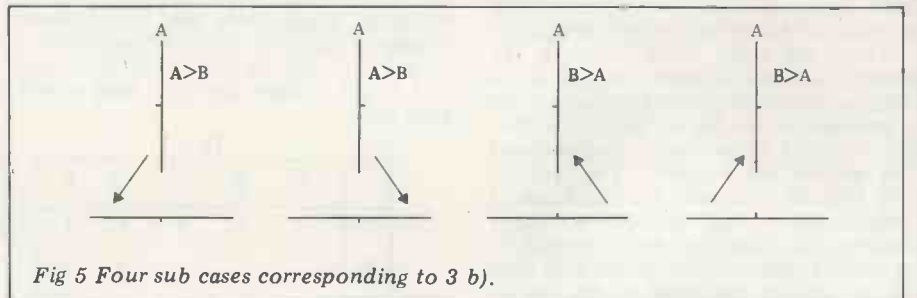


Fig 5 Four sub cases corresponding to 3 b).

inside and outside, the situation is not much more complicated. No inside surface can get in front of an outside one, or in front of another inside surface. Each outside surface can obscure some inside surfaces but no outside ones, as noted above. The order of plotting is therefore all (visible) inside surfaces in any order, then all (visible) outside surfaces in any order. Again this applies to any convex body.

For concave bodies and for more complex scenes the situation is more complicated, but in many cases the order of plotting can be decided for all viewpoints. To show this we must abandon this study of particular cases and launch into more basic analysis. This consists of considering in turn all possible relationships between a pair of surfaces. Most of these are straightforward, but there is one set of awkward cases at the end. This is best explained with a set of diagrams in which each of the 2 surfaces is seen end on and so just appears as a line.

A little bit of notation. The two surfaces are A and B.

- $A > B$  means that A can obscure B
- $A < B$  means that B can obscure A
- $A = B$  means that neither can obscure the other.

Now refer to the diagrams in turn.

- 2a) A and B are in the same plane, so neither can obscure the other:  $A = B$ .
- 2b) A and B are in parallel planes and face in opposite directions, either both inward or both outwards.  $A = B$ .
- 2c) A and B are in parallel planes and both face the same way.  $A > B$ .

In the diagrams the convention is that the plain side of the line is the front, visible side of the surface, and the one with the small mark is the back, invisible side.

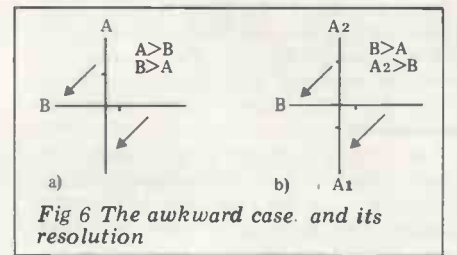


Fig 6 The awkward case and its resolution

If the surfaces are in skew planes—that is planes that intersect—they do so along a line. There are 3 possible arrangements to consider, shown in Figure 3.

- 3a) The line of intersection passes through neither surface.
- 3b) The line of intersection passes through one surface, say B, but not the other.
- 3c) The line of intersection passes through both A and B. This is the awkward case.

Now we must look at each of these cases in more detail, returning to the edge-on view, looking down the line of intersection of the planes. Figure 4 shows the four sub-cases from 3a and the resulting visibility relation in each case. There is no other way in which two such surfaces can be arranged. Figure 5 shows the detail for 3b, and is again complete. Figure 6 shows the awkward case, and the reason for it is that part of A can obscure B, and part of B can obscure A. Our system breaks down because there is not a single fixed relation between A and B. In fact, this case is a problem for any method, because both relations can hold even from a single viewpoint; plotting A then B may fail, and plotting B then A may fail. The solution, in any method, is to split one of the surfaces into two parts along the line of intersection. This decomposes the case into three surfaces which can be taken in pairs.  $A_1$  and  $A_2$

# PATTERNS

are case 2a and so  $A_1 = A_2$ .  $A_1$  and B is case 5d) and so  $B > A_1$ .  $A_2$  and B is case 5a) and so  $A_2 > B$  (see Figures).

Given this decomposition, we have derived for every pair of surfaces in a scene a single fixed visibility relation which holds for all points of view.

## Graphs and cycles

This is good, but not all we wanted. It is still possible that there are cyclic loops among these relations of the kind  $A > B$ ,  $B > C$  and  $C > A$ , as shown in Figure 7. If there are such loops, then the relation to be used to determine the order of plotting can only be settled when the viewpoint is known. If there are no such loops, then it is possible to draw up a fixed list of plotting order for all viewpoints. In any case it will be possible to draw up a partial list, leaving as little as possible to be decided for each viewpoint.

Thus the next main steps in the process are to convert the data on relations between pairs of surfaces as far as possible into a list of plotting order, that is, until some loop is encountered that cannot be resolved. The way to start this list is to look for two kinds of surface: those that obscure no other surface, and those that are obscured by no other surface. Those of the first kind can be put at the head of the list of plotting order, to be plotted first, while those of the second kind can be put at the bottom of the list. This process can then be repeated and the list built up, from the top down and from the bottom up.

A simple example should make this clear. Consider two vertical square blocks arranged as in the plan view of Figure 8. Forget the tops and bases of these

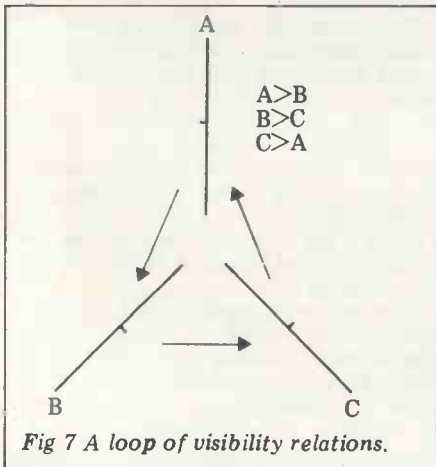


Fig 7 A loop of visibility relations.

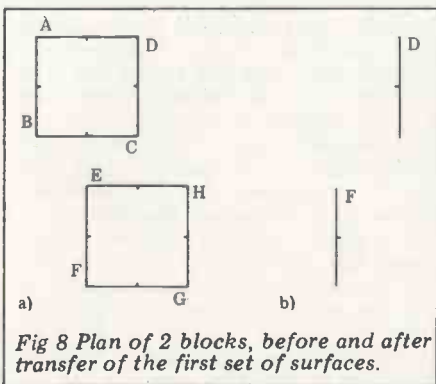


Fig 8 Plan of 2 blocks, before and after transfer of the first set of surfaces.

blocks and look only at the sides. Clearly A, B, G and H each have nothing obscuring them, so they may be put at the bottom of the list and plotted last, in any order. Equally C and E obscure nothing and so may be put at the top of the list of plotting order. These surfaces can now be removed from the diagram, leaving only D and F. Neither of these now obscure anything and so they may be put in the middle of the list which is complete:

C, E  
D, F  
A, B, G, H

If the columns are the same height, the tops and bases can be added to the list with no trouble: they are all in the category of being obscured by nothing and so go on the last line with A, B, G and H. The order of plotting within a line does not matter.

How are these relationships stored and manipulated inside the program? There is a two-dimensional array with an element for each ordered pair of surfaces, where their row and column intersect. Suppose the relations are  $A > B$ ,  $A > C$ ,  $A > D$ ,  $A > E$ ,  $B > D$ ,  $B > E$  and  $C > E$ . The array for this data would look like:

		To				
		A	B	C	D	E
From	A		1	1	1	1
	B				1	1
	C					1
	D					
	E					

A helpful way of thinking about this data is as a directed graph. Each surface is represented by a point, and the relation  $A > B$  is represented by a line from A to B with an arrow indicating its direction. The same data is shown in this form in Figure 9. Here are the rules for converting this data on relations into a list of plotting order, expressed in terms of the directed graph.

1. A point which has only lines leading to it can be placed at the head of the list—but below any already put at the head—and erased from the graph.
2. A point which only has lines leading from it can similarly be placed at the bottom of the list, but above any already put at the bottom.
3. A point with no lines leading to or from it can be dealt with either as for 1 or for 2 above.

In every case, the point and all the lines connected to it can be removed from the graph when the point is put on the list. This may well bring other points into one of the categories 1, 2 or 3 which can be dealt with even though until this stage they were in the fourth category of having lines leading both to and from them, and so not capable of being transferred to the list under the rules above.

It is this process of peeling off successive layers from the top and bottom that makes it difficult, looking at the data for all but the simplest graphs, to tell whether it is going to be possible to complete the plotting list or whether some loops will turn up to frustrate the process.

GOTO page 189

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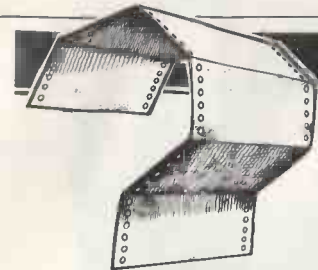
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## Map guide

Would somebody please explain what memory mapping is?  
*R Gilmore, Manchester*

Memory mapping is the method in which ports are addressed as memory locations. This means that they are addressed (selected) by the address bus and their data is transferred along the data bus. The advantage of this system is, on an 8-bit processor, up to 65,535 individual 8-bit ports can be addressed. This is compared with the 255 ports available using the I/O lines provided on such processors as the 8080A and the Z80.

Another advantage of memory-mapped I/O is ports can be read by PEEK statements and set by POKE statements. This means that their controlling software can be written in Basic with the exception of applications where speed is important.  
*D Stocqueler*

## Which WP?

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One essential requirement is that the printed copy is of a quality high enough to present to editors, etc.  
*Robin Clarke, Bishop's Castle, Shropshire*

There are many microcomputer systems for which word-processing program/software is available. The critical feature in any word processing system is the printer, the cost of which depends on the quality of print and the facilities available for complex word-processing operations. Of the systems available, the following reflect the general cost: PET 4000 series with disk drive (32k only) £1525; Apple II standard system with disk £1623; TRS-80 Level II with expansion interface £1535; Sorcerer standard

system (single disk) £1494; to these costs, the cost of the software must be added. On systems which can use CP/M, ie, Apple II (with Softcard), TRS-80 and Sorcerer, the Wordstar system can be used at a cost of £255 plus the cost of the CP/M system itself.

Additionally, the Sorcerer has a word processing ROM PAC which, with a disk drive, would cost £145. The word processing software for the PET is Wordpro and costs £75. There is also a separate word processing system for the Apple at £42. Finally, the cost of the printer which may double the total system cost. These range from a simple dot-matrix printer, like the Epson TX-80B at £359.00, to a Spinwriter at £1500. Perhaps the best compromise in your situation would be a converted IBM Selectric typewriter at an average cost of £350. At least the print quality will be acceptable since it produces a typewriter style.  
*SW*

## 'Brain help

As a SuperBrair owner, I would be grateful if you could help me with the following.

How do I create the contents of a file 'DATES.COM' such that, by switching on, inserting the disk, and typing 'DATES', the Basic program 'DATES.BAS' will be run?

I should be able to cope with assembler programming as I was a machine-code programmer for many years. The SuperBrain user's manual is no help at all. Can you please recommend a suitable book?  
*Barbara Sanders, London SW20*

I contacted the CP/M user group, (which you should join: write to CP/M User Group, MML, 11 Sun Street, Finsbury Sq, London EC2M 22D) to ask them your question. They said that the routines in BIOS need changing and that although there is a method, they would not openly publish it. There is, however, a very simple solution to your problem — rename your version of Basic to 'GO' and then all you need to do is type GO DATES.

There are several suitable books which provide an introduction to machine-code programming. Since you don't say which language you require, I will give you several

titles: *Z80 Assembly Language Programming* Lance A Leventhal, Osborne & Associates Inc. ISBN 0-9311988-21-7; *Programming the Z80*, Rodney Zaks, Sybex Inc. ISBN 0-89588-013-X; *The Z80 Microcomputer Handbook*, William Barden Jr, Howard W. Sams. ISBN 0-672-21500-4; *Micro-processors and Micro-computers*, Barry G Woollard, McGraw-Hill ISBN 0-07-084640-5; *8080/Z80 Assembly Language*, Alan R Miller, John Wiley and Sons. ISBN 0-471 08124-8.  
*Ian Pardington and SW*

## AtomC break

I own an Acorn Atom and I've expanded the memory to 12k, put in the floating point ROM and the VIA, and added a printer. When the memory grew beyond my Acorn PSU's abilities, I took out the regulator and heat sink according to Acorn's instructions. However, right in the middle of writing or running a program, or even when the machine is idling, all the keys lock, including the 'break' key, and I have to sit there tapping the key until the machine comes to life. One person suggested that an IC may not be in its socket properly and advised me to ease each one out and in again — no change, though. Can you help?

*C Nelson, Harrow, Middlesex.*

The symptoms you describe could be caused by a number of different faults. The least likely, and the easiest to test, is that the power supply regulator(s) are shutting down due to overwork. If this were the case you would lose any picture on the screen, and a voltmeter check would reveal zero output from the PSU. This seems quite unlikely in the circumstances but is worth getting out of the way.

The fact that the machine locks up could be caused by just about anything; but the fact that it will not restart when you hit 'break' narrows things down a little. First of all, test that the break key actually *does* reset the 6502. Do this by measuring the voltage on pin 40 of the CPU (IC 22). As you hit 'break' this should drop to zero. If it does then the fault is in the CPU, the ROM or the address or data lines (or possibly in the system RAM — the bottom 1k). The two most likely contenders are: a bad

contact on the IC socket of CPU ROM or system RAM; or a short circuit in the address or data bus. For the former, remove the relevant four or five ICs, clean their pins with methylated spirit (using a cloth *not* made from artificial fibre) and replace them. You could also test the contact electrically (with the power off) by using a multimeter between each IC pin above board and the solder blob on the appropriate pin of the IC socket on the underside of the board. To test for the short circuit, use a multimeter (again with the power off), checking that none of the address or data lines that run close to each other, or close to other pins (anywhere on the board) actually touch. You can sometimes spot a fault of this nature by close visual inspection, and even if you can't see a short you can sometimes clear it by brushing the printed circuit board with an implement such as a (disused?) toothbrush. A drop of meths on the brush may assist matters here.

Finally it would be worth testing for an open circuit in an address or data line between CPU, ROM and RAM (though test for the short circuit *anywhere* on the board). To check the system RAM, simply replace the bottom 1k of RAM with RAM from elsewhere in the machine.

*D E Graham*

## Vic Galaxian

Please could you tell me how much the VIC-20 game 'Galaxian' costs and whether it comes as a tape, disk or plug-in cartridge?

*Timothy Bown, Heathfield, E Sussex.*

As far as I can tell, 'Galaxian' is not available for the VIC-20, but a similar game, 'Avenger', is available as a ROM pack for £19.95.

*Ron Geere, Editor, IPUG.*

## Corrupted Commodore

To provide the greatest number of systems for our students at the least cost, we have chosen the Commodore 4000 series computer. We have six of these linked to one 4000 series disk and an Anadex DP8000 printer, all linked via a Mupet system. We only went for this system because we were told that it



# COMPUTER ANSWERS

would fulfil our needs at a reasonably competitive price. However, we are having considerable trouble with: slow response because the system takes so long to print; system sometimes has to be switched off to get disks to work again; and files become corrupted when more than one person is processing a file.

Is there any solution to the problems?  
*David Lee, Enfield, Middlesex.*

Yes, the solution is to go to the person who recommended the system and ask them to show you how to overcome the problems. Obviously, they know how to do it otherwise they wouldn't have recommended it, would they?

I am being a bit cruel, but there are many people around who are recommending equipment on hearsay only, and have no first-hand comparative experience of it. I had a very similar system at the last college I taught in, except that it was based on the Commodore 8000 series. I do think that the Mupet set-up provides a reasonable cheap system, but you do have to know how to get around its limitations. Answers to your problems are as follows:

1. Buy as much extra buffer store as the Anadex will hold, I think you can extend it to 3k. This is fairly cheap (say £5) and will probably eliminate the problem entirely. The average student program is unlikely to be much longer than 3k of source code, and it will only take one or two seconds to fill the buffer, hence releasing the system immediately.
2. This is probably because the students have not been told that an error condition locks up the system. Getting the offender to type 'CATALOG' is a simple way to release the system.
3. The problem here is that if the Mupet does not detect any activity for three seconds it will release the system for someone else to use. If your file is still open, all the next person's data will happily rush into your file. The solution is simple: whatever happens, don't let the system wait three seconds. The only place this is likely to happen is if you DOPEN the file, then wait for an INPUT or series of INPUTs before writing to the file. This is fatal. The easiest solution is to use direct access files (which are easy in Basic v4) and then open, write, close immediately.

200 DOPEN£10, "STOCK DATA",L126  
210 RECORD£10, (N):  
PRINT£10,R\$  
220 DCLOSE£10

But, most important, you must explain to the students the reasons behind everything that you tell them; explain the

dangers of failing to obey.

To conclude, I found the Mupet very reliable provided it is the last item to be switched on. It will easily support two printers and a host of other items. That is not to say that it is the system that I would consider best value for money — I would need a more detailed specification for its uses before I'd say that.

SW

## Portable poser

I am looking for a small computer similar to the Sinclair ZX81, but fully portable with at least a two line-read-out built in and provision for connection to a TV and a printer.

*N M Clements,*

The machine that might almost have been designed for you would have been the NewBrain; but there are still (as of November 1981) none of these on the market. This leaves the Sharp PC1211 (and the Tandy equivalent) and the newly introduced Casio FX702P. Both of these are 'pocket computers', are battery operated, and have built-in displays, so they meet your requirement for portability. Neither of the displays provides more than one line, and this was also the one part of your specification not met by the NewBrain. However, both machines will scroll through lines, and more than one statement can be displayed at a time if the statements are short and you use multiple statement lines.

Both machines have compatible portable printers connect to a TV. Neither machine is fast in performing calculations, even by micro-computer standards. This is not really due to the use of interpreted Basic, but is essentially related to the type of components used to obtain the very small size and low power drain of these machines.

If you are used to normal Qwerty keyboards you will probably prefer the Sharp (or Tandy) as they use this standard layout. If you are daunted by the thought of learning this layout, then the Casio, with its alphabetic order layout, may suit you better.

*P L McIlmoyle*

## Model III m/c code

At present I find I have two problems with the programming of a TRS-80 Model III.

The first involves the saving of machine code programs. As I don't have either a T-Bug or an editor-assembler tape, I have written my programs by

POKEing in the code via a Basic program and run them using SYSTEM. But how can I save these on tape so that they can be loaded using SYSTEM?

The second involves programs listed in PCW and the like. They are invariably written to run on a specific machine. I am quite sure that the majority could be converted if only one knew the meaning of some of the more obscure commands encountered, such as VTAB, VLIN, HLIN and GET. What do the symbols printed as white character on a black background mean, to say nothing of the many codes involved with PEEK, POKE & CHR\$?  
*H Muten, Crawsborough, E Sussex*

1. The best idea to save your programs would be to save your money up and buy T-Bug (under £10 — I think).
2. If you want to know the codes used by PET, Apple etc, it would be a good idea to look up back issues of PCW that have, for example, a PET program with comments about the various symbols. Converting from one machine to another is, however, a lengthy and difficult process and, ideally, requires a good knowledge of both machines involved.  
*Stephen Bird, Oxfordshire Micro Club*

## PET measures up

I am attempting to measure irregular areas on a 32k PET. I have seen the Apple Versawriter Graphics Tablet which will perform this function. Do you know of an equivalent for the PET, preferably not requiring a disk system?  
*Dr T G Smith, Brunel University.*

I am surprised that no one at the University can help you on this as it is a very simple matter. There are dozens of graphics tablets or 'bit-pads' on the market, and your choice will simply depend on such features that you require. For example: the physical size of the graphics area; the resolution that can be detected (ie 100 points per inch); the means for locating a point, which can be a simple pen or a magnifying cursor with several buttons; whether you need a power supply or not.

I have recently bought a model called the Summagraphics Bitpad from a company called TDS in the Midlands. A glance through PCW will give you a few more local suppliers. It is nearly double A4 size and has sufficient resolution (about .01 inch) for me to wonder why anyone would want any better. The cost was £600 including a power supply, I

am very pleased with it indeed and it allows me to use the 'wondrous' graphics package called Jackson on the RML 380Z.

A point worth mentioning is that for the PET you must get a bit-pad that has an IEEE interface — virtually all will have one available as an option. Some suppliers can even supply some software to enable you to use it directly in Basic. On a system running under CP/M you will need to patch CP/M so that you attach it to the serial port (say) and read it via the OPEN£10, "RDR:" file channel. I have a simple one-statement POKE for the RML 380Z which I can give if required (SAE please).

So, to summarise, get one from a supplier who can also let you have some software for your PET.  
SW

## Word power failure

I have typed out (with the aid of a magnifying glass) Wordpower as listed in Sept PCW and tried to run it on my PET 8032. The author, Kevin Pretorius, states that it runs on a 3032 PET. The problem is that one gets '?Syntax error in 80'. This doesn't happen on a PET 2000 series so I assume that the statement at 80 DS=TS is the problem. What is the reason/cure?  
*C Monk, University College of Wales*

I feel that Kevin Pretorius, and for that matter anyone who submits listings for PCW, should check that the program works on the manufacturer's latest models. If 2000 and 3000 series PET users can afford to upgrade to 4000 series then they should, as there are a host of extra features; plus the essential 'direct access file' capability. In a nutshell, the problem is that some two-letter variables contain reserved words and DS is a reserved variable (like TI) that holds the disk status. Change all occurrences of DS to something else. Any graphics used may also appear strange.  
SW

## Vic update

Could you please tell me when the VIC-40 will be available and how much will it cost approximately?  
*Chan Fai Yuan, Congleton, Cheshire.*

It is anticipated that the VIC-40 will not appear on the market for about a year. No price has been fixed, but one can guess that it will not differ much from the VIC-20 price.  
*Ron Geere, Editor, IPUG.*



# NEWCOMERS START HERE

*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 (Erasable 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 system 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.





Application	Machine	Price	Code	Application	Machine	Price	Code	Application	Machine	Price	Code			
	8080/Z80	£325	L1		Superbrain	£250+	T3		CP/M	£450	G1			
Job costing	Apple II	£300	P1		Tandy Model I	£249	M1		CP/M	£500	L3			
	Apple II	£990	X1		TRS-80	£200	H1		CP/M	£425	L1			
	CP/M	£700	C4		TRS-801	£218	T1		CP/M	£400	M3			
	CP/M	£350	M3		TRS-8011	£375	T1		CP/M	£400	B5			
	CP/M	£990	X1		8000 Series	£250	C2		CP/M	£275	S7			
	North Star				8080/Z80	£475	L1		CP/M	£350	B3			
	Horizon	£350	M3		8080/Z80	£275	G3		CP/M	£300	W1			
	PET/CBM	£750	X1		PET/CBM	£150	G2		CP/M	£425	B6			
	Superbrain	£350	M3		PET/CBM	£150	J1		CP/M	£400	B5			
	Tandy Model I	POR	M1		PET/CBM	£150	C2		North Star					
	Tandy Model II	POR	M1		Sorcerer	£250	L2		Horizon	£250	B3			
Job order control	8080/Z80	£275	G3		Tandy Model I	£249	M1		North Star					
Legal precedents	CP/M	£1100	C4		TRS-80	£200	H1		Horizon	£400	M3			
Letter writer	Apple II	£80	V1		TRS-801	£218	K1		North Star					
	CP/M	£150	M3		TRS-801	£218	T1		Horizon	£400	B5			
	North Star				TRS-8011	£375	T1		PCC 2000					
	Horizon	£150	M3		8000 Series	£250	C2		Simplec Triton 3	£350	B2			
	Superbrain	£150	M3		8080/Z80	£475	L1		PET/CBM	£300	B4			
Lotteries	PET/CBM	£45	H2		8080/Z80	£275	G3		PET/CBM	£800	C1			
Mailing List	Altos (CP/M, MP/M)	£75	B1	Perpetual Inventory	CP/M	£150	B5		PET/CBM	£95/350	A1			
	Apple II	£300	A2		Cromemco	£150	B5		PET/CBM	POR	J1			
	Apple II	£50-150	S2						PET/CBM	£200	C2			
	Apple II	£300	S5						PET/CBM	£350	C7			
	Apple II	£300	K2		Personnel records	Apple II	£98	P2		PET/CBM	POR	S3		
	Apple II	£40	P2			CP/M	£450	C4		CBM/8032	£395	S1		
	Apple II	£50	D1			MCZ Zilog	£400	I1		Sharp PC 3201	£300	P2		
	Apple II	£100	S4			PET/CBM	£85	H2		Superbrain	£400	M3		
	CP/M	£50-150	C4		Petaid report generator	PET/CBM	£125	S3		Superbrain	£300	S6		
	CP/M	£250	G1			PET/CBM	£160	J1		Tandy Model I	£90	M1		
	North Star				Petsoft programs	PET/CBM	£160	J1		Tandy Model II	£90	M1		
	Horizon	£195	W1		Planning/Maintenance	CBM/8032	£595	S1		TRS-80	£225	H1		
	PET/CBM	£45	H2			Apple II	£350	S2		TRS-801	£225	T1		
	PET/CBM	£50	D1		Postal advertising response package					TRS-8011	£375	T1		
	PET/CBM	£15	A1							Vector	£400	C5		
	PET/CBM	£75	B1		PR/advertising package	PET/CBM	£1000	S3		8000 Series	£250	C2		
	PET/CBM	£35	H3							8080/Z80	£275	G3		
	PET/CBM	£100	S3		Price lister	PET/CBM	£12	H3		8080/Z80	£425	L1		
	CBM/8032	£75/150	S1		Printers job control	PET/CBM	£250	S3	Salesman	Apple II	£10	D1		
	Superbrain	£140	C9		Production analysis	Apple II	£75	P2		PET	£10	D1		
	Tandy Model I	£40	M1			CP/M	£700	C4	S/L, P/L & stock control	Apple II	£900	P2		
	Tandy Model II	£75	M1			PET/CBM	£300	B1		Apple II	£1000	T2		
	TRS-80	£50-150	S2		Prof appts groups	8080/Z80	£275	G3		CP/M	£1000	L3		
	TRS-80	£25/38/55	H1			8080/Z80	£220	G3		CP/M	£900	B5		
Mail shot	Apple II	£14	S2		Prof appts individ	8080/Z80	£220	G3		Cromemco	£900	B5		
	Apple II	£40	P2		Prof client billing	8080/Z80	£330	G3	Solicitor's complete record accounting	Apple II	£3000	S2		
	Apple II	£25	T2		Programming aids	Apple II	£40	P2	Solicitor's package	CBM/8032	£750	S1		
	Challenger	£25	C7		Property management	CP/M	£450-1000	C4	Statistics	Apple II	£150	G3		
	CP/M	£200-360	C4			CP/M	£400	M3		Apple II	£100-195	P2		
	CP/M	£90	M3			North Star				Apple II	£140	C8		
	CP/M	£75	S7			Horizon	£400	M3		TRS-80	£45	S2		
	CP/M	£50/150	G5			Superbrain	£400	M3	Stock control/recording	Altos (CP/M, MP/M)	£300	B1		
	MCZ Zilog	£250	I1		Purchase ledger	Apple II	£300	A2		Apple II	POR	A2		
	North Star					Apple II	£300	S5		Apple II	POR	K2		
	Horizon	£90	M3			Apple II	£300	K2		Apple II	POR	S5		
	PCC 2000					Apple II	£295	C6		Apple II	POR	S5		
	Simplec Triton 3	£450	B2			Apple II	£300	P1		Apple II	£150	G3		
	PET/CBM	£125	S3			Apple II	£300	P2		Apple II	£80	S2		
	Superbrain	£90	M3			Apple II	£315	V1		Apple II	£75/300	P2		
	Tandy Model I	£75+	G4			Apple II	£250P	S4		Apple II	£10	D1		
	Tandy Model II	£75	M1			Challenger	£300	T2		Apple II	£285	V1		
	Tandy Model II	£75+	G4			CP/M	£25	C7		Apple II	£300	P1		
Membership accing	Apple II	£75	P2			CP/M	£500	C7		Apple II	£500	S4		
	MCZ Zilog	£250	I1			CP/M	£450	G1		Challenger	£25	C7		
	PET/CBM	£85	H2			CP/M	£500	L3		CP/M	£325	L1		
Motor Dealer	Famos	£5000	M2			CP/M	£425	L1		CP/M	£500-1500	C4		
Order entry/invoicing	CP/M	£350	G1			CP/M	£400	M3		CP/M	£350	G1		
Order processing	CP/M	£550	L1			CP/M	£400	B5		CP/M	£900	M3		
	8080/Z80	£550	L1			CP/M	£275	S7		CP/M	£700	B5		
Office admin	Apple II	£100	S4			CP/M	£350	B3		CP/M	£550	B5		
Pad to plotter systems	Apple II	£250	P2			CP/M	£300	W1		CP/M	£550	B3		
	Apple II	£180	C8			CP/M	£425	B6		CP/M	£300	W1		
Payroll	Apple II	POR	A2			Cromemco	£400	B5		CP/M	£700	B5		
	Apple II	£200	S2			North Star				Famos	£1500	M2		
	Apple II	POR	S5			Horizon	£250	B3		MZ-80K	£150	P2		
	Apple II	POR	K2			North Star				North Star				
	Apple II	£200	P2			Horizon	£400	M3		Horizon	£450	B3		
	Apple II	£375	V1			North Star				North Star				
	Apple II	£375	C6			Horizon	£400	B5		Horizon	£900	M3		
	Apple II	£10	D1			Superbrain	£400	M3		PCC 2000				
	Apple II	£250P	S4			Superbrain	£400	M3		PCC 2000				
	Apple II	£400	T2			Superbrain	£300	S6		Simplec Triton 3	£350	B2		
	Challenger	£24	C7			Superbrain	£300	S6		PET/CBM	£12/25/350	A1		
	CP/M	£450	L3			PCC 2000				PET/CBM	£10	D1		
	CP/M	£475	L1			Simplec Triton 3	£350	B2		PET/CBM	£195	I2		
	CP/M	£495	C4			PET/CBM	£300	B4		PET/CBM	£300	B4		
	CP/M	£500	G1			PET/CBM	£95/120/350	A1		PET/CBM	£15	A2		
	CP/M	£390	M3			PET/CBM	£200	C2		PET/CBM	£300	B1		
	CP/M	£500	B5			PET/CBM	POR	J1		PET/CBM	£150	C2		
	CP/M	£450	B3			PET/CBM	£350	H3		PET/CBM	£150	J1		
	CP/M	£425	B6			PET/CBM	£395	S1		PET/CBM	£150	G2		
	CP/M	£425	W1			CBM/8032	£395	S1		PET/CBM	£250	R1		
	Famos	£1500	M2			Sharp PC3201	£300	P2		PET/CBM	£35/25	H3		
	North Star					Tandy Model I	£90	M1		PET/CBM	£100/250	S1		
	Horizon	£350	B3			Tandy Model II	£90	M1		CBM/8032	£395	S3		
	North Star					TRS-80	£225	H1		Sharp PC3201	£300	P2		
	Horizon	£390	M3			TRS-801	£225	T1		Superbrain	£900	M3		
	Horizon					TRS-8011	£375	T1		Superbrain	£300	S6		
	Horizon					Vector	£400	C5		Superbrain	£450	T3		
	Horizon					8000 Series	£250	C2		Superbrain	£450	T3		
	Horizon					8080/Z80	£275	G3		Tandy Model I	£30-50	M1		
	Horizon					8080/Z80	£275	L1		Tandy Model II	£300	M1		
	Lease		W1			Quotation estimating	Apple II	£300	P1		TRS-80	£48	S2	
	PET/CBM	£200/350	C5			Sales ledger	Apple II	£300	A2		TRS-80	£200	H1	
	PET/CBM	£200/25/195	A1				Apple II	£300	S5		TRS-80	£115	J1	
	PET/CBM	£50/195	I2				Apple II	£300	K2		TRS-801	£200	T1	
	PET/CBM	£150	D1				Apple II	£300	K2		TRS-8011	£375	T1	
	PET/CBM	£150	G2				Apple II	£295	C6		8080/Z80	£275	G3	
	PET/CBM	£150	J1				Apple II	£300	P1		8080/Z80	£325	L1	
	PET/CBM	£150	C2				Apple II	£300	P2		TAP business system	PET/CBM	£125	H2
	PET/CBM	£150	C3				Apple II	£315	V1		Text file librarian	Apple II	£125	S4
	PET/CBM	£10	H3				Apple II	£250P	S4		Time/cost recording	Apple II	£450	S2
	Scorcerer	£250	L2				Apple II	£300	T2			Apple II	£300	P1
	Superbrain	£390	M3				Apple II	£25	C7					
	Superbrain	£400	S6				CP/M	£500	C4					





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**DIRECT ACCESS**

Machine	Application	Price	Code
	Word processing	£150-260	C4
	Word processing	£250	M3
	Word processing	£250	B6
	Work in progress	£850	B5
Famos	Customer file	£1000	M2
	Data base	£1500	M2
	Integrated accts	£2000	M2
	Motor dealer	£5000	M2
	Payroll	£1500	M2
	Stock control	£1500	M2
	Word processing	£500	M2
MCZ Zilog	Mail shot	£250	I1
	Membership accting	£250	I1
	Personnel records	£400	I1
MZ-80K	Estate agent	£195	W1
	Integrated accounts	£150	P2
	Stock control/recording	£150	P2
North Star Horizon	Budgeting package	£95	B5
	Cash flow	£95	B5
	Database management/information retrieval	£250	B3
	Double glazing costing	£750	W1
	Estate agent	£750	B5
	Financial modelling	£95	B5
	General ledger/NL	£250	M3
	General ledger/NL	£400	B5
	General ledger/NL	£400	B5
	Incomplete records	£250	M3
	Incomplete records	£250	B5
	Incomplete records	£975	B3
	Incomplete records	£950	B3
	Integrated accts	£990	M3
	Integrated accts	£690	B5
	Integrated accts	£900	B5
	Integrated accts	£100	B3
	Invoicing	£250	M3
	Invoicing	£100	B5
	Invoicing	£350	M3
	Job costing	£150	M3
	Letter writer	£195	W1
	Mailing List	£90	M3
	Mail shot	£90	M3
	Payroll	£350	B3
	Payroll	£390	M3
	Payroll	£390	M3
	Lease	£900	W1
	Property Management	£400	M3
	Purchase ledger	£250	B3
	Purchase ledger	£400	M3
	Purchase ledger	£400	B5
	Sales ledger	£250	B3
	Sales ledger	£400	M3
	Sales ledger	£400	B5
	SL, PL + stock control	£900	B5
	Stock control/recording	£450	B3
	Stock control/recording	£900	M3
	Time/cost recording	£250	B3
	Time/cost recording	£200	M3
	Time/cost recording	£450	W1
	Word processing	£250	M3
PCC 2000	Estate Agent	£350	B2
Simpelec	General ledger/NL	£350	B2
Triton 3	Mail Shot	£450	B2
	Purchase ledger	£350	B2
	Sales ledger	£350	B2
	Stock control/recording	£350	B2
	Time/cost recording	£350	B2
PET/CBM	Appointment planner	£100	S3
	Assembler dev	£50	C2
	Bank account	£10	D1
	Bank accounts	£100	S3
	Bonds/pension quotations	£100	S3
	Bureau de change	£8	H3
	Cash flow	£8	A1
	Cash register	£10	D1
	Credit control	£650	B4
	Database management/information retrieval	£75	B1
	Database management/information retrieval	£50/150	C2
	Database management/information retrieval	£150	G2
	Database management/information retrieval	£150	J1
	Database management/information retrieval	POR	C1
	Database management/information retrieval	£325	A1
	Database management/information retrieval	£225	H4
	Database management/information retrieval	£250	C3
	Database management/information retrieval	£45-250	S3
	Disk operating system	£150	B1
	Estate agent	£25	A1
	Estate agent	£30	H3
	Estate agent	£250	S3
	Estate agent	£225	H4
	File handling	£425-535	A1
	Financial modelling	£125	A1
	General planning	£200	C2
	General ledger/NL	£1000	C1
	General ledger/NL	£200	H3
	General ledger/NL	POR	S3
	Incomplete records	£750	S3
	Industry factory loading	£300	X1
	Industry work study	£750	X1
	Integrated accts	£300	B1
	Integrated accts	£(50)	C2
	Integrated accts	£650	G2
	Integrated accts	£650	J1
	Integrated accts	POR	S3
	Invoicing	POR	J1
	Invoicing	£25-50	B1
	Invoicing	£350	A1

Machine	Application	Price	Code
	Invoicing	£400	C1
	Invoicing	POR	S3
	Job costing	£750	X1
	Lotteries	£45	H2
	Mailing list	£75	B1
	Mailing list	£15	A1
	Mailing list	£50	D1
	Mailing list	£45	H2
	Mailing list	£35	H3
	Mailing list	£100	S3
	Mail shot	£125	S3
	Membership accting	£85	H2
	Payroll	£150	G2
	Payroll	£150	J1
	Payroll	£150	C2
	Payroll	£50/195	
	Payroll	195	I2
	Payroll	£10	D1
	Payroll	£50/25/195	A1
	Payroll	POR	C1
	Payroll	£200/350	C5
	Payroll	£10	H3
	Personnel recors	£85	H2
	Petsoft programs	£160	J1
	PR/advertising package	£1000	S3
	Printers job control	£250	S3
	Prise lister	£12	H3
	Production analysis	£300	B1
	Purchase ledger	£200	C2
	Purchase ledger	POR	J1
	Purchase ledger	£95/120	
	Purchase ledger	350	A1
	Purchase ledger	£1000	C1
	Purchase ledger	£300	B4
	Purchase ledger	£350	H3
	Purchase ledger	POR	S3
	Sales ledger	POR	J1
	Sales ledger	£200	J1
	Sales ledger	£300	B4
	Sales ledger	£800	C1
	Sales ledger	£95/350	A1
	Sales ledger	£350	H3
	Sales ledger	POR	S3
	Salesman	£10	D1
	Stock control/recording	£150	C2
	Stock control/recording	£300	B1
	Stock control/recording	£150	G2
	Stock control/recording	£150	J1
	Stock control/recording	£195	I2
	Stock control/recording	£10	D1
	Stock control/recording	£12/25/350	A1
	Stock control/recording	£15	A2
	Stock control/recording	£300	B4
	Stock control/recording	£35/25	H3
	Stock control/recording	£100/250	S3
	TAP business system	£125	H2
	Time/cost recording	£300	B1
	Time/cost recording	POR	S3
	Time/cost recording	£78	H3
	VAT	£17.50	A1
	VAT master	£25	H3
	Word processing	£75/150	J1
	Word processing	£75/150	G2
	Word processing	£75/150	C2
	Word processing	£40	D1
	Word processing	£85/65	
	Word processing	£40/20	H2
	Word processing	£375	H4
	Word processing	£25/325	A1
	Word processing	£325	C5
	Word processing	£35	H3
	Word processing	£120	S3
PET/Computhink	Stock control/recording	£250	R1
CBM/8032	Mailing list	£75/150	S1
	Planning maintenance	£595	S1
	Purchase ledger	£395	S1
	Sales ledger	£395	S1
	Solicitor's package	£750	S1
	Stock control/recording	£395	S1
	Vet package	POR	S1
	Warehousing	POR	S1
Sharp PC-3201	General ledger	£450	P2
	Sales ledger	£300	P2
	Purchase ledger	£300	P2
	Stock control	£300	P2
Sorcerer	Payroll	£250	L2
Superbrain	Bill of materials	£450	T3
	Database	£300	S6
	Estate agent	£800	S6
	General ledger	£400	M3
	General ledger	£400	S6
	Incomplete Records	£750	M3
	Integrated Accts	£1200	S6
	Integrated Accts	£990	M3
	Integrated accts	£1000	T3
	Invoicing	£250	M3
	Invoicing	£150	S6
	Job costing	£350	M3
	Letter writer	£150	M3
	Mailing list	£140	C9
	Mail shot	£90	M3
	Payroll	£400	S6
	Payroll	£390	M3
	Payroll	£250+	T3
	Property management	£400	M3
	Purchase ledger	£300	S6
	Purchase ledger	£400	M3
	Sales ledger	£300	S6
	Sales ledger	£400	M3
	Stock control	£300	S6
	Stock control	£900	M3
	Stock control	£450	T3
	Time recording	£200	M3
	Word processing	£250	M3

Machine	Application	Price	Code
	Travel agency accts	£800	S6
Tandy Model I	Database management/information retrieval	£25-80	M1
	General ledger/NL	£90	M1
	Incomplete records	£40	M1
	Inegrated accts	£350	M1
	Invoicing	£90	M1
	Job costing	POR	M1
	Mailing list	£40	M1
	Mail shot	£75+	G4
	Payroll	£249	M1
	Purchase ledger	£90	M1
	Sales ledger	£90	M1
	Stock control/recording	£30-50	M1
	Travel Agency Accts	£225	G4
	Travel Agents Dairy	£100	G4
	Travel Ticket Sales	£225	G4
	Time/cost recording	POR	M1
	Word processing	£50/75	M1
Tandy Model II	General ledger/NL	£90	M1
	Integrated accts	£350	M1
	Invoicing	£90	M1
	Job costing	POR	M1
	Mailing list	£75	M1
	Mail shot	£75	M1
	Mail shot	£75+	G4
	Purchase ledger	£90	M1
	Sales ledger	£90	M1
	Stock control/recording	£300	M1
	Time/cost recording	POR	M1
	Travel Agency Accts	£225	G4
	Travel Agency Diary	£100	G4
	Travel Ticket Sales	£225	G4
	Word processing	£175-240	M1
Tektronix	Various engineering Packages		E1
TRS-80	Database management/information retrieval	£60	S2
	Database management/information retrieval	£32.50	H1
	Database management/information retrieval	£150	J1
	General ledger/NL	£225	H1
	Incomplete records	£40	H1
	Integrated accts	£75	J1
	Investment portfolio	£20	S2
	Invoicing	£25	H1
	Mailing list	£25/38/55	H1
	Mailing list	£50-150	S2
	Payroll	£200	H1
	Purchase ledger	£225	H1
	Sales ledger	£225	H1
	Statistics	£45	S2
	Stock control/recording	£200	H1
	Stock control/recording	£48	S2
	Stock control/recording	£115	J1
	VAT register	£15	H1
	Word processing	£45/95	J1
	Word processing	£15	H1
	Word processing	£30/60/90	S2
TRS-80I	General ledger/NL	£225/325	T1
	Invoicing	£75	T1
	Payroll	£218	T1
	Purchase ledger	£225	T1
	Sales ledger	£225	T1
	Stock control/recording	£200	T1
TRS-80II	General ledger/NL	£425	T1
	Invoicing	£125	T1
	Payroll	£375	T1
	Purchase ledger	£375	T1
	Sales ledger	£375	T1
	Stock control/recording	£375	T1
Vector	General ledger/NL	£400	C5
	Integrated accts	£1000	C5
	Purchase ledger	£400	C5
	Sales ledger	£400	C5
	Word processing	£40	C5
8000 Series	Database management/information retrieval	POR	C2
	Integrated accts	POR	C2
	Payroll	£250	C2
	Purchase ledger	£250	C2
	Sales ledger	£250	C2
	Word processing	£250	C2
8080/Z80	General ledger/NL	£275	G3
	General ledger/NL	£375	L1
	Integrated accts	£950	L1
	Integrated accts	£995	G3
	Invoicing	£325	L1
	Job order control	£257	G3
	Order processing	£550	L1
	Payroll	£475	L1
	Payroll	£275	G3
	Prof appts groups	£275	G3
	Prof appts indivd	£220	G3
	Prof client billing	£330	G3
	Purchase ledger	£425	L1
	Purchase ledger	£275	G3
	Sales ledger	£275	G3
	Sales ledger	£425	L1
	Stock control/recording	£325	L1
	Stock control/recording	£275	G3

*Here's a complete listing of all the clubs and user groups of which we're aware. The next full listing will be published in July, with updates appearing in the meantime. Send your alterations/updates to: User Groups Index, PCW, 14 Rathbone Place, London W1P 1DE.*

**INTERNATIONAL**

**Apple Users' Group Europe.** President: K Giese, Hackstucker 11, D-4320 Hattingen 15, West Germany. Tel: 02324 52240.

**Central Program Exchange.** Full membership (£25 Europe, £40 overseas) provides 30 free programs pa. Small user service (£10 Europe, £20 overseas) provides 10 free programs pa. Contact: Mrs Judith Brown, The Polytechnic, Wulfuma St, Wolverhampton WV1 1LY.

**Comp 80 User Group.** Monthly newsletter. Annual subscription £6.50 UK, £8.00 overseas. Contact: Philip Probetts, 50 Cromwell Road, Wimbledon, London SW19 8LZ.

**GP/M. IRL. Irish CP/M Users' Group.** Meets monthly in Dublin area, membership IR £5 pa. Newsletter: CP/M.MAG. Contact: Doug Notley, Gardner House, Ballsbridge, Dublin 4. Tel: 01-686411.

**DENSPEP:** group specifically for exchange or original programs for MTU 200x320 dot matrix hi-res PET add-on. Send sample of your work or £2.50 (£2.50) & receive sample in return plus newsletter sub & lists of available programs. Contact: DENSPEP, Rock House, Ballycro, Westport, Co Mayo, Eire.

**DA Inamic:** European DAI personal computer users' club. Has over 500 members, publishes a bi-monthly newsletter with most articles in English. Contact: DA Inamic, Heide 98, 3171 Westmeerbeek, Belgium.

**European Sorcerer Club.** For sample newsletter contact Colin Morie at 32 Watchyard Lane, Formby, Nr Liverpool L37 3JU. Annual sub UK £5, Overseas £12.00.

**Group/380.** Recently established for information interchange on microsystems equivalent to IBM 360/370 main frames, newsletter, access to a computerised database listing relevant software. Annual sub: \$10 for individuals, \$25 for organisations. Contact: Mokurai Cherin, PO Box 111, Mokurai Cherialin, PO Box 1131, Mount Shasta, CA96067, USA.

**International Sharp User Group.** 1400 members in 31 countries £3 sub includes MZ-80K International Sharp User Group. 1400 members in 31 countries £3 sub includes MZ-80K Space Invaders cassette and newsletters. Contact: Graham Knight, 108 Rosemount Place, Aberdeen. Tel: 0224 630526.

**Irish ZX80/81 Users' Club,** the first club in Ireland. Open for all owners of Sinclairs. For info send two 22p stamps (six counties 40p). Users Club, c/o M Cronstein, 73, Cnoc Crionain, Baile Atha, Cliath 1.

**Ithaca Intersystems and S100 Bus Users' Club.** Formed to 'organise the construction and design of software and hardware based on Ithaca or other S100 systems.' Contact: George Brooke, Sebastian Bayerstrasse 20c, 8000 Munich 83, W Germany.

**KAOS — the official 6502 Users' Group of Australia.** Has a range of projects within special interest groups: hardware, software, amateur radio, Pascal, education. Publishes monthly newsletter. Contact: Mr Ian Eyles, 10 Forbes St, Essendon, Victoria, Australia 3040.

**Microcomputer Users' Club.** Recently established for program writing and exchange, emphasis on 6502 Z80 users. Contact: c/o Synthetronics Microcomputers PO Box 151, 1322 Hoevik Norway.

**Pascal Z User Group (Europe)** Affiliated with Pascal Z USA. 12 user disks available plus newsletter. Contact: George Brooke, Sebastian Bauerstrasse 20c, 8000 Munich 83, West Germany.

**Post Sharp:** International exchange and contact club on the Sharp MZ-80K. Has over 100 members. Contact: Mr Daniel Joly, 207, Rue sur les Thiers, B-4400 Herstal, Belgium.

**Powertran Users' Club.** Annual subscription £6.50 UK membership, £8.00 for members abroad, which includes a monthly newsletter. Contact: Philip Probetts, 50 Cromwell Road, Wimbledon, London SW19 8LZ. Tel: 01-540 3713.

**Powertran Users' Club.** Annual sub. £6.50 UK, £8.00 overseas which includes monthly newsletter. Contact: Philip Probetts, 50 Cromwell Road, Wimbledon, London SW19 8LZ. Tel: 01-540 3713.

**Tangerine Users' Group (International),** recently formed for users of the Microtan 65, the TUG will act as a central information clearing house, including exchange of programs, etc. Annual membership £5.00. Details from TUG at 16 Idlesleigh Rd, Charminster, Bournemouth, Dorset BH3 7JR.

**UCSD System User Society.** Existing special interest groups include industrial application, word processing, real time, business applications and forward planning. UK contact: John Ash, Dicoll Data Systems Ltd, Bond Close, Kingsland Estate, Basingstoke, Hants RG24 0QB.

**ZX80/81 Users' Club.** Low cost software. Technical support, newsletter. Subscription £6.00 UK, £10.00 overseas. Contact: D Blagen, PO Box 159, Kingston-Upon-Thames, Surrey KT2 5UQ (sae for further information).

**NATIONAL**

**6502 Users' Club.** Holds regular meetings and welcomes new members. Contact: Walter Wallenborn, 21 Argyll Avenue, Luton, Beds or Joe Manifold, 16 Bunyan Close, Piton, Hitchin, Herts.

**80 UK — User group for all TRS-80 owners,** including VG/Colour/Level 1. Bi-monthly magazine. Write for details to: N Rushton (ref 80 UK), 123, Roughwood Drive, Northwood, Kirkby, Merseyside L33 9UG.

**9900 Users' Group.** Contact: Chris Cadogan, Dept. Computer Science, University of Manchester, Manchester M13 9PL.

**11s Users' Group.** A sort of help service only. No meetings, no newsletter. Contact: Pete Harris, 119 Carpenter Way, Potters Bar, Herts, EN6 5QB. Tel: 0707 52091 or 01-248 8000 ext 7065.

**11's User Group.** A sort of help service only. No meetings, no newsletter. Contact: Pete Harris, 119 Carpenter Way, Potters Bar, Herts EN6 5QB. Tel: (0707) 52091 or 01-248 8000 ext 7065.

**77/68 Users' Group.** Quarterly Newsletter. Free membership for 1st year if you buy the 77/68 instruction manual, £1.50 thereafter. Contact: Newbury Computing Store, 40 Bartholomew St, Newbury, Berkshire.

**Amateur Computer Club.** National organisation with seminars, local group meetings. Bi-monthly newsletter 'ACCUMU LATOR'. 6800, Z-80, and 2650 libraries. Founded 1972. Fee £4.50 sae Jim McDonald, 1 Carlton Court, Studley Grange Road, London, W7 2LU.

**Amateur Computer Club, 2650 Library.** 2650 related data and technical assistance only. No meetings, no newsletter. Contact: Roger A Munt, 51 Beechwood Drive, Feniscowles, Blackburn, Lancs. BB2 5AT. Tel: (0254) 22341.

**Apple Music Synthesis Group.** Interested in ALF, Mountain Hardware, Alpha Syntauri and Soundchaser systems. Contact: Dr David Ellis, 22 Lennox Gardens, London SW1 enclosing an SAE.

**Atom User Group.** Quarterly newsletter, software library, technical help when possible. Some local groups. Membership £4.00 pa including newsletter. Contact: Richard Meredith, Sheerwater, Yealm View Road, Newton Ferrers, S Devon, PL18 1AN.

**BEEBUG — BBC Micro Independent National User Group.** Regular magazine with programs feature in each issue, hardware tips, software library, advice clinic and reviews. Membership £4.50 (6 months) £8.50 (full year) all inclusive. SAE for further details. Contact: Sheridan Williams/D E Graham, 35 St. Julian's Road, St. Albans, Herts AL1 2AZ.

**British Apple Systems User Group For Apple II and III 2020 users.** Meets 1st Tues eve & 3rd Sun afternoons monthly at The Old School, Branch Rd, Park St, St. Albans (on A5 about 2 miles south of city centre). Contact: John Sharp, Garston. Tel: (09273) 75093; or David Bolton, Park Street. Tel:(0727) 72917.

**Commodore Pet Users' Group** publishes a monthly magazine — the official voice of Commodore. For membership details contact: Margaret Gulliford. Tel: (Slough) 74111.

**Compucolor II User Group (UK).** Quarterly newsletter: Hardware and software advice:

Program library and exchange; links with other CGII national groups. Contact: Bill Donkin, 19 Harwood Avenue, Bromley, Kent. Tel: 01-460 2626 (evenings).

**Compukit User Club.** Details, contact: P. Crabb Esq., 21 Jones Close, Yatton, Avon. Tel: (0934) 834808.

**Compukit User Club.** Details contact: S H Grisvenor Esq., 11 Bernard Rd, Oldbury, Warley, West Midlands. Tel: 021-422 3298.

**Compukit User Club.** Contact: P Crabb, 21 Jones Close, Yatton, Avon. Tel: (0934) 834808.

**Cosmac Users' Club (proposed).** For people using the RCA 1802, Cosmac ELF, ELFII, Super ELF etc. Those interested contact James Cunningham at 7 Harrowden Court, Harrowden Road, Luton LU2 0SR (enclosed sae, please).

**CP/M Users' Group (UK).** Annual sub £6.00. S/ware library, newsletters, meetings, 'help' service. Contact: 11 Sun Street, Finsbury Square, London EC2M 2PS. Tel: 01-247 0691.

**Educational Users' Group for TRS-80 & Video Genie.** Offshoot of Nat TRS-80 UG, other TRS-80/Video Genie users welcome. Contact: D J Fatcher, Head Teacher Beaconsfield First & Middle School, Beaconsfield Rd, Southall, Middx.

**EZUG: Educational ZX80/1 Users' Group.** Annual sub £2.50 (UK), £3.00 (rest of Europe), £6/\$12 elsewhere Bi-monthly newsletter Large SAE for sample newsletter (UK & Eire only). Contact: Eric Deeson, Highgate School, Balsall Heath Rd, Highgate, Birmingham B12 9DS.

**FX500-P Users' Association.** for Casio FX501-P & FX502-P users to communicate with each other and to work together. SAE to Max Francis, 38 Grymsdyke, Gt. Missenden, Bucks HP16 0LP.

**The Home Computing Special Interest Group of British Mensa Ltd.** Six eight-page newsletters per annum, subscription £2.00. Circulation is restricted to Mensa members. Details may be obtained from Gordon Grant, Flat 3, 63, Cleveland Rd, Crumpsall, Manchester M8 6GT. Please send sae.

**Independent PET Users' Group.** Contact: IPUG, 57 Clough Hall Rd, Kidsgrove, Stoke-on-Trent. Staffs.

**Ithaca Audio S-100 bus UK User Group.** Contact: Dave Weaver, 16 Etive Place, Bumbernauld, Glasgow G67 4JE. Tel: (02867) 36570.

**Mk 14 Club.** Bi-monthly magazine called 'Complement and Add'. Contact: Geoff Phillips, 8 Podsford Rd, London NW9 6HP.

**MUSE** is an organisation for co-ordinating activity in schools and colleges. Meetings are held regionally and nationally. Full details from Muse, Freepost, Bromsgrove, Worcs B61 0JT.

**National Acorn Atom User Group.** Publishes monthly program magazine. For free copy and club details send large SAE (15 1/4p) to Alan Carr, 105 Fairholme Avenue, Gidea Park, Romford, Essex.

**National Personal Computer Users Association.** Cassette/SAEs supplied for continuous program exchange. ALL PERSONAL COMPUTERS. Subscriptions £12.00 (£15.00 overseas) with computer details to NPUCA 11 Spratling Street, Manston, Ramsgate, Kent.

**National RML User Group, c/o RML Ltd.,** PO Box 75, Oxford.

**National TRS-80 Users' Group.** Activities include a computerised bulletin board service (see 'Network News'). Contact: Brian Pain, National TRS-80 UG, 40A High Street, Stony Stratford, Milton Keynes. Tel: (0908) 566660 (office) 564271 (home).

**National T158/9 Club:** bi-monthly newsletter, program exchange etc. Annual sub £5.50 or, if you include a program with your cheque then it's £3.50. Contact: R M Murphy, Dept. of Electronic Engineering, University College Swansea, S. Wales.

**National ZX80 and ZX81 Users' Club.** Publishes monthly magazine Interface. For free copy and club details send a large SAE (15 1/4p) to 44-46 Earls Court Road, London W8 6EJ.

**Ohio Scientific UK User Group.** Independent of OSI, an important role will be the disentangling of poor documentation. There will be regular newsletters and membership is at present £5.00 per year. The group will initially be concerned with the practical aspects and applications of OSI systems — rather than with games. Contact: Tom Graves, 19a West End, Somerset, BA16 0LQ.

**Sharp MZ-80k User Group.** Contact: Joe LP Sct, 16 Elmhurst Drive, Hornchurch, Essex RM11 1PE. Tel: 04024 42905.

**Sharp MZ-80K User Group** (and shortly PC3201/00 and 80B) £3.00 per annum for three newsletters. Send cheque/POs tips, articles and sales to Mr R Erdine, 271 Meadow Rd, Sheffield S8 7UN.

**Sharp MZ-80 Users Club.** Free membership. Extensive library and facilities. Details on meetings & Newsletters (SAE please) from: Paul Chappell, Computer Centre, Yeovil College, Yeovil, Somerset. BA21 4AE.

**Sharp PC-1211 Users' Club** for all PC-1211/TRS-80 Pocket Computer users. Membership of £5.00 p.a. includes newsletter containing programs etc. Contact: Johnathan Dakeyne, 281 Lidgett Lane, Leeds LS17 6PD.

**TI 99/4 Users' Group — TIHOME** offers access to a software library and sends out a monthly newsletter. Contact: P M Dicks, 157 Bishopsoford Road, Morden, Surrey.

**Transducer.** The club for those interested in robotics, micro's and micro hardware. Send 25p to D Stockqueler 66 Waterloo Rd, Penylan, Cardiff for sample newsletter and details.

**Tangerine Users' Group (TUG),** 16 Idlesleigh Rd, Charminster, Bournemouth, Dorset BH3 7JR. Tel: (0202) 294393.

**TRS-80 Level 1 User Group.** Software library and quality newsletter (write for details and free copy). £5.00 p.a. N Rushton (LIUG), 123 Roughwood Drive, Northwood, Kirkby, Merseyside L33 9UG.

**TRS-80 Medical & Laboratory Users Newsletter.** Free quarterly newsletter detailing interests, programs & applications. Send SAE & details of interests to: Dr N Robinson, The Residency, Northwick Park Hospital, Harrow, Middx.

**UK Apple Users' Group.** Contact: (Keen Computers) 5 The Poultry, Nottingham. Tel: 0602 583254/5/6.

**UK101/Superboard User Group (Computer User Aids).** Newsletter, software library and technical service. Membership £4.60 inc VAT per 6 months — £5.00 overseas. Apply to Adrian Waters, 9 Moss Lane, Romford, Essex Tel: (Romford) 64954.

**UK Intel MDS Users' Group.** Contact: Lewis Hard, Space Intelligence, The Old Coach House, Court Row, Upton-Upon-Severn, Worcestershire WR8 0NS.

**UK Pilot Users' Group — SAE** for fact sheet on Pilot versions available Common Pilot Reference Manual £5.00. Contact: Alec Wood, Wirral Grammar School for boys, Cross Lane, Bebington, Wirral, Merseyside L63 8AQ.

**USUS (UK) — British arm of the UCSD p-system Users Society.** An international organisation created to promote the UCSD p-system (which includes Apple Pascal) and other machine independent software systems. Contact: Malcolm Harper, PRG, 45 Hanbury Road, Oxford OX2.

**ZX80/81 National Software Association.** Annual sub £6.00, incs cassette of software. Bi-monthly newsletter, software available on cassette. Send SAE for details. Contact: 15 Woodlands Rd, Wombourne, Staffs WV5 0JZ.

**REGIONAL**

**ACC (Merseyside 380Z Users Group).** Contact: Alan Pope, Paal Enterprise, 37 Stuart Road, Crosby, Liverpool L23 0QE.

**Anglia Computer User Group.** Contact: Jan Rejzl, 128 Templemere, Sprowston Road, Norwich NR3 4EQ.

**Central Scotland Computer Club.** Meets the first and third Thursdays each month in Falkirk College of Technology, Grangemouth Road, Falkirk. Secretary: J Lyon, 78 Slamannan Road, Falkirk, FK1 5NF. Tel: 22430.



# USER GROUPS INDEX

**DIRECT ACCESS**

Computer Education Society of Ireland. A voluntary organisation that consists of a national body and an expanding number of local branches. Their brief is to monitor computer education in Ireland. *National CESI* (£3.00 p.a.). Contact: Dairmuid McCarthy, 7 St Kevin's Park.

East Anglian Computer Users' Group. Meets: Crane Community Centre, Telegraph Lane East, Norwich. Contact: Gill Rijzl, 88 St Benedict's Street, Norwich NR2 4AB. Tel: (0603) 29652.

Grampian Amateur Computer Society. Meets 2nd Monday every month. New premises are in Thistle Lane, Aberdeen. Contact: Alan Hird, 20 Harcourt Road, Aberdeen. Tel: (90224) 33102.

IPUG South East. Meet 7.30 3rd and 4th Thursday. Charles Darwin School, Jail Lane, Biggin Hill. Bi-monthly newsletter. Contact: M Ryan, 164 Chertierfield Drive, Sevenoaks. Tel: (0733) 53530.

MACC (Midlands Amateur Computer Club) meets every Friday evening 7.00 p.m. onwards — no sub, no magazine. Contact: John or Roy Diamond. Tel: Coventry (0203) 454061.

Manchester Computer Club (formerly the Amateur Computer Club (North-west Group)). Meets 1st and 3rd Thursdays monthly at St Peter's Chaplaincy, Precinct Centre, Oxford Road, Manchester. Contact: David Wade, 28 Hazel Road, Altrincham, Cheshire WA14 1JL. Tel: 061-941 2486.

Merseyside Nascom Users' Group. Now independent, with 150 members. Meets 1st Monday monthly, 7.30 p.m. at Mona Hotel, James Street, Liverpool. Contact: T Scarle, 14 Hawkeshead Close, Maghull, Liverpool L31 9BT.

Merseyside TRS-80/Video Genie Users' Group. Contact: Peter Toothill, 101 Swanside Road, Liverpool L14 7NL. Tel: 051-220 9733.

Merseyside Microcomputer Group. Special interest groups: PET, Apple, 380Z, SC/MP, Education (Mr M Trotter, tel: 051-652 1596). Contact: Fred Shaw, 14 Albany Avenue, Eccleston Park, Prescott, Merseyside L34 2QW. Tel: 051-426 5436.

Kilmacud, Blackrock, Co. Dublin. *Cork branch* (£1.00 extra) — Michael Moynihan, Colaiste an Spioraid Naomh, Bishopstown, Cork. *Dublin branch* (£1.50 extra) — Jim Walsh, CBS Naas, Co Kildare. *Limerick branch* (£1.00 extra) — Sr Lourda Keane, Convent FCJ, Laurel Hill, Limerick. *Waterford branch* (£1.00 extra) — Mr Hugh Dobbs, Newtown School, Waterford. *Kilkenny branch* (£1 extra) — Sr Helen Lenahan, Presentation Secondary School, Kilkenny.

Northeast PETs. Contact: Jim Cocalis, 20 Worcester Road, Newton Hall Estate, Durham. They meet the 2nd Monday of each month for software tuition and the 3rd Monday for hardware tuition (both in addition to normal activities). They start at 7.00 p.m. and meet in the PET Lab, Newcastle Polytechnic, Ellison Building, Newcastle upon Tyne.

North-East RML 380Z Users' Group. Meets monthly at Micro-Electronics Education Centre, The Polytechnic, Newcastle upon Tyne. Contact: M Hatfield or R Reed, Computer Unit, Northumberland Building, The Polytechnic, Newcastle-upon-Tyne NE1 8ST. Tel: 26002 ext. 268 office hours.

Northwest Computer Club. Fortnightly meetings 25p attendance fee. No subscriptions. Contact: John Lightfoot, 135 Ashton Drive, Frodsham, Warrington, Cheshire WA6 7PU. Tel: (0928) 31519.

Pennine & District Computer Club. Open at both 26 and 51 Mill Hey, Haworth, W. Yorks each Saturday and Sunday 10 a.m. to 10 p.m. Systems books, magazines, members' shop. Contact: club at weekends on Haworth 43007 or chairman, Douglas Bryant, on Bradford 569660.

A PET group is being formed on the Sussex/Surrey border, presently centred on Crawley & Horsham. Aims to meet monthly and produce a monthly newsletter. Contact: Richard Dyer, 33 Parham Road, Ilfield, Crawley RH11 0ET.

Scottish Amateur Computer Society. Meetings 1st Wednesdays monthly, Claremont Hotel, Claremont Crescent, Edinburgh from 7.30 onwards. Meetings include talks and demonstrations. Contact: P Lindsay, (Top Right Flat), 1, Lower Gilmore Place, Edinburgh. Tel: 031-229 6841.

Scottish TRS-80 Users' Group. Meetings on 2nd Thursdays monthly at 7.30 p.m., normally in the Mansion House Hotel, West Milton Road. Software library and monthly newsletter. Contact: Dick Mackie on 031-229 6032 or at 3 Warrender Park Crescent, Edinburgh EH9 1DX.

Southern Users of PETs Association, free membership, meet first Wednesday each month £1.50 for monthly newsletter. Contact 42 Compton Road, Brighton BN1 5AN.

Surrey Microprocessor Society. (SUMPS) Coventry Surrey plus bits of South London and other adjacent countries. Anyone interested in joining, call Mike on 01-642 8362.

Thames Valley Nascom User Group. Newsletter to be published for novice and expert alike. Regular meetings in Slough/Staines/Windsor planned and we need support! Interested? Contact: Mike Rothery, 37 Eton Wick Road, Windsor, Berks, and enclose SAE. Tel: Windsor 56106.

TRS-80 — North West Group. (for 6 issues). Meetings last Wednesday monthly (not December). Contact: Melvyn D Franklin, 40 Cowlees, Westhoughton, Bolton BL5 3EG. Tel: (0942) 812843.

West Sussex — Rustington, Littlehampton. Is anyone interested in starting a computer club in this area? Contact: Chris Evans, 115 Worthing Road, Rustington, W Sussex. Tel: Rustington 74998.

Wirral Microcomputer Users' Group. Meets at Mons at Birkenhead Technical College. Contact: J Phillips, 14 Helton Close, Nocturum, Birkenhead, Merseyside L43 9HP. Tel: 051-652 0268.

380Z User Group Northern Home Counties: inc Herts, Cambs, Oxon. Contact: Sheridan Williams, 35 St Julian's Road, St Albans, Herts AL1 2AZ.

6502 User's Club (Southern Region). Welcomes all 6502 Users — Acorn, Aim, Apple, Atari, Atom, Kim, Microtan, PET, SYM, Superboard, UK101, etc. Regular Newsletter. Contact: Steve Cole, 70 Sydney Road, Gosport, Hants.

## COUNTY

Would anyone interested in setting up an Apple Users' Group in the Bucks/Berks area contact: Steve Proffitt. Tel: 01-759 5511 ext 7298 day, or Marlow 73074 evenings or weekends.

Cornish Radio Amateur Club — Computer section meets on the second Monday of every month at the SWEB Social Clubroom, Pool, Redruth. New members welcome. Contact: Bob Reason, 24 Mitchell Road, Camborne, Cornwall TR14 7JH.

South East Essex Computer Society, holds monthly informal computer evenings plus lectures. Open to anyone over 14. Contact: R Knight at Southend-on-Sea. Tel: 218456.

Gwent Amateur Computer Club. Covering the Gwent and Cardiff areas, the club has its own computer room and technical library. Meetings are held once a week on Wednesdays at 10 Park Place, Newport. Contact: Ian Hazell. Tel: (0633) 277711 office hours.

N Herts area CBM/PET/VIC Users' Group. Regular meetings, talks, affiliated to IPUG. Contact: P Mortiboy, 2 Spurr's Close, Hitchin, Herts SG4 9OE. Tel: Hitchin (0462) 54435.

West Herts 80 User Group. Membership not restricted to Herts residents — many members are also in National TRS-80 User Group. Meetings fortnightly at St Stephens Parish Centre, Station Road, Bricklet Wood, North of Watford. Contact: Terry Bradbury, 20 Spruce Way, St Albans. Tel: Park Street 73633. Or Reg Smith, 24 Sempill Road, Hemel Hempstead. Tel: Hemel Hempstead 60085.

Mid Kent TRS-80 User Group. Users and potential users of TRS-80 and Video Genie welcome. Meetings fortnightly at Kent Micro Services, 53 High Street, Maidstone, Kent. Contact: Mike Mariott also John Rayfield, 22 Beaconsfield Road, Sittingbourne, Kent.

North Kent Amateur Computer Club. Meetings first Thursday of each month, usually in Biggin Hill. New members and visitors always welcome. Contact: Barry Biddles (sec). Tel: Biggin Hill 71742.

North Lancs User Group. Contact: John Robinson, 12 Harold Avenue, Blackpool, Lancashire.

PET Users' in West Lancashire. Meetings on the third Thursday of each month at Arnold School, Blackpool. Contact: David W Jowett, 197 Victoria Road East, Thornton, Blackpool FY5 3ST. Tel: Cleveleys 869108.

The Leicestershire Personal Computer Club. Meetings held the 2nd Monday in each month, at Leicester University and Loughborough University alternately. They start 7 p.m. Membership is £2.00 p.a. £1.00 for under 16s. Contact: Ms Jill Ollershaw (Club Secretary) c/o Arden Data Processing, Municipal Buildings, Charles Street, Leicester. Tel:

(0533) 22255. Or Mr Dick Foden (Club Chairman) at 11 Gaddesby Lane, Rearsby, Leicester.

Lincolnshire Microprocessor Society. Various meeting places. For up-to-date information contact: Hon. Sec. Mr Eric Booth, Senior Common Room, Bishop Grosseteste College, Newport, Lincoln.

LPRINT is the newsletter of the East Midlands TRS-80/VG User Group. For a FREE sample copy send large SAE to: Mike Costello, 17 Langbank Avenue, Rise Park, Nottingham NG5 5BH.

MACRO (Medway Amateur Computer & Robotics Organisation). Meets monthly, sub £3.00. Contact: Ms Christine Webster, 13 Ladywood Road, Cuxton, Rochester, Kent. Tel: (0634) 78517.

Merseyside Microcomputer Group. Several sub-groups including: 380Z Users Group (Alan Pope on 051-924 2470); Computer Education Society (Mr M Trotter on 051-652 1596); SC/MP Special Interest Group (Bob Perrigo on 051-677 6716); PET Special Interest Group: 6800 and 77/68 Special Interest Group: Apple Special Interest Group: The secretary is John Stout of the Dept. of Architecture, Liverpool Polytechnic, 53 Victoria Street, Liverpool L1 6BY. Tel: 051-416 5536.

ACC (Merseyside 380Z and BBC Atom Users Group). Contact: Alan Pope, Paal Enterprise, 37 Stuart Road, Crosby, Liverpool L23 0QE.

Manchester area TRS-80 Users' Group. Contact: Francis Glenister, 13 Pridmouth Road, Withington, Manchester M20 9GN. Tel: 061-445 7191.

West Midlands Amateur CC. Meet 2nd and 4th Tuesdays each month at Elmfield School, Love Lane, Stourbridge. Further details contact: John Tracey, 100 Booth Close, Brierley Hill, West Mid. Tel: (0384) 70097.

West Midlands RML User Group, c/o BECC, The Bordesley Centre, Camp Hill, Stratford Road, Birmingham B11 1AR.

NE RML 380Z Users' Group. Meets monthly at MEC, Newcastle-upon-Tyne Polytechnic, Coach Lane Campus. Contact: M Hatfield or R Reed. Tel: 26002 ext 268 (office hours).

Oxford Microcomputer Club. £5.00 p.a. Contact: S C Bird, 139 The Moors, Kidlington, Oxford OX5 2AF. Tel: Kidlington (08675) 6703.

South Shropshire: Ludlow & Dist Microcomputer Club. Meets 7.30 p.m. 2nd Monday monthly at Diocesan Education Centre, Lower Galdeford, Ludlow. Contact: David Pauli, 32 High Street, Leintwardine, Craven Arms, Shropshire. Tel: 05473 287.

Stafford Computer Club of North Staffordshire. Call or write to Mr M Turner (chairman) ACCNS, 542 Lightwood Road, Lightwood, Stoke-on-Trent ST3 7EH. Tel: (0782) 324639 evenings.

Suffolk Microcomputer Club. Meets monthly, produces newsletter, sub £5.00 p.a. Contact: Mr S Pratt, c/o Microtek, 15 Lower Brook Street, Ipswich, Suffolk IP4 1AQ. Tel: (0473) 50152.

Anyone interested in forming a Suffolk Computer Users' Club should contact Ian on Ipswich 831353 evenings/weekends.

Thames Valley Amateur Computer Club. Meetings 1st Tuesdays monthly. From November on at the Southcote, Southcote Lane off the Bath Road, Reading, Berks. Start 7.00 p.m. Contact: Brian Quarm (Camberley 22186) or Brian Steer (Slough 20034).

South Yorkshire Personal Computing Group. Meets 7.30 p.m., second Wednesday each month. St George's Building, Mappin Street, Sheffield. Visitors always welcome. Contact: Paul Sanderson, 8 Vernon Road, Totley Sheffield. Tel: (0742) 351895.

West Yorkshire Microcomputer Group. Formed following an inaugural meeting on October 23rd, a varied diary of events has been drawn up. For details contact: The Chairman, Philip Clarke, Care Computers Services, 15 Wellington Street, Leeds LS1 4DL. Tel: (0532) 450667. Or the Secretary, Keith Knaggs, Price Waterhouse & Co., Leeds Tel: (0532) 448741.

## TOWNS

Aylesbury ZX Computer Club. Regular meetings at Aylesbury College 1st Tuesday monthly 7.30 p.m. — 9.30 p.m. Contact: D P Nowotnik (secretary). Tel: Aylesbury 630867.

Ashfield Computer Club. Meets 1st and 3rd Thursdays each month at Carsic Junior School, membership £3.00 p.a. Contact: Deric Esherby. Tel: (0380) 75376. Or Derrick Daines. Tel: (0380) 56198.

BAUD (Bristol Apple Users and Dabblers). Contact: Geoff Smythe, Datalink Microcomputer Systems Ltd., 10 Waring House, Redcliffe Hill, Bristol BS1 6TB. Tel: (0272) 213427.

Bedford Amateur Computer Club. Recently started, no further details as yet. Contact: Mr R Bird, 7a High Street, Great Barford, Bedford MK44 3LB. Tel: (0234) 870763.

Bournemouth Area Computer Club. Meets monthly at the Kinson Community Centre. Contact: Peter Hills, 54 Runnymede Avenue, Bournemouth, Dorset BH11 9SE. Tel: Northbourne 6547.

Bristol Computing Club. £4.00 p.a. Meetings 3rd Wednesday monthly. Contact: Leo Wallis, 6 Kibbimic Road, Bristol BS14 0HY. Tel: Bristol 832453.

Brunel Computer Club. Meets alternate Wednesdays, 1900 — 2200 hours at St Werburgh's Community Centre. Contact: Mr R Sampson, 4 The Coats, Stockwood.

Brunel Technical College Computing Club. The Club divides into two sections — the "skilled" and the "not skilled". They share alternate Wednesdays at the College. Contact: S W Rabona at 18 Castle Road, Worle, Weston-Super-Mare, Avon BS22 9JW. Tel: (0934) 513068.

Birmingham Computer Club. To be formed shortly, catering for all micro users. Fortnightly meetings planned but venue not yet fixed. Contact: Dr M Bayliss. Tel: 021-743 7197.

Brighton, Hove & District Computer Club. First meeting held on Friday 31st October. We are interested in corresponding with other societies, exchanging software and attracting new members. Many existing members have access to hardware. Contact: Rod Philippe at Hobbyist, 3 The Broadway, Southwick, Brighton BN4 4ND.

Cambridge Microcomputer Club. Meets 3rd Wednesday monthly at Portland Arms, Cambridge. Contact: Duncan Mackay, 4 High Street, Waterbeach. Tel: 63137 (day).

Cheltenham Amateur Computer Club. Meetings 4th Wednesday monthly. 7.30 p.m. start. Contact: Mr M Pullin, 45 Merestone Drive, The Park, Cheltenham GL50 2SU. Tel: (Cheltenham) 25617.

Anyone interested in forming a computer club in Cornwall, catering mainly for PET, ZX80 and UK 101 computers should contact: M F Grove, 35 Causeway Head, Penzance, Cornwall.

A Crawley computer club has recently been formed, open to anyone interested in personal computing, with or without computing facilities. Contact: Mr J Fieldhouse, 18 Seaford Road, Broadfield, Crawley, West Sussex. Tel: Crawley 542509. Or, Mr J M Clarke, 31 Hyde Heath Court, Pound Hill, Crawley, West Sussex. Tel: Crawley 884207.

Crews Computer Users' Group. Meetings monthly (Thursdays) at Crews Library. Details of meetings in local press. Contact: Bram Knight. Tel: Nantwich 623375.

Croydon micro/small computer group. Contact: Vernon Gifford, 111 Selhurst Road, London SE25 6LH.

The Colchester Microprocessor Group. Meetings held at the University of Essex on the second and fourth Wednesdays of each month — 7.30 p.m. start. Membership is open to all, on payment of £5.00 annual sub (£1.00 for full-time students). Contact: The Information Centre at the University on the evening of the meeting.

TRS80 User Group (Chelmsford). Now part of the National TRS80 User Club. Contact: Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.

Computer Club. Business & Word Processor section meets Fridays 7.30 p.m.; Scientific & Recreational Saturdays 10.00 a.m. Contact: I. Boxell, 8 Vane Terrace, Darlington. Tel: (0325) 67766.

Dalton-in-Furness Computer Club. Recently formed. Contact: A H Gay, 24 Rusland Crescent, Ulverston, Cumbria LA12 9LX. Tel: (0229) 52854.

Derby & District Branch of IPUG meets monthly in Derby. For details contact: Raymond Davies, 105 Normanton Road, Derby DE1 2GG. Tel: 41025 (day) 514016 (evening).

Derby Microcomputer Society. Meets fortnightly at Derby Lonsdale College, Uttoxeter Road, Derby. Contact: Mike Riordan, 172 Blagrove Lane, Littleover, Derby. Tel: (0332) 769440.



Exeter & District Amateur Computer Club. General meetings 2nd Tuesday monthly, specialist meetings 3rd or 4th Tuesday. £7.50 adults p.a. Contact: Ian Hodgson, 21 Dean Street, Exeter EX2 4HH. Tel: Exeter 50812.

Folkestone needs a computer club. I am willing to start one but I need some help. Please write or call any evening. Contact: Ray Milton, 94 Linden Crescent, Folkestone, Kent.

Grimby Computer Club. Meets fortnightly on Mondays at 7.30 p.m. Contact: Jensen Lee, 29 Park View, Cleethorpes. Tel: 32559.

Glasgow area ZX80/81 User Group, presently being formed. Main aim is to promote computer literacy. Will eventually include BBC Micro. Contact: Ian Watt, 107 Greenwood Road, Clarkston, Glasgow G76 7LW. Tel: 041-638 1241.

Glossop (Derbyshire) — is anyone interested in forming a computer club in this area? If so, please contact: Neil Jenkinson. Tel: (Glossop) 66027.

Harpenden Microcomputer Group. Informal meetings are held on alternative Monday evenings. Contact: David James, 5 Ox Lane, Harpenden, Herts AL5 4HH. Tel: (05827) 5366 (evenings).

Harrow Computer Group meets on alternative Wednesdays at 7 p.m. in room G43 of Harrow College of Higher Education. Summer meetings in the 'Plough', Kenton. Contact: B Butcher. Tel: 01-950 7068.

Hartlepool, Cleveland. Is anyone interested in starting a TRS-80 Users' Group in this area? If so, please contact: Ian Nicholson, 3 Thirsk Grove, Hartlepool, Cleveland TS25 1LT.

IOW TRS-80 Users' Club. Meets last Friday in every month at 7.30 p.m. at the London Hotel, Ryde. Contact: Mr M Collins, 11 Star Street, Ryde, Isle of Wight. Tel: (Ryde) 614589.

Leeds Microcomputer Users Group. Meets fortnightly on Thursday evenings in Leeds, new members welcome. Contact: Paul O'Higgins, 20 Brudenell Mt, Leeds 6. Tel: (0532) 742347 (after 6).

The SOBAT Computer Club (Leyton). Meets in first week of each month at 12 Calderon Road, London E11 4EU. Anyone (including beginners) is welcome. Membership fee only £1.00 p.a. including newsletter. Specialised information and access to several different kinds of microcomputers. Contact: Mr T Tavani. Tel: 01-556 5423 (evenings).

East London Amateur Computer Club. Meets 7 - 10 p.m. on 2nd & 4th Tuesdays monthly at Harrow Green Library, Leytonstone, London E11. Contact: Fred Linger. Tel: 01-554 3288.

East London Computer Club. Meets every Friday at 7.30 p.m. in term at North East London Polytechnic, Romford Road Precinct, Stratford E15. Contact: John Grieve. Tel: 01-553 4761.

North London Hobby Computer Club. Workshops four evenings a week during term

time. General meetings open to all last Wednesday of each month. Contact: Secretary DELE, Polytechnic of North London, Holloway Road, London N7 8DB. Communications Group — interfacing personal computers with Prestel/teletext and Networks like PC Net and The Source. Every Thursday 6.30 - 9 p.m. Room 2/5, Tower Block, Holloway Road. ZX81 User Group every Monday during term-time 6 - 9 p.m. Room 3/4, Tower Block, Holloway Road.

North London VIC-20 Users' Group to be formed. People interested please contact: Jim Chambers. Tel: 01-387 7050 (day).

SELMIC (South East London Microcomputer Club). Meets fortnightly at Thames Polytechnic, Woolwich. Contact: Peter Phillipps, 61 Craigerne Road, London SE3. Tel: 01-853 5829.

London-based Atom/Proton User Group. Regular newsletter including software and hardware tips, listings, reviews. Problems answered when possible. Meetings arranged. Membership £3.50 p.a. Details from M Jaffer, 71, Mill Farm Close, Pinner, Middx. Tel: 01-429 8042 or C Holt 01-427 6088.

Local IPUG Group meet other PET users and make friends. Contact: G Squibb initially. 108 Teddington Park Road, Teddington, Middx.

Manchester Atom Users' Group. Meets last Tuesday monthly during school terms at Abraham Moss Centre, Crescent Road, Manchester 8. Contact: John Ashurst. Tel: 061-370 5121 ext 27 (day), 061-681 4962 (evenings).

Manchester Computer Club. Meetings 1st and 3rd Thursday monthly in the Computer Science Building, Manchester University, Oxford Road. Contact: D Wade, 28 Hazel Road, Altrincham, Cheshire WA14 1JL. Tel: 061-941 2486.

North Manchester. Anyone interested in a ZX81 Users' Group? Contact: Jon Harvey, 93 Glebelands Road, Prestwich, Manchester M25 5WF.

MKMUG-Milton Keynes Microcomputer Users' Group. Weekly meetings Tuesdays 7.30 - 10.00 p.m. Lectures, etc, frequently arranged. For further information contact: Brian Pain, 40a High Street, Stony Stratford, Milton Keynes. Tel: (0908) 566660 (w) or 564271 (h).

Medway Atom Users' Group. Meets last Tuesday monthly during school terms at St John Fisher School, Ordinance Street, Chatham. Contact: Clem Rutter. Tel: (0634) 42811 (day).

Newcastle-upon-Tyne Personal Computer Society. Meets first Tuesday each month in Room D103, Newcastle Polytechnic. Over 60 members sub £5.00. Several sub-groups inc. PET, TRS-80 and S100 (last one meets weekly). Contact: Pete Scargill, Secretary. Tel: (0632) 573905.

Nottingham Microcomputer Club. Lectures arranged by visiting speakers. Meetings 1st Tuesday monthly at the Friends Meeting House, Clarendon Street, Nottingham. Subs £5.00 p.a., reduced for students and OAPs.

Non-members pay 50p entrance fee to meetings. Contact: Geoffrey Jago. Tel: Nottingham (0602) 621453.

Orpington ZX80/81 Computer Club. Meeting each Friday. Contact: R A Pyatt, 23 Arundel Drive, Orpington, Kent BR6 9JF. Tel: 66 20281.

Microsoc the Oxford University micro group holds shared meetings with the Oxford Microcomputer Club. Contact: M Bourla, St. John's College, Oxford.

Oxford University Microcomputer Society. Meets weekly in Clarendon laboratory, Oxford, visiting speakers, micros available for programming. Contact: Richard Ash, Christchurch, Oxford.

South Oxford Computer Club. Covers Wantage, Abingdon, Didcot, Wallingford and Newbury. Meets 1st Tuesday monthly at The Star, East Ilsley. Contacts: Mike — Tel: (0235) 834402; Malcolm — Tel: (0235) 816949; Paul — Tel: (0235) 815305; Rocky — Tel: (0635) 34456.

Peterborough Computer Club. Recently formed, meets on first and third Mondays each month at Adult Education Centre, Brook Street, Peterborough. Contact: T Marchant. Tel: (Peterborough) 76681 after 8 weekdays, anytime weekends.

Plymouth and District Amateur Computing Club. Subscription £5.00 p.a. Meetings last Wednesday monthly. Contact: Mr S A Bell, Secretary, Plymouth and District Amateur Computing Club, 31 Victoria Place, Stoke, Plymouth, Devon.

Would anyone interested in forming a computer club in the Portsmouth area please contact: Dave Cocker. Tel: (Portsmouth) 751156.

Richmond Computer Club. Meets 8.00 p.m. 2nd Monday monthly, Richmond Community Centre. Contact: Bob Forster. Tel: 01-892 1873 (evenings).

TRS-80 Independent User Group. Recently formed in Birmingham. Contact: Mike Bayliss. Tel: 021-743 7197.

Salisbury. Is anyone interested in forming a microprocessor and computer society in this area? SAE to David Bone, Flat 2, 24 St. Mark's Road, Salisbury, Wilts.

Shibley College Computer Group (Sorcerer/6800). They meet Tuesdays (software) and Wednesdays (hardware/advanced) between 7.00 & 9.00 p.m. Contact: Paul Channell. Tel: (Shibley) 595731.

Sunbury Amateur Computer Club. Meets 1st Friday monthly whenever possible, 20p per meeting. Contact: S Taylor, 8 Priory Close, Sunbury-on-Thames TW16 5AB. Tel: (Sunbury) 86649.

Scunthorpe & District Microprocessor Society. Contact: G Hinch, 21 Old Crosby, Scunthorpe, S Humberside DN15 8PU.

Southgate Computer Club. The club recently held its AGM and adopted a formal

constitution. Annual subscription will be £2.50 from January 1981, including a club newsletter, full-time students under 18 pay half-cost. The club now has 83 members. Contact: Panos Koumi, Southgate Computer Club, 33 Chandos Avenue, London N14.

Southampton Amateur Computer Club. Meets 8 p.m. 2nd Wednesday each month (not July - September) at Medical Science Building, Bassett Cres. East, Southampton. £3.00 p.a., OAPs & students £2.00. Newsletter and special int. groups: 2 years old, 80 members soon setting up another club in Portsmouth area. Contact: P G Dorey, Dept. Physiology, The University, Southampton SO9 3TU, or Andy Low. Tel: (0703) 555 605 ext 34.

Springfield Computer Club. Special interest in Sorcerer but beginners and others welcome. Meetings 1st Friday monthly. Contact: Stephen Cousins, 1 Aldeburgh Way, Springfield, Chelmsford, Essex CM1 5PB. Tel: (0245) 50155.

Taunton Computer Club. Meets weekly at Somerset College of Art & Technology (Tuesdays 18.00 p.m., term time). Other occasional general meetings outside, eg, visits, demonstrations. Beginners welcome. Contact: Mrs D Walker, Glenleigh, Whiteball, Sampford Arundel, Wellington, Somerset.

Anybody interested in forming a microcomputer users' club in the Towcester (S. Northants) area, please contact: R J Wellsted, 20 Hampton Court Close, Abbey Chase, Towcester. Tel: (Towcester) 51354 (evenings).

TRS-80 User Club (Chelmsford). Now part of the National TRS-80 User Club. Contact: Michael Dean, 22 Roughtons, Galleywood, Chelmsford, Essex.

Would anyone interested in joining an informal Computer Club in the Tonbridge or Tunbridge Wells area please contact: Chris Wallwork Tel: (Tonbridge Wells) 37682; or, Ray Szatkowski. Tel: (Tonbridge) 355960.

Worle Computer Club. Meets alternate Mondays 19.00 - 22.30 p.m. at Woodsprings Inn Function Rooms. Contact: S Rabe, 18 Castle Road, Worle, Weston-Super-Mare, Avon. Tel: (0934) 513068.

Worcester & District Computer Club. Meets 2nd Monday monthly at 8 p.m., Old Pheasant Inn, New Street, Worcester. Contact: D Stanton, 55 Vauxhall Street, Rainbow Hill, Worcester WR3 8PA.

West London Personal Computer Club. Meets first Tuesday each month at Willesden Technical College. Also visits, special int. groups, demos, problems surgeries. Contact: Graham Brain, 81 Rydal Cres., Perivale Middx. Tel: 01-997 8986.

York Computer Club. Meetings 8 p.m. Mondays at Holgate WMC New Lane, Acomb, York. Contact: K Thomas. Tel: (York) 38239.

Anyone interested in forming a micro group in the Doncaster area, contact: Mr P Flinders. Tel: (Doncaster) 78954 or (Doncaster) 868 379, (6 - 9 p.m.).

**TRANSACTION FILE**

*We know when we're beaten! The volume of readers using Transaction File is escalating beyond our resources to cope. Regrettably, therefore, we are increasing the flat fee to £2.50 per advertisement. Each ad must be printed on the form below, using a maximum of 30 words. We cannot accept Transaction File ads unless they are sent to us on this form. (If you don't want to damage your copy of PCW by cutting out the form then please use a photo-copy.) All ads must be accompanied by a cheque or PO for £2.50 made payable to SportsScene Publishers (PCW) Ltd. Ads are accepted only from non-commercial readers. We cannot repeat an ad unless a new form is sent in, nor can we guarantee to place an ad in a particular issue. Ads are printed on a strict 'first-come-first-published' rota basis. Please mark your envelope very clearly: Transaction File (PCW) 14 Rathbone Place, London W1P 1DE. Thank you for your co-operation.*

**WANTED**

Complete novice requires cheap ZX80. . . to start to learn on with extras if possible. R Whitworth, Tresco, Goldhill, Tansley, Derby DE4 5FG

PPC ROM. . . required desperately, for HP-41. Contact Martin, Tel 0482 (Hull) 441104.

Cash available. . . for TRS80 expansion interface with or without memory and, if reasonably priced, one disk drive, Swansea 290668.

Wanted. . . Program listings of MIX simulator and Mixal assembler transportable high level language, preferably Cobal. Name your price, inc post & packing. Mr Leigh, Rochdale 354291 eve.

Will swap my wife's colour telly for your video monitor. If you haven't got a monitor either, I'll take your ZX81 instead. Ring John, Kirkham (Lancs) 683504 after 6.

Wanted. . . 32k PET system. Will pay 4000 series up to £1300, 3000 series up to £1100. Tel: Colnbrook 3854 eve/wends.

**FOR SALE**

TRS80 Model 1 LII. . . 16k CPU with leads, manuals, PSU, and £100 + of s/ware, inc chess, editor/assembler, and adventures. Also printer interface £300 ono. Tel: 061 330 4615 after 6.

Casio fx-501P. . . complete with overlay, case, box, manual and programme library. £30, 01-802 8487.







TRS80 . . . 48k Green screen £495. Also disk drives £295, ring 01-445 0745.

UK101. . . 1yr old, 8k, 32x48, Cegmon improved Basic 1,3,4,5 Eprom board, case, k/pad, psg, pcc, Fan, 300/600 baud, manuals, software, 4amp PSU, £250. Phone Barking 01-591 5224 before 9pm.

HP 41C. . . 3 memory modules plus a card reader (20 magnetic cards + holder) in excellent cond. only £235 ono. Please write to V Prevelakis Eliot College, Kent University, Canterbury, Kent CT2 7NS.

ZX81. . . Sinc built, PSU, leads, manual, mains adaptor — perfect cond. £55, will arrange postage. Tel: 041 638 5292 after 6.30.

HP-41C. . . Hewlett Packards Astronaut quality Alpha Calculator plus one memory module. Never used. Selling for sentimental reasons, £120. Stuart 0607-34120 (Nottingham).

PET. . . upgraded to Basic 4.0. For sale 1 Basic 2 toolkit £15; Superchip £20; Decrasher £6; Papermate Wordprocessor £20; + other programmes. D Milnes, 13 Delmont Close, Whitelee Rd, Batley, West Yorkshire. Send cheque/PO + self SAE.

ZX80. . . 16k RAM, 8k ROM ZX80+81 manuals, 2 books of programs. Cost £180 ono. Tel: Wargrave 4650.

ZX81. . . Sinc built. Compete with all leads, mains adaptor, manual etc. Brand new complete with sinc games cassette. £65, J Benfield, Story House, Culford, Bury St Edmunds, Suffolk. Sorry no phone.

Acorn Atom. . . 12k RAM + 12k ROM, inc floating point + colour ROM, with manual, leads & cassette recorder, boxed as new, £220. Tel: Hemel Hempstead 62194.

ZX80. . . 1k complete with operating manual, leads, 30 programs on tape, good working order, £45 ono. Write or call 28 Curson Rd, Poulton-Le-Fylpe, Lancashire.

Apple II + 48k. . . Autostart ROM. UHF modulator, 16" Phillips TV cassette recorder with rev counter and VU meter. All manuals and programs, inc. relocated interger Basic. £595.00. Basildon (0268) 412546.

ZX80. . . 16k RAM, Sinc built, PSU, manual, all leads plus 2 extra books. All as new £80. Ring 01-864 0231.

PET 2001. . . 8k, integral cassette, old ROM, good cond. dust cover, introduction book, users handbook, PET tutorial cassettes, pontoon, space invaders, chess, £295. Tel: Wilmslow (0625) 524 747.

Acorn Atom. . . 12k + 12k, PSU, Atom books and games magazines, software inc. Invaders, Star Trek etc, £200 ono. Tel: Leamington Spa (0926) 312805.

ZX81/80. . . expansion board, 8k; £25; Space Invaders ROM (hi-res graphics); £10; for ZX80 only: 2k Invaders; £2; ZX80 handbook (Linsac 2nd edition); £4; Phone Harrogate 503079 after 6.

ZX80. . . 8k ROM, £50, 16k RAM pack £40, ZX printer £40, or £120 the complete system inc PSU, manuals, books and sample programs. P Fisher Wolverhampton (0902) 341333.

T158. . . prog calc inc master module, manuals, coding sheets, case, charger, as new in original box, £30. Tel: Flitwick (0525) 714634.

ZX81. . . Sinc built, with leads and mains adaptor, book of progs, manual, games cassette, £65. Tel Leeds 684148. After 6pm or weekends.

Video Genie 16k. . . 8 months old — hardly used £245 ono. Tel: 098 389 319.

Nascom Castle. . . Interface with DOCS, new un-used £16. Data dynamics RO £390. Teletype £120 ono, can deliver 100 mls rad. Micro type case, 101 cut out £8.00. Ring Michael 0782 311573.

PET . . . 8k 2001 (new rom) internal cassette, sound box, lots programs, little used £350. Tel: Hapenden 62503.

CMB 4032. . . with cassette and dust cover. 6 months old, hardly used. Tel: Windsor 61975 eve.

Video Genie. . . 16k, perfect con. sound box, tab keys, VU meter, various manuals, still under warranty. Several progs (eg, renumber, tiny Pascal, Supernova) £265. Tel: (0533) 883658.

UK101. . . in microtype case with 8k RAM and programmable sound generator. Lots of software inc. Chess, Invaders and Asteroids. 6 months old, only £160. Phone Norwich (0603) 618995.

ZX81. . . Sinc built, complete with all leads, manual, mains adaptor, in box, £55, Tel: 01-801 2644 after 5.

Video Genie. . . 16k manuals, lead and lots of software. One year old. £270 ono. Portable b/w TV £60 ono. Cassette recorder £25 ono. Tel: Shepshed 8411. Loughborough, Leics.

Acorn Atom. . . Immac cond. Acorn built, 6k RAM, 8k ROM + B/W TV monitor; all leads, cassette deck; many progs inc. Space battles; manual + Atom Magic. Kant (0474) 872546 Price £210 ono.

Video Genie. . . 16k has right arrow key. Exc cond. with many programmes, eg. Galaxy, Microchess, Editor Assembler, TBug etc. and TRS-80 books £250. Tel Fleet: 7367.

HP 41C. . . calculator complete with 3 memory modules all in perfect cond. £227 value yours for £150. Tel: 01-730 9600 ext. 257 office hours.

PET 2001. . . 24k, old ROMs, large key board, computhink disk drives, Anadex DP8000 printer. Everything works and used daily. A complete business system for £1500. Ring 0823 69399.

TRS-80. . . level II 4k, very good cond. complete with PSU, leads, tapes, books and recorder. £300 Tel: 0522 690528.

Microtan 65. . . with keypad, PSU and manual, all in perfect cond, fully working as new, £75 ono. Tel: 051 525 4283.

TRS80. . . 16k Level II, numeric keypad, green screen monitor, cassette, PSU, covers, manuals, books, some software, £340 ono. Tel: Potters Bar (0707) 58743.

Professionally assembled fully expanded Acorn Atom. . . 12k ROM + 12k RAM, PSU, printer interface, cassette recorder and over 60 programs inc Space Invaders. £325 ono. Tel: Eston Grange (0642) 454300.

Why pay more. . . and have to wait months for a 16k ZX81 when you can buy mine with games cassettes and recorder NOW for only £125. Tel: Blandford (0258) 54653.

Offers please for. . . 16 4k dynamic RAMs, 16 pin DIL type MK4096P. Also for \$100 static RAM memory board using 64 21L02. Tel: 0989 2715.

Compak2. . . by Molimerx, tiny Pascal compiler, 350 page Tiny Pascal Book (inc programs) full instructions, cost £39, sell £21 ono. Phone Ron 733 2251 eve.

Anadex DP8000 Printer. . . recent overhaul by Anadex. Exc cond, £280 ono. Must sell! 01-640 6777.

Commodore 3022 Tractor printer. . . just 1yr old. Must be sold so that I can up-grade. £295 ono. Tel: 01-953 1823.

ZX81 Microprocessor. . . Factory built, complete with 16k RAM package, Sinc Basic manual, mains adaptor, all leads, and Sinc cassettes, only £100. Tel: 0376 515220.

Microsoft EDTASM+ with ZBug. . . m/c book by H Howe, Z80 opcode book, Tandy beginners assembly book cost £41. Sell £22 ono. Phone Rom 733 2251 eve.

Apple Software — surplus to requirements: Supertext II Word Processor, complete with manual, absolutely unused: £70. Unused games in original packs: Galaxian, Galaxy Wars, Space Eggs: £7 each. Tel: 031-669 6430.

Intellivision. . . with 18 cartridges (inc. Horse racing). Superb colour and graphics and exc sound effects. Cost £530, first £400 secures. (has just been serviced). Phone 031-664 3879.

PET 2001. . . 8k, ex cond. (Reason for sale up grade to 32k). Large collection of software, games, educational and many more. Sound box, joy stick, light pen, D — A converter, buffer for user port, light & sound detecting circuits, manuals. Offers around £300. Ring Danny 01-680 5939 after 4.

ZX81. . . Sinc built, still under guarantee, included also a games tape. £57.

ZX81. . . 16k RAM, Sinc built inc manual, PSU all leads, 2 Sinc cassettes (games + business), 30 prog book, all packaging. £120 ono. Tel: 01-751 0280 after 6.

PET 4008. . . 8k new ROM, 5 months old, green screen, large keyboard, Commodore cassette deck, instruction manual, many magazines, many games tapes. Cost £550. Will accept £330 ono for quick sale. Will deliver. Phone (039 17) Fleetwood 2706 eve.

ZX81. . . with 16k RAM, PSU, leads and manual, all in original packaging plus five ZX80/81 books and Sinc business cassette. £120 ono. Phone 021-444 7982.

ZX81. . . 16k RAM and printer, Games cassette, manuals plus 20 inch b/w TV monitor, £130. Tel: Rowlands Castle 2353.

Sharp MZ-80K. . . 48k, as new. Inc Toolkit, Pascal, Assembler, M/C tape, Asteroids, Invaders, Backgammon, Othello, Pontoon & many others — marriage forces reluctant sale. £450. Tel: 0245 73057.

Sinc built ZX80. . . 3k RAM pack with full complement of IC's for sale. Little used. £20. Phone Blackburn (0254) 886 523.

ZX81. . . Sinc built, 16k RAM pack, 4 months old, and printer, only 1 month old. Complete with leads, mains adaptor, manual cassettes, books etc. Only £150 the lot. Tel: 02594 2645.

ZX81. . . with Sinc 16k RAM pack, hardly used. Inc all leads, PSU, and manual. Some tapes and books, £110 Armstrong, 3 Chagford Villas, Netherton, Maryport, Cumbria, Tel: Maryport 3044.

ZX81. . . Sinc built, housed with leads for easy connection, manual, hints & tips book, exc cond, £55. Phone 01-989 6246 (Wanstead, London).

ZX81. . . Brand new, perfect cond. All leads, Sinc built. Available now. Only £50. Tel: Jeremy at Mogador 833205.

Casio FX502P. . . £50 as new. 256 step non-volatile memory programmable calculator. Also Sony pocket cassette recorder (ideal for storing prog. calc programs on!) £30. Boxed. 2 Brooms Close, Wilwyn Gdn City, Herts.

16k ZX81. . . RAM pack, £25; Sharp CE-121 cassette interface, unwanted gift, £10; Video-master 3 game colour TV game, £10. All inc postage, R Woodcock, 46 Palgrave Rd, Gt Yarmouth, Norfolk.

Monitor 3. . . by Molimerx (gives assembler output) etc, Fun House Adventure and Seven issues of 80-Microcomputing Mon3, great for machine code, cost £57 sell £24. Phone Ron 733-2251 eve.

Complete TRS80. . . 16k, LII system, inc: quick printer II, s/paper, Hatachi 9" monitor, all manuals, power supply, TV modulator, cables, +50 programs, inc: Sargon, Tbug, Othello, etc. Books: Into TRS-80 Graphics, TRS-80 Assembler Programming, Everything mind! +140 top quality mags. inc: PCW, CT, PC, TRS-80, etc. £499. Tel: 01-986 4245 eve.

OSI Challenger IIP. . . 32k RAM. 610 expansion board. 3 channel sound, high resolution by Char. Generator — Segmon — 300, 4800 baud cassette, 32x48 screen, cooling fan — 12" monitor — professional case, all manuals £460. Tel: 542 7593 (Allen).

Sharp MZ-80K. . . 36k RAM; MZ-8010 Interface, MZ-80P3 printer plus interface card — all mind cond. Plus toolkits 1&2, many games and much software. Owner emigrating. £750 ono everything. Tel: Croydon 01-656 0945.

PET 2001. . . 8k old ROM small keyboard, with Strathclade Basic course £250 ono. Tel: 031-663 5625.

Acorn Atom. . . 12k + FL point plus MZ70 printer. Five amp PSU games and printer paper and word pack. Tel: West Drayton, 41224. Owner leaving country.

UK101. . . 8k professionally built; inc Cegmon monitor, Easi-comp sound generator, 300/600 baud, fan, case, over 90 programs inc M/C Invaders, complete documentation ideal, £230. Telephone 0473 685341 Ipswich.

Video Genie EG3003. . . latest model, new type keys and tape level meter, mint, under guarantee (1 year), 16k RAM, games also for sale, £299 ono. Tel: 01-654 4361 (eve).

Nascom IMP. . . printer with TRS-80 interface, perfect, £200 ono, also JPC fast cassette systems for TRS80, £50. Sinc, Hedingham (0787) 61004.

PET 8k. . . new ROM, green screen, small keyboard, programmable music, many games, books etc. All as new £300 ono. Phone Ruislip 37283 eve.

UK101. . . cased, 12k RAM, only 4 months old, still under guarantee, Great software inc. Asteroids, invaders etc. Great machine. Genuine reason for sale. Bargain £195. Tel: Meopham 814654.

Microtan 65, 8k RAM, Tanex, XBug, ASCII keyboard, Hexpad, Large case, PSU, Basic graphics, lower case, manual, software, cost £350, Bargain only £179. Phone 01-394 0394.

PET 32k. . . model 2001, with games software inc Space Invaders and chess. Price £300. Tel: Khalid Khan, Romford 070 845553.

Tandy printer. . . Line lprinter 7, serial and parallel interfaces. Used twice only, cost £239, accept £205. Phone Colchester 841293.



DAI... 48k RAM, 24k ROM, 16 colour graphics + sound, BRAND NEW, replacement guarantee, + cassette recorder, leads, manual, newsletters, software, word processor, lunar lander, forced to sell - £670 ono. Contact 01-794 2767.

UK101... 24k RAM, Cegmon monitor, 10k Basic, toolkit in EPROM, 300/6004800 baud cassette enhanced power supply all in custom case. Lots of professional software, £400. Phone Oxted 5380 after 5.

PET 2001... 8k old ROM integral cassette deck; software inc. space invaders, Basic course; £275 ono. Ask for John on Brentwood (0277) 223328, after 4.

ZX81... Sinc built, with adaptor, etc and one cassette. Virtually unused (dup gift). Available right now with no waiting for only £62. Call Derek 01-673 0219 (eve Thur to Fri/w.ends) Now!

Sharp MZ-80K... 48k, new, boxed, C/W guarantee, 64,000 DOT hi-res graphics board, Basic, toolkit, forth, Fortran, Pascal, Sharp assembler and machine code, 120 programs, Asteroids, Chess, Payroll. Worth £875, due to difficult circumstances willing to accept £560 for quick sale. Tel: office hours 01-628 0071.

TRS-80... 16k level 2 keyboard unit with PSU and modulator with new ROM to debounce keyboard. £285 ono. R. Kitchin. Tel: (0792) 460638 9am to 5pm.

Video Genie... 16k, plus TRS80 green screen monitor, EXTASM (microsoft), Tiny Pascal, manuals, books: Pascal and TRS80 Assembly Language Programming. £350. Tel: 01-575 5863 eve.

ZX81... Sinc built, complete outfit; adaptor, leads, 2 books, sound equipment, 6 software cassettes and 6 listings for the expanded machine. £145. Southend-on-Sea (0702) 66742.

Sharp MZ80K... 48k, 2 weeks old, unwanted gift, games prog etc. Brand new, 2 year guarantee £350 ono. Phone Cliff 01-577 0323 (Hounslow)

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## ACC NEWS

*News from the Amateur Computer Club, the national club for all amateur and personal computer users.*

### Hints on setting up a local club

The ACC is often asked for advice on setting up local clubs, so here are some points gathered from established clubs and the ACC's own experience in starting clubs.

Before you start to set up a club, it is worth checking that there isn't a club in your own area that you don't know about. Some ComputerTowns and clubs either restrict their advertising deliberately while they build their foundations, or else they just aren't any good at publicity. If you do find another club nearby, then there must be really good reasons if you want to still go ahead and form your own.

Consult the ACC Club database, the last six months' magazines (try a library if you haven't got them all) and local computer shops and libraries, in order to find the details of clubs near you. Also check the addresses on letters in magazines. Experience shows that about one adult in 10,000 is seriously interested in personal computers, although the advent of machines such as the VIC and ZX81 along with the BBC project is likely to double that figure (ie, to one in 5000). This means that you can guess the likely number of members in your catchment area and decide

whether to go ahead. Note that ComputerTowns often co-exist with clubs, as the former cater more for beginners and that seasonal university or college clubs can often supplement and enhance a local group.

Before you do anything, you will need some people to help. Apart from your friends, one good source is neighbouring clubs, so it is well worthwhile to go to some of these, even as far away as 30 miles, and see what they do. You may meet one or two people who could form a steering committee with you to help get the thing off the ground. Providing you are diplomatic about it and don't seem to be poaching their members, a neighbouring club may give you substantial support; perhaps you could invite somebody to come and speak at one of your early meetings.

Once you have a steering committee, you (the committee) should decide what kind of club you want. Is it just a meeting place, a source of free computing facilities or a teaching centre? Businessman and children require more organisation and support than hobbyists do; ideally, you will have separate groups for these, but this will have to wait until you have a few more people around to help. You should also decide at this point whether the club should be a full affiliate of the ACC (ie, take part in the

block membership scheme) from its inception; if so get in contact with me (Rupert Steele) for the details.

The next requirement is a meeting place. Aim for somewhere free or extremely cheap, or you may end up with a £100 membership fee just to pay for the venue. Start by trying the Technical College; some will provide free access to a room and perhaps computers, while others see it as an easy source of revenue. The best person to approach is the head of the electrical or computing department. However, don't forget that they spend half the year closed for holidays. Then try community centres, church halls, libraries, schools and lastly public houses as their rooms tend to be expensive. Libraries are popular with ComputerTowns, but you may run into problems of noise disturbing other users.

Once you have a meeting place set up, you can start on the publicity. This should be started cautiously; although it may seem attractive to go for a splash in the local paper(s), this may result in 200 or more people with no knowledge of computers who will not appreciate the fact that alone you cannot instantly mend all their ZX81s. It is better to start (fairly) slowly to build up your capability and expertise. Inform the ACC and the major computing magazines,

bearing in mind the long lead times; possibly also put something in the local computer shops (if they'll take your publicity). This approach ensures that the people who come initially have a significant interest in computers. Later on, contact local libraries, more computer shops and local newspapers. Control the rate of your publicity so that you have a steady flow of new recruits.

It is unfortunately true that people are greatly influenced by the first meeting that they happen to attend, and expect to be immediately provided with the answer to all their (computing!) desires. For example, a couple who came to a meeting of the Harrow Computer Group and were not straight away introduced to other PET users left within five minutes and were not seen again for five years. Others assumed that, because the first three meetings were all on Pascal (the only speaker available), nothing else would ever be discussed. You will always have the problem of trying to appeal to all tastes simultaneously and should therefore inject variety, not only between meetings, but within them. Local shops will often be prepared to give a presentation of their wares, but mostly you will have to rely on the more expert of your club members for lectures (if that is, indeed, what you want



to do in the club).

Once there are a few active members, you should try to formalise the set-up of the club. You may already have co-opted people to supplement the original two or three of the steering committee, but you should aim, as soon as possible, to hold your first Annual General Meeting (AGM) at which a constitution will be adopted and a committee formally elected. Don't worry, there is no chance that

they won't re-elect you, at least the first year.

The officers that you require are chairman, secretary and treasurer but I would strongly advise a membership secretary be also elected to handle membership records and to distribute meeting lists, etc, to the membership. If you require a bank account, you will have to fill out a 'mandate' form (obtainable from your chosen bank), and a photocopy of the completed form should

be stuck in the minute book. Choose a bank that one of the committee has an account at, and good relations with, if possible; this can save a lot of red tape with references, etc. The bank will require a copy of the club's constitution (I hope to publish a sample constitution in a future issue of ACC news), although they may let you open the account first if they like you. The bank will want you to specify what signing arrangements you want on the account. A

common arrangement is two out of three officers (eg, treasurer, secretary and chairman) required to sign each cheque; this saves embarrassment if the treasurer goes on holiday (but if he takes the cheque book with him. . .). You may prefer to only require one signature on each cheque (eg, either the treasurer or the chairman may sign).

Good luck, and *don't forget to tell the ACC!*

Rupert Steele

**USER GROUPS INDEX**

*Here is a list of all British (and one Dutch) personal computer networks. As more networks appear — and as more facilities are added to existing ones — we'll report them in this section, which appears monthly.*

**Forum-80 Hull. . . Operator:** Frederick Brown, tel 0482 856169. Facilities: electronic mail, software up/down loading, Forum-80 Users' Group, PET users' section, shopping list. Hours: 7 days/week, midnight-0800, Tues & Thurs 1900-2200, Sat & Sun 1300-2200.

**Forum-80 London. . . Operator:** Leon Jay, tel 01-286 6207. Facilities: electronic mail, program downloading. Hours: Tues, Fri, Sat & Sun 1900-2300.

**80-NET . . . Operators:** Leon Heller & Brian Pain, National TRS-80 Users' Group, tel 0908

**566660. Facilities:** electronic mail, software for downloading, newsletter, TRS-80 information. Hours: 7 days/week, 1900-2200.

**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.

**Forum-80 Holland. . . Operator:** Nico Karssemeyer, tel 010 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.

**CTUK! CENTRES**

*Here's an updated list of people organising ComputerTowns. Don't forget to enclose an SAE if you write to your nearest Town for details.*

Lyn Antill,  
1 Defoe House,  
Barbican,  
London

Peter J Kiff,  
52 Stone Road,  
Broadstairs,  
Kent CT10 1DZ

Patrick Colley,  
52 Queensway,  
Caversham Park Village,  
Reading,  
Berks RG4 0SJ

Pete Shaw,  
15 St Vincent Road,  
Clacton-on-Sea,  
Essex CO15 1NA

Steven Christian,  
51 Burnstones,  
West Denton,  
Newcastle-on-Tyne NE5 2DF

Derek Moody,  
2 Victoria Terrace,  
Dorchester,  
Dorset DT1 1LS

David Tebbutt,  
7 Collins Drive,  
Eastcote,  
Middx HA4 9EL

Vernon Gifford,  
111 Selhurst Road,  
Croydon,  
London SE25 6LH

John Stephen Bone,  
2 Claremont Place,  
Gateshead,  
Tyne & Wear NE8 1TL

Mike Baker,  
5 Edinburgh Road,  
Hanwell,  
London W7 3JY

Vernon Quaintance,  
50 Beatrice Avenue,  
Norbury,  
London SW16 4UN

R L Saunders,  
14 St Nicholas Mount,  
Hemel Hempstead,  
Herts.

Pete Rowan,  
10 Lambton Road,  
Jesmond,  
Newcastle-on-Tyne NE2 4RX

Steve Haynes,  
5 Guinea Street,  
Kingsholm,  
Gloucester GL1 3BL

Ted Broadhead,  
27 Cardinal Road,  
Leeds LS11 8EY

Andrew Holyer,  
10 Masons Field,  
Mannings Heath,  
Horsham, Sussex RH13 6PJ

Brigitte Gorton,  
18 Purbright Crescent,  
New Addington,  
Croydon CR0 0RT.

Susan Kelly,  
Head of Reference Services,  
PO Box 4,  
Civic Centre,  
Harrow,  
Middlesex.

Bill Gibbings,  
3 Longholme Road,  
Retford,  
Notts DN22 6TU

Philip Joy,  
130 Rush Green Road,  
Romford,  
Essex.

Richard Powell,  
22 Downham Court,  
South Shields,  
Tyne & Wear

Derrick Daines,  
18 Cuttings Avenue,  
Sutton in Ashfield,  
Notts

Keith Taylor,  
Carter Hydraulic Works,  
Thornbury,  
Bradford BD3 8HG

Roger Shears,  
18 Woodmill Lance,  
Bitterne Park,  
Southampton SO2 4PY

Alan S Waring,  
50 Drayton Gardens,  
Winchmore Hill,  
London N21 2NS

Alan Northcott,  
Rushmoor,  
464 Reading Road,  
Winnersh,  
Wokingham,  
Berks RG11 5ET

Alan Sutcliffe,  
4 Binfield Road,  
Wokingham,  
Berks RG11 1SL

Tony Cartmell,  
54 Foregate Street,  
Worcester WR1 1DX

Tom Graves,  
19a West End,  
Street,  
Somerset BA16 0LQ

**DIARY DATA**

*Readers are strongly advised to check details with exhibition organisers before making travel arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.*

London	(West Centre Hotel) Microsystems Exbn. Contact : IPC Exbns Ltd, 01-643 8040	24-26 Feb.
County Down	(Alexander Hall) Business Equipment Exbn & Conf Contact : WHC Industrial Promotions Ltd, 0247-812577	8-11 March
Glasgow	(Albany Hotel) Scottish Computer Show Contact : Couchmead Communications Ltd, 01-653 1101	16-18 March
San Fransisco USA	West Coast Fair	19-21 March
Ipswich	(Gt. White Horse Hotel) Computer Open Day Exbn Contact : Couchmead Communications Ltd, 01-653 1101	24 March
Guildford	(Metropolitan Exbn Hall) Computer Aided Design Exbn & Conf. Contact IPC Science & Technology Press 0483-38085	30 March-1 April
London	(Polytechnic of North London) London Computer Fair	15-17 April



# LEISURE LINES

By JJ Clessa

December's problem was to find the smallest number with exactly 104 factors excluding unity (ie, 105 factors if we include unity). This can be done analytically, although it would call for an interesting bit of programming if a computer were used. The analytical proof is as follows:

Express the required number  $n$  in terms of powers of prime factors, ie  $n = p_1^{a_1} \cdot p_2^{b_2} \cdot p_3^{c_3} \dots$  where  $p_1, p_2, p_3$  etc are prime factors. Then the number will contain exactly  $(a+1)(b+1)(c+1)$  factors (excluding unity and  $n$ ). Now  $105 = 3 \times 5 \times 7$ , and so if we choose three prime factors and  $a=2, b=4, c=6$ , then, regardless of the prime factors chosen, a number,  $n = p_1^3 \cdot p_2^5 \cdot p_3^7$  will contain exactly 105 factors.

The smallest number is obtained by using the three lowest prime factors, ie, 2, 3, and 5 and gives the answer  $n = 2^3 \cdot 3^5 \cdot 5^7 = 129,600$ . The smallest odd number is  $n = 3^3 \cdot 5^5 \cdot 7^7 = 22,325,625$ .

Less than 100 entries were received, mostly correct. Quite a few were from far afield — Greece, Norway, Belgium — and one or two entrants submitted wrong answers and included rigorous mathematical proofs as to why, the answers were correct. One entrant proved that there was no smallest

number but the proof was too complex for us to understand, and so instead we chose the winning entry from those giving the answers shown above. Congratulations, Mr Fiddy of Cricklewood, London NW2, who solved this problem with a calculator. Your prize is on its way.

## Quickie

The big hand of Big Ben weighs 1,200 pounds, the hour hand weighs 700 pounds. What is the total weight of the hands? The answer is *not* 1900 pounds.

## Prize puzzle

Slightly more difficult than usual, and, although it can be solved analytically, most people will probably prefer a programmed solution.

What is the largest number whose prime factors (excluding unity) add up to exactly 100? Just to be sure we're all on the same system, the prime factors of 12 are  $2 \times 2 \times 3$  — their sum is 7. The prime factors of 90 are  $2 \times 3 \times 3 \times 5$  — their sum is 13 and so on.

Answers on postcards, please, to March Prize Puzzle, PCW, 14, Rathbone Place, London W1P 1DE to arrive by the last day of March 1982.

# PROGRAMS

PCW is interested in Basic or Pascal Programs for any popular micro — please tell us which one you wrote your program on and how much memory it uses.

Make sure your programs are fully debugged before you send them in one cassette (although we will accept disks) with a clear listing on plain paper. Documentation would be welcome, and if you want it returned please label everything with your name and address and include an SAE. Send contributions to Maggie Burton, PCW Programs, 14 Rathbone Place, London W1P 1DE

Sincere thanks to everyone who has volunteered to join PCW's referee scheme. Although I wasn't 'deluged with replies by New Year's Day', they came flooding in afterwards! I must now inform you that the number of volunteers is beginning to exceed demand and the register is closed to further applications.

While on the subject of thanks, due mention must go to a certain very patient Tandy Store (Centre Point, London W1) just around the corner from PCW which has provided me with

most of the TRS-80 listings published in the last few months. They have also let me use their machines to test programs and have been helpful in sorting out at least one program blunder...

I hope that before too long I'll be seeing more programs written for new machines such as the Ataris, VIC-20 and TRS-80 Color. You've read the tests, been to the shows, seen the adverts, now write the programs! There must be at least a few ardent keyboard bashers hiding one or another of the afore-

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# PROGRAMS

## Nascom Business Documents

by A Hetherington

Now that I've finished being frivolous, here is something which would be of help to a small businessman, a news-agent say, who has to deal with small orders and accounts. It is meant to cut down the paperwork involved in this kind of work.

It's written for a 32k Nascom II and Epson MX-80f/t printer, but adaptation should not be too difficult if your printer is different. As listed, the program uses 8k.

When run, the program presents the user with a menu of options. After making the appropriate choice the user can print out a sales invoice, delivery note or, if required, a remittance note. Account statements could be added to produce two copies of any document unless a list of addresses is requested, in which case one is supplied. Information

necessary for printing out a document is collected via input from the user.

All the records in the program (the ones in this listing are dummy addresses) are actually stored as DATA statements because Nascom does not facilitate string storage on cassette. These commence on line 3000. Each line of a particular address is coded with a number which is entered by the user when requested by the program. These numbers do not appear on the document and if more addresses are needed each one must be given a new number and be added before the program is run, as they are effectively part of it. Line 2780 will need altering in accordance with the total number of addresses in the program and line 620 sets the number of copies to be printed.

```

5 CLS
10 REM ** BUSINESS DOCUMENTS
20 GOSUB 2690
30 CLEAR 2000
40 CLS
50 PRINT "          ***** MENU *****"
60 PRINT
70 PRINT "SELECT YOUR REQUIREMENT BY TYPING THE ";
80 PRINT "NUMBER"
90 PRINT "NEXT TO THE FOLLOWING:"
100 PRINT
110 PRINT "      1. INVOICE AND DELIVERY NOTE"
120 PRINT "      2. REMITTANCE ADVICE"
130 PRINT "      3. ORDER"
140 PRINT "      4. LIST OF NAMES & ADDRESSES" ; PRINT
150 PRINT "WHEN PRINTED EACH OF YOUR SELECTIONS ";
160 PRINT "WILL GIVE"
170 PRINT "TWO COPIES, EXCEPT FOR ITEM 4 WHICH ";
180 PRINT "WILL ONLY"
190 PRINT "GIVE ONE"
200 PRINT
210 E=0
220 INPUT "YOUR SELECTION"; Q
230 PRINT " ON ERROR TYPE '999' AND PRESS RETURN";
240 INPUT E : IF E=999 GOTO 210
250 IF Q>4 GOTO 40
260 IF Q=4 GOTO 2330
270 GOTO 280
280 CLS
290 Z=0
300 WIDTH 80
310 IF Q=2 THEN GOTO 1750 : IF Q=3 THEN GOTO 1820
320 IF Q=3 THEN GOTO 1820
330 E=0
340 INPUT "CUSTOMERS ORDER NO"; CO$
350 INPUT "DATE OF ORDER"; DO$
360 INPUT "INVOICE NO"; IN$
370 INPUT "DATE"; D$
380 INPUT "NUMBER OF ITEMS"; N
    
```

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# PROGRAMS

```

390 PRINT " ON ERROR TYPE '999' AND PRESS RETURN";
400 INPUT E : IF E=999 GOTO 330
410 FOR J=1 TO N
420 E=0
430 PRINT "DESCRIPTION, ITEM"J : INPUT DES*(J)
440 PRINT "QUANTITY, ITEM"J; : INPUT Q(J)
450 PRINT "UNIT PRICE, ITEM"J; : INPUT P(J)
460 PRINT " ON ERROR TYPE '999' AND PRESS RETURN";
470 INPUT E : IF E=999 GOTO 420
480 T(J)=P(J)*Q(J)
490 Z=Z+T(J)
500 NEXT
510 E=0
520 INPUT "TYPE IN ADDRESEES' NUMBER "; R
530 PRINT " ON ERROR TYPE '999' AND PRESS RETURN";
540 INPUT E : IF E=999 GOTO 510
550 R1=R
560 V1$="TEL XXXXX *****"
570 V$="VAT REG No *** **** **"
580 INPUT "DO YOU WISH TO PRINT Y OR N"; Y$
590 IF Q=1 THEN K=4
600 IF Y$<>"Y" GOTO 580
610 IF Q=2 OR Q=3 THEN K=2
620 FOR I=1 TO K : GOSUB 1230
630 PRINT CHR$(12)
640 SI$="SALES INVOICE"
650 IF I=3 OR I=4 THEN SI$="DELIVERY NOTE"
660 W=AD : GOSUB 2000
670 IF Q=2 THEN SI$="REMITTANCE ADVICE"
680 IF Q=3 THEN SI$="PURCHASE ORDER"
690 PRINT CHR$(14)CHR$(27)CHR$(69)SI$;
700 GOSUB 1710
710 GOSUB 2780
720 R=1
730 RESTORE
740 FOR J=1 TO D
750 READ P$
760 IF VAL(LEFT$(P$,2))=R THEN GOSUB 2610
770 NEXT
780 RESTORE
790 PRINT
800 PRINT TAB(48)V1$
810 PRINT "To"; TAB(48)V$
820 PRINT
830 GOSUB 1730
840 R=R1 : GOSUB 2100
850 IF I=1 OR I=2 THEN C$="INVOICE No "
860 IF Q=2 THEN C$=""
870 IF Q=3 THEN C$="ORDER No "
880 IF I=3 OR I=4 THEN C$="DELIVERY NOTE No "
890 IF Q=1 THEN T$="TAX POINT "
900 IF Q=2 OR Q=3 THEN T$="DATE "
910 IF Q=1 THEN CU$="CUSTOMERS ORDER No "
920 IF Q=2 THEN CU$="YOUR REFERENCE "
930 IF Q=3 THEN CO$=""
940 IF Q=1 OR Q=2 THEN GOSUB 2310
950 PRINT : PRINT CU$; CHR$(32); CO$; TAB(48)C$; IN$
960 IF Q=1 THEN DT$="DATE OF ORDER "
970 IF Q=2 OR Q=3 THEN DT$=""
980 PRINT DT$; CHR$(32)DO$; TAB(48)T$; CHR$(32);
990 PRINT D$
1000 PRINT : PRINT
1010 IF Q=2 GOTO 1400
1020 PRINT : PRINT
1030 IF Q=3 GOTO 1510
    
```

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# PROGRAMS

```

:PRINT@Z+20,C$;
:A$=""
:K=K+1
:GOTO18004
18003 IFAS>CHR$(47)ANDAS<CHR$(57)ANDJ<1THENC$=C$+A$
:PRINT@Z+20,C$;
:A$=""
:J=J+1
:GOTO18004
18010 IFK=1ANDJ=1THEN18012ELSE18004
18012 PRINT@Z+20,C$;
:A$=""
:J=J
:K=0
:A$=LEFT$(C$,1)
:BS=RIGHT$(C$,1)
:Z=Z+64
18014 IFAS<BS THENA=VAL(A$)
:B=ASC(B$)-65ELSEA=VAL(B$)
:B=ASC(A$)-65
18016 A$=""
:B=327+(3*B)
:P=B+(64*A)
:X=0
:M=Z
18018 IFPEEK(P+15360)<>42ANDPEEK(P+15360)<>191THENPRIN
T@Z+64,"NO COUNTED";
:FORT=0TO750
:NEXT
:RESTORE
:T1=1000
:GOTO16000
18019 IFPEEK(P+15360)=191THENPRINT@Z+64,"OFF BOARD";
:FORT=0TO750
:NEXT
:RESTORE
:T1=1000
:GOTO16000
18020 IFM<Z+(5*64) THENREADA$
:PRINT@M,A$;
:M=M+64
:GOTO18020
18022 A$=""
:K=0
:J=0
18024 A$=INKEY$
:IFAS=CHR$(91)THEN18026
18025 IFAS>CHR$(10)ORAS<CHR$(8)THEN18024
18026 IFAS=CHR$(91)ORAS=CHR$(9)ORAS=CHR$(8)ORAS=CHR$(1
0)ORAS<>""THEN18027ELSE18024
18027 IF ASC(A$)=91 THEN READ J ELSE READJ
:FORK=8TOASC(A$)
:READJ
:NEXT
18030 K=0
:X=PEEK(P+J+15360)
:X1=PEEK(P+(J/2)+15360)
18032 IFK=1910RK1=191THENPRINT@M+64,"OFF BOARD MOVE";
:RESTORE
:T1=2000
:FORT=0TO750
:NEXT
:GOTO16000
18034 IFK=42THENPRINT@M+64,"INVALID MOVE";
:RESTORE
:T1=1000
:FORT=0TO750
:NEXT
:GOTO16000
18036 IFK1<>42THENPRINT@M+64,"MUST JUMP A PIECE";
:RESTORE
:T1=2000
:FORT=0TO750
:NEXT
:GOTO16000
18038 PRINT@P,CHR$(32);
:PRINT@P+J,CHR$(42);
:PRINT@P+(J/2),CHR$(32);
:N=N+1
    
```

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# PROGRAMS

```

:G=G+1
:PRINT#66,"MOVE NO.":G;
:PRINT#77,D$;
:RESTORE
:IFG<20THEN16000ELSE$=15687
:FORX1=0TO24STEP3
:FORY1=0TO8
:Q1=S+Y1+64+X1
18104 IFPEEK(Q1)=42THENQ2=Q2+1
:IFPEEK(Q1-64)=42ORPEEK(Q1+64)=42ORPEEK(Q1-3)=42ORPEEK
(Q1+3)=42THENGOTO18200
18106 NEXTY1,X1
:IFQ1=1THENCLS
:PRINT#130,"CONGRATULATIONS YOU HAVE SOLVED THE PROBLE
M IN ";G;" MOVES"ELSECLS
:PRINT#130,"HARD LUCK, NO MORE MOVES AND STILL NOT SOL
VED THE PUZZLE"
18108 PRINT#130+128,"PRESS << SPACE-BAR >> TO RE-RUN"
18110 IFINKEY$<>" "THEN18110ELSERUN
18200 FORX=6TO128STEP122
:IF(PEEK(Q1+X)=32ANDPEEK(Q1+X/2)=42)OR(PEEK(Q1-X)=32AN
DPEEK(Q1-X/2)=42)THEND$=" YOU CAN STILL MOVE"
:GOTO16000ELSENEXT
18210 GOTO18106
18500 DATA"OBJECT OF THE GAME IS","TO MOVE COUNTERS (*
S ","") IN VERTICAL JUMPS,OR ","HORIZONTAL JUMPS, OVE
R ","ADJACENT COUNTERS INTO ","A VACANT SPOT ONLY (A
S ","IN DRAUGHTS),UNTIL ONE ","COUNTER ONLY IS LEFT
"
18510 DATA"IN CENTRE SPOT,IN THE ","LEAST NUMBER OF M
OVES. ","FROM KEYBOARD PRESS ","KEYS REPRESENTING TH
E ","GRID CO-ORD (A LETTER ","& NUMBER COMBINATION)
","THAT YOU WISH TO MOVE ","AND THE DIRECTION OF "
18520 DATA"THE JUMP USING THE 4 ","KEYS MARKED WITH V
ERT ","& HORIZ ARROWS. ENTRY ","WILL THEY BE TESTED
",-128,-6,6,128
    
```

## ZX81 Graphplot

by N Angell

This runs in 1k and will plot a graph for a large variety of equations of the form  $y=2x$ ;  $y=x^2+4$ ;  $y=1/x$  (y in terms of x). It requests the equation and then works out maximum values for x and y thereby dividing the screen appropriately. This done, it will plot the graph using the previously deduced

volumes as limits so that the graph does not run over the edge of the screen. It is useful for handling negative values in plotting graphs. The number or range of x values can easily be altered — see lines 110 and 120 — according to the equation used or the accuracy of plotting required.

```

10 REM "GRAPHPLOT"
20 LET I = 0
30 LET H = I
40 LET P = I
50 LET M = I
60 LET C = -1
70 PRINT "INPUT EQUATION NOW"
80 INPUT A$
90 CLS
100 PRINT "Y = ";A$
    
```

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## PROGRAMS

```

110 FOR X = -3 TO 3 STEP .5
120 IF X = 0 THEN LET X = .001
130 LET Y = VAL A$
140 IF C = -1 THEN GOTO 500
150 LET N = 40 / J
160 PLOT M , (Y + ABS I) * N
170 LET M = M + (60 / P)
180 PRINT INT Y
190 NEXT X
200 STOP
500 LET P = P + 1
510 IF Y > H THEN LET H = Y
520 IF Y < I THEN LET I = Y
530 LET J = 0
540 IF SGN I = -1 THEN LET J = ABS I + H
550 IF SGN I = 1 THEN LET J = H - I
560 IF SGN I = 0 THEN LET J = H
570 NEXT X
580 LET C = 0
590 GOTO 110
    
```

## MZ-80K Race Chase

by D Denholm

This game is very like the arcade game 'Space Chaser' (which you hardly ever see nowadays). The player attempts to score as many points as he can by hitting and obliterating dots placed around a maze-type track before he is hit by a homing missile rushing around in the opposite direction replacing dots as it goes. If used exactly as listed, the

program is quite easy, but you can make it almost impossible by changing line 610 to simply GET PM\$. This means that you have to press the controls exactly when you want to turn out of a lane otherwise you keep going in a straight line and have to hope for the best. It uses 4k in memory.

```

250 PRINT"*****RACE CHASE":PRINT"*****"
260 PRINT"*****In this game,you (♦) hurtle round"
270 PRINT"on a track trying to hit as many targets"
280 PRINT"♦(♦) as you can before you are hit by a"
290 PRINT"ballistic missile (♦) which is hurtling"
300 PRINT"round the track in the opposite"
310 PRINT"direction from you."
320 PRINT"*****Key Z will move you in one lane"
330 PRINT"*****Key M will move you out one lane."
340 PRINT"*****PRESS ANY KEY TO PLAY"
350 GET K$:IF K$="" THEN 350
360 PRINT"0:POKE 10167,1:GOSUB 940
370 P1=54068:B1=54066:POKE P1,68:POKE B1,106:P2=1:B2=-1:P3=-40:B3=-40
380 USR(60):POKE 4466,12:PRINTTAB(11);"On your marks!"
    
```

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# PROGRAMS

```

390 FOR X=1 TO 1000:NEXT X
400 USR(60):POKE 4466,12:PRINTTAB(11);"    Get set ! "
410 FOR X=1 TO 1000:NEXT X
420 USR(60):POKE 4466,12:PRINTTAB(16);"  G O ! "
430 FOR X=1 TO 200:NEXT:USR(60):POKE 4466,12:PRINTTAB(15);"FACE CHASE"
440 REM
450 REM --- START LOOP ---
460 REM
470 REM --- MOVE MISSILE ---
480 REM
490 POKE B1,0
500 B1=B1+B2
510 IF (PEEK(B1)=121)+(PEEK(B1)=120) THEN 720
520 IF (PEEK(B1+B3)=0)*(PEEK(B1+B2)=0)+(PEEK(B1-B3)=0)*(PEEK(B1+B2)=0)
    THEN 730
530 IF PEEK(B1)=68 THEN 810
540 IF B4<>0 THEN POKE B4,219:B4=0
550 IF PEEK(B1)=219 THEN B4=B1
560 POKE B1,106
570 REM
580 REM --- MOVE * YOU ---
590 REM
600 POKE P1,0
610 GET PM$:PM$=CHR$(PEEK(17828))
620 IF (PM$="M")*(PEEK(P1-F3)=0)+(PM$="Z")*(PEEK(P1+F3)=0) THEN 910
630 P1=P1+F2
640 IF (PEEK(P1)=120)+(PEEK(P1)=121) THEN 800
650 IF FEEK(P1)=219 THEN NT=NT+10
660 IF NT>1400 THEN GOSUB 970:TN=NT+TN:NT=0
670 IF FEEK(P1)=106 THEN 810
680 POKE P1,68
690 GOTO 470
700 REM --- //subroutines (???)//

720 B1=B1-B2:SB=B2:B2=B3:B3=-SB:B1=B1+B2:GOTO 530
730 R=INT(RND(1)*5)+1:ON R GOTO 540,540,740,770,540
740 IF FEEK(B1+B3)<>0 THEN 540
750 POKE B1,0
760 B1=B1+B2+B3+B3:GOTO 540
770 IF FEEK(B1-B3)<>0 THEN 540
780 POKE B1,0
790 B1=B1+B2-B3-B3:GOTO 540
800 P1=P1-F2:SB=P2:F2=F3:F3=-SB:GOTO 630
810 REM   C R A S H !!!
820 POKE B1,107:POKE 4466,12:PRINTTAB(15);"  CRASH  "
830 FOR X=1 TO 1000:NEXT
840 PRINT"#####YOU SCORED ";NT+TN;" POINTS BY HITTING"
850 PRINT"#####";(NT+TN)/10;" TARGETS "
860 PRINT"#####WANT ANOTHER GO ?"
870 GET AG$:IF AG$="" THEN 870
880 IF AG$="Y" THEN CLR:RUN 340
890 IF ASC(AG$)<>78 THEN 870
900 END
910 IF PM$="M" THEN 930
920 P1=P1+F3+F3:GOTO 630
930 P1=P1-F3-F3:GOTO 630
940 REM ---+ RACE TRACK +---
950 PRINT"02...in          RACE CHASE          M...out"
960 PRINT"
970 PRINT"#####"
980 PRINT"|"
990 PRINT"|"
1000 PRINT"|"
1010 PRINT"|"
1020 PRINT"|"
1030 PRINT"|"
1040 PRINT"|"
1050 PRINT"|"
1060 PRINT"|"
1070 PRINT"|"
1080 PRINT"|"
1090 PRINT"|"
1100 PRINT"|"
1110 PRINT"|"
1120 PRINT"|"
1130 PRINT"|"
1140 PRINT"|"
1150 PRINT"|"
1160 RETURN

```

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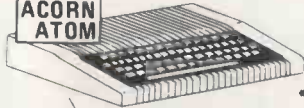
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# PROGRAMS

mentioned under their TV's; there is a little evidence of this, but it's rather scarce. I realise that there's a slight problem with printers. If you either

haven't got a printer or can't fit one to your machine then a carefully typed or, at last resort, hand-printed listing will be quite acceptable.

## TRS-80 Solitaire

by D Ensor

I'm including this program not so much for the game it plays as for the way the whole thing is presented. Lines 10-1030 are a subroutine for displaying the author's name and the title in decorative lettering on the screen for about five seconds. This is not unusual, but what makes this one stand out is that these line are deleted from memory the rest of the program is run — see line 1030. This would be useful for anyone who wanted to give a program trimmings and save memory at the same time. It means that you have to re-execute the

program at line 1030 and the program tells you this. Although something like this could possibly be done better using assembler language, it is making good use of Basic in spite of the fact that the program is temporarily halted by using it. Good use is also made of PRINT AT commands. Solitaire needs 5k and TRS-80 model I level II to run. Finally, advice is provided during play on the number of moves made at any stage in the game and the player can find out if no more moves or a win are possible.

```

10 DATA200,191,329,176,342,150,223,191,291,191,273,131
,201,131,593,176,537,140,542,140,613,159,615,191,463,1
31,465,131,204,199,276,175,352,144,284,131,337,176,332
,159,340,130,534,191,528,191,605,179,609,175,551,191,5
53,140,595,176,334,175,339
20 DATA144,349,176,343,129,264,191,296,131,347,191,535
,140,607,191,611,176,548,140,555,193,546,140,530,140,3
35,176,274,189,271,131,202,131,279,159,351,191,330,176
,602,191,549,192,604,179,464,191,466,131,554,140,540,1
88,348,176,345,191,277,144
30 DATA270,190,328,191,341,169,285,131,539,188,596,176
,545,184,598,191,547,140,592,191,552,184,272,131,268,1
91,278,160,283,191,331,176,338,191,350,176,606,179,467
,131,610,176,536,140,543,140,529,140,594,176,203,131,3
36,176,287,191,541,140,612
40 DATA176
1000 CLS
:FORX=0T0127
:SET(X,0)
:SET(X,47)
:NEXT
:FORX=0T047
:SET(0,X)
:SET(127,X)
:NEXT
:FORX=0T085
:READA,B
:PRINT#A-134,CHR$(B);
:NEXT
:FORX=596T0852STEP64
:PRINT#X,STRING$(38,42);
:NEXT
:PRINT#670,"PRESENTS ";
:PRINT#798,"SOLITAIRE ";
:FORT=0T01000
:NEXT
:CLS
1010 PRINT#21,CHR$(23);$S;
:PRINT#128,"PRESS << ENTER >> TO CONTINUE";
1020 DS=INKEY$
:IFDS=""ORDS=CHR$(1)020
1030 IFDS<>CHR$(13)$S="I SAID ,"
:RESTORE
:GOTO1000ELSECLS
:PRINT#0,CHR$(28);
:PRINT#390,"AFTER PROGRAM DELETES HEADINGS";
:PRINT#518,"AND ' > ' SYMBOL APPEARS ";
:PRINT#646,"THEN TYPE R U N << ENTER >>";
:PRINT
    
```

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# PROGRAMS

```

:PRINT
:PRINT
:PRINT
:DELETE10-1030
10500 CLEAR105
:DEFINT A-Z
:CLS
:PRINT@0,"===== SOLITAIRE ===== D.F.
ENSO? = 01/01/82 ==
11000 FORX=0T038
:AS=AS+CHR$(191)
:NEXT
11500 FORX=0T012
:PRINT@192+(X*64),AS;
:NEXT
12000 AS=""
12500 FORX=0T03
:AS=AS+CHR$(32)+CHR$(X+65)+CHR$(32)
:NEXT
13000 PRINT@198,AS;
:PRINT@966,AS;
:AS=""
13500 FORX=0T08
:L=320+(X*64)
:AS=CHR$(32)+STR$(X)+CHR$(32)
:PRINT@L,AS;
:PRINT@L+36,AS;
:NEXTX
:AS=""
14000 FORX=0T02
:AS=AS+CHR$(32)+CHR$(42)+CHR$(32)
:NEXT
14500 FORX=0T08
:PRINT@335+(X*64),AS;
:NEXT
15000 FORX=0T02
:L=518+X*64
:PRINT@L,AS;
:PRINT@L+13,AS;
:NEXT
15500 PRINT@595,CHR$(32);
:AS=""
:L=0
:X=0
:PRINT@128,"GRID BOARD";
:PRINT@104,"RULES";
:T1=3000
16000 X=169
:N=808
:Z=0
:K=0
:J=0
16250 FORQ=169T01001STEP64
:PRINT@Q,CHR$(214);
:NEXT
:Q=0
16500 IFX<NTHENPEADAS
:PRINT@X,AS;
:X=X+64
:GOTO16500
17000 IFX>808 ANDN=808 THENFORT=0TOT1
:NEXT
17500 IFN<>424+64THEIN=424+64
:X=169
:T1=100
:GOTO16500
17550 IFN=424+64ANDX<808THENAS=CHR$(215)
:PRINT@X,AS;
:X=X+64
:GOTO17550
18000 Z=N+65
:PRINT@N+65,"COUNTER COORDINATES=" ";
18002 X=0
:AS=""
:CS=""
18004 AS=INKEY$
:IFK>10PJ>1THEN13000
18006 IFA$>CHR$(64)AVIA$<CHR$(74)ANDK<1THEVCS=CS+A$

```

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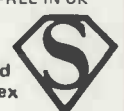
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## PROGRAMS

```

1040 PRINT TAB(9)"DESCRIPTION", TAB(41)"QTY";
1050 IF I=3 OR I=4 THEN GOTO 1070
1060 PRINT TAB(49)"UNIT PR"; TAB(65)"TOTAL"
1070 PRINT : PRINT
1080 FOR J=1 TO N
1090 W=P(J) : GOSUB 2000
1100 IF I=3 OR I=4 THEN GOTO 1140
1110 PRINT DES*(J); TAB(41)Q(J); TAB(56-LEN(W*))W$;
1120 W=T(J) : GOSUB 2000
1130 GOTO 1150
1140 PRINT DES*(J); TAB(41); Q(J)
1150 IF I=3 OR I=4 THEN GOTO 1170
1160 PRINT TAB(71-LEN(W*)); W$
1170 PRINT : NEXT
1180 IF I=3 OR I=4 GOTO 1350
1190 FOR F=1 TO 15 : PRINT : NEXT
1200 W=Z : GOSUB 2000
1210 PRINT TAB(46); "NET"; TAB(71-LEN(W*))"£"; W$
1220 PRINT : GOTO 1260
1230 DOKE 3189,1921
1240 DOKE 3187,1918
1250 RETURN
1260 NV=INT((Z*.15)*100+.5)/100 : W=NV : GOSUB 2000
1270 PRINT TAB(46); "VAT @ 15%"; TAB(71-LEN(W*))"£"; W$
1280 AD=NV+Z
1290 W=AD : GOSUB 2000
1300 PRINT
1310 PRINT TAB(46); "AMOUNT DUE"; TAB(71-LEN(W*))"£"; W$
1320 PRINT " ";
1330 PRINT : PRINT : PRINT : PRINT : PRINT "
PAYMENT DUE WITHIN 30 DAYS OF ";
1340 PRINT "INVOICE DATE"
1350 GOSUB 1460
1360 NEXT
1370 GOSUB 1230 : FOR X=1 TO 32 : PRINT : NEXT
1380 GOSUB 1460
1390 END
1400 PRINT : PRINT : PRINT
1410 W=CHQ : GOSUB 2000
1420 PRINT "Please find enclosed our cheque value ";
1430 PRINT " £"W$
1440 GOSUB 1460
1450 GOTO 1360
1460 DOKE 3189,1922
1470 DOKE 3187,1919
1480 RETURN
1490 PRINT TAB(48)
1500 RETURN
1510 PRINT TAB(9)"QTY"; TAB(20)"DESCRIPTION"
1520 PRINT
1530 FOR J=1 TO N
1540 PRINT TAB(9)Q(J); TAB(18)DES*(J)
1550 NEXT
1560 FOR X=1 TO 10-N : PRINT : NEXT
1570 PRINT TAB(9)RE$
1580 PRINT : PRINT
1590 PRINT TAB(9)"DELIVERY REQUIRED " ;
1600 PRINT DR$
1610 FOR X=1 TO 5 : PRINT : NEXT
1620 GOSUB 1490
1630 PRINT "Signed
1640 GOSUB 1490
1650 PRINT "For PONGO LTD.
1660 PRINT : PRINT : PRINT : PRINT : PRINT
1670 GOSUB 1490
    
```

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# PROGRAMS

```

1680 PRINT "....."
1690 GOSUB 1460
1700 GOTO 1360
1710 PRINT TAB(25)
1720 RETURN
1730 PRINT TAB(7);
1740 RETURN
1750 E=0
1760 INPUT "CUSTOMERS REFERENCE"; C$
1770 INPUT "DATE OF REMITTANCE ADVICE"; D$
1780 INPUT "CHEQUE VALUE"; CH$
1790 PRINT " ON ERROR TYPE '999' AND PRESS RETURN";
1800 INPUT E : IF E=999 GOTO 1750
1810 GOTO 520
1820 E=0
1830 INPUT "DATE OF ORDER"; D$
1840 PRINT " ON ERROR TYPE '999' AND PRESS RETURN";
1850 INPUT E : IF E=999 THEN GOTO 1820
1860 INPUT "ORDER NUMBER"; IN$
1870 INPUT " NUMBER OF ITEMS"; N
1880 PRINT " ON ERROR TYPE '999' AND PRESS RETURN";
1890 INPUT E : IF E=999 GOTO 1820
1900 FOR J=1 TO N
1910 E=0
1920 PRINT "DESCRIPTION ITEM"J; : INPUT DES$(J)
1930 PRINT "QUANTITY ITEM"J; : INPUT Q(J)
1940 NEXT
1950 PRINT "REMARKS"; : INPUT RE$
1960 INPUT "DELIVERY REQUIRED"; DR$
1970 PRINT " ON ERROR TYPE '999' AND PRESS RETURN";
1980 INPUT E : IF E=999 GOTO 1910
1990 GOTO 520
2000 W$=STR$(W)
2010 L=LEN(W$)-2
2020 IF L=0 THEN 2060
2030 IF MID$(W$,L,1)="." THEN 2090
2040 L=L+1
2050 IF MID$(W$,L,1)="." THEN 2080
2060 W$=W$+".00"
2070 GOTO 2090
2080 W$=W$+"0"
2090 RETURN
2100 FOR J=1 TO D
2110 READ P$
2120 IF VAL(LEFT$(P$,2))=R THEN GOSUB 2650
2130 NEXT
2140 RETURN
2160 GOSUB 1730
2170 PRINT CU$(1); TAB(48)V1$
2180 GOSUB 1730
2190 PRINT CU$(2); TAB(48)V$
2200 GOSUB 1730
2210 PRINT CU$(3)
2220 GOSUB 1730
2230 IF I=1 OR I=2 THEN C$="INVOICE No"
2240 IF I=3 OR I=4 THEN C$="DELIVERY NOTE No"
2250 PRINT CU$(4); TAB(48)C$; IN
2260 GOSUB 1730
2270 PRINT CU$(5); TAB(48)"TAX POINT"; CHR$(32); D$
2290 PRINT TAB(48)
2300 RETURN
2310 PRINT : PRINT
2320 RETURN
2330 CLS : PRINT " DO YOU WISH TO PRINT Y OR N";
2340 INPUT Y$
2350 IF Y$<>"Y" GOTO 2370
    
```

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# PROGRAMS

```

2360 GOSUB 1230
2370 GOSUB 2780
2380 FOR J=1 TO D
2390 M=VAL(LEFT$(P$,2))
2400 READ P$
2410 IF VAL(LEFT$(P$,2))=M+1 THEN PRINT
2420 PRINT MID$(P$,3)
2430 NEXT
2440 GOSUB 1460
2450 END
2610 Q$=RIGHT$(P$,LEN(P$)-2)
2620 PRINT CHR$(14)CHR$(27)CHR$(69)Q$
2630 GOSUB 2290
2640 RETURN
2650 Q$=RIGHT$(P$, (LEN(P$)-2))
2660 PRINT Q$
2670 GOSUB 1730
2680 RETURN
2690 SCREEN 1,4
2700 PRINT "
2710 PRINT "          * BUSINESS DOCUMENTS *
2720 PRINT "          *           BY           *
2730 PRINT "          *   A HETHERINGTON   *
2740 PRINT "          *   JANUARY 1982   *
2750 PRINT "          * ***** *
2760 FOR I=1 TO 2000 : NEXT
2770 RETURN
2780 D=15
2790 RETURN
2800 PRINT
2810 RETURN
2820 IF VAL(LEFT$(P$,3))>1 THEN VAL(LEFT$(P$,3))=0
2830 RETURN
3000 DATA 01PONGO LTD
3010 DATA 01NEWGATE
3020 DATA 01WESTOWN
3030 DATA 01EAST YORKSHIRE
3040 DATA 01ZZ14 8PP
3050 DATA 02OTHER FIRM LTD
3060 DATA 02PO BOX 30
3070 DATA 02NORTHSEA
3080 DATA 02GUMSHIRE
3090 DATA 02YY15 9TT
3100 DATA 03HARPOON WHALE CO LTD
3110 DATA 03WHALE PARK WORKS
3120 DATA 03VICTORIA STREET
3130 DATA 03NEWTOWN
3140 DATA 03MIDSHIRE
    
```

## TRS-80 Ducks

by Marie Byatt

For parents trying to teach young children to count, Ducks might well be a useful aid. The adult sets a maximum limit on numbers used and the computer will display a random number of ducks on the screen which the child has to count and work out the correct number

to be rewarded with a smile face on the screen. The program wisely gives no reply for a wrong answer as a very young child would tend to consider this a reward also. It was written on a TRS-80 model I and should run in about 2k.

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# PROGRAMS

```

5 CLS
10 INPUT "PICK A MAXIMUM NUMBER, 1 TO 15";N
11 IF N>15 THEN 10
12 CLS
15 REM DUCK DISPLAY
20 LET V=RND(N)
30 FOR S=1 TO V:W=3:A=S
40 IF S>5 THEN A=S-S;IF S>5 THEN W=W+9
50 IF S>10 THEN A=S-10;IF S>10 THEN W=W+9
60 X=14*(A-1)+10
70 SET (X+3,W): SET(X+4,W): SET(X+5,W)
80 SET(X+1,W+1): SET(X+2,W+1): SET(X+3,W+1): SET(X+5,W+1)
90 SET(X+3,W+2): SET(X+4,W+2): SET(X+5,W+2):
   SET(X+11,W+2)
100 FOR Y=5 TO 11: SET(X+Y,W+3): NEXT Y
110 FOR Y=5 TO 10: SET(X+Y,W+4): NEXT Y
120 FOR Y=6 TO 9: SET(X+Y,W+5): NEXT Y
130 NEXT S
140 REM RESPONSES
150 PRINT AT 645, "HOW MANY DUCKS ARE SHOWING": INPUT D
160 IF D=V THEN 300
200 REM ERROR RESPONSE
210 PRINT AT 715, "WRONG!!!---TRY AGAIN"
220 FOR R=1 TO 200: Y=Y+R: NEXT R
230 PRINT AT 704, "          (25 BLANKS)  "
240 GOTO 150
300 REM CORRECT ANSWER
310 PRINT AT 715, "RIGHT!!!  VERY GOOD!!!!!"
340 PRINT AT 173, "XXX---XXX"
350 SET(98,10): SET(99,10)
360 SET(90,12): SET(91,12): SET(106,12): SET(107,12)
370 SET(91,13): SET(92,13): SET(105,13): SET(106,13)
380 FOR Q=92 TO 105: SET(Q,14): NEXT Q
500 PRINT AT 135, "IF YOU WANT TO PLAY AGAIN, PRESS A KEY"
510 GOTO 12
    
```

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## PATTERNS

Continued from page 158

### Processing an array

The rules above can be reformulated in terms of the data in an array. Compare

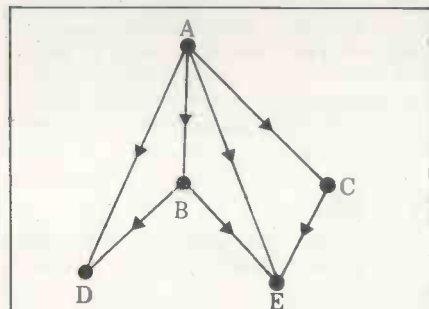
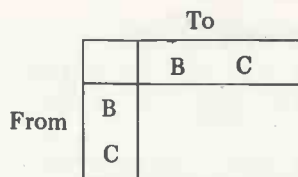


Fig 9 Directed graph representing data in the array.

the array above and figure 9.

1. A point that only has lines leading to it (a surface that obscures no other) has its row blank in the array. D and E in the example.
2. A point that only has lines leading from it (a surface that is obscured by no other) has its column blank in the array. A in the example.

Removing D, E and A from the array leaves only B and C with no line connecting them.



These can be added to the middle of the list completing it:

D, E  
B, C  
A

Continued over

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PATTERNS *continued from previous page*

The rules can therefore be restated in the following terms.

Rule 1: Remove from the array any surface with a blank row and put it at the top (inner) of the list.

Rule 2: Remove from the array any surface that has a blank column and put it at the bottom (inner) of the list.

Any isolated surface with both blank row and column will get dealt with by one of these rules and a third rule for them is not needed.

Continue applying these rules in turn until either all the surfaces have been transferred to the list and none is left in the array, or until all that can be have been transferred and further progress is frustrated by a loop of relations in the array. To recap, the stages in the whole procedure are as follows:

1. Take each pair of surfaces in turn:
  - a) If the plane of each surface cuts the other surface (the awkward case), divide one of the surfaces along the line of intersection.
  - b) When all such divisions have been carried out, for each pair of surfaces determine the visibility relation and record it in the array.

2. Transform the array as far as possible into a list of plotting order. This is a fairly heavy load of computing, but the savings can be considerable over computing the relations and distances for each viewpoint. Even if the list can only partially be set up there should be some saving in reducing the work needed for each view. The following further stages are needed for each viewpoint.

3. Remove any surfaces from the list not visible from this viewpoint.

4. a) If there are points still left in the array, remove any not visible from this point of view.

- b) For those remaining, transform them using the same rules as before into further items in the list.

5. With the list complete, draw the surfaces in the order of the list. This order of plotting will take care of what obscures what. That which should be hidden will be hidden and that which should show will show.

Next month I will present the code that implements some of these stages, particularly the part dealing with the conversion of the array into the list, and give an example of its application to a particular set of data representing a small model. END

## HP-125

*Continued from page 111*

A variety of HP printers (dot matrix, thermal or daisywheel) and plotters may be attached via HP-IB, or any other make via RS232. An HP 300 baud modem is available but any other compatible device could be used.

Other HP implemented languages promised are Pascal and Cobol, though neither is currently available.

The potential for networking is a bit of a mystery; no mention is made in the manuals and no call exists in the CP/M BIOS for input from an HP-IB device, so HP doesn't appear to be pushing this mode of use.

## Documentation

The manuals, as might be expected by those familiar with HP's products, are excellent. In addition to a 'Getting Started' booklet, HP provides an owner's manual, a systems reference manual and a separate manual for each software package, all of which fit into a single large ring binder.

'Getting Started' details (with diagrams) how to set up the hardware and install and back up your programs.

The owner's manual is pitched at a non-specialist (but intelligent) end-user and is sufficiently comprehensive to cover all eventualities of everyday use and the operation of all the features, including a potted but readable guide to CP/M utilities.

The system reference manual is for the programmer; a well laid-out, detailed account of the guts of the beast, including listings and explanations of all escape codes and function calls; unlike most US manufacturers HP has completely rewritten the CP/M manuals in a far clearer form than the originals.

The Basic manual follows Micro-soft's exactly for its instruction definitions, but the introductory part is expanded and rewritten into a more lucid form. The Visicalc manual is similarly improved over the original. All in all, an exemplary standard of documentation.

## Prices

Now for the bad news. A minimum system price (excluding VAT) is composed as follows:

HP-125	£2,479
Dual 5in drive (82901M)	£1,693
Dot-matrix Printer (82905B)	£639
Total	£4,811



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An amazing seventy program listings for the 1K ZX81 for only £4.95, Barclaycard/Visa accepted, includes dozens of games, home finance, mortgage, telephone index, call timer, reaction tester, machine code loader, chequebook, Invaders, large word display, perpetual calendar and more. Also includes hints 'n' tips.

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To this the following options could be added:

Dual 8in drive	£4,515
Internal printer	£800
Basic/125	£201
Visicalc/125	£124
Word/125	£309
Link/125	£77
Graphics/125	£124
Plotter (7225B)	£2115

This brings a top line system price to over £11,000 with 2 Mbytes.

The 125 is being marketed by both the Computer and Calculator divisions of Hewlett-Packard so that it can be obtained either through an HP-approved micro dealer or from the manufacturer. Several different schemes for on-site maintenance are offered.

## Conclusions

On paper, the HP-125 is just another 64k CP/M computer (a species which now provokes excuses like 'I'd love to test it but my grandmother just died again' around our office). In practice, it is a peep into the future as regards ergonomics and user friendliness, achieved by painstaking attention to detail in the

user interface. To be sure, it doesn't have an 8088 or 68000 or a winchester and it doesn't run Unix or anything else to cause excitement among journalists. To users who can afford it, I suspect it will set a standard of convenience which could be habit-forming. It would be nice to think that other manufacturers are working towards this standard and not just to harder hardware; don't bet on it, though. In short, if you can afford it go ahead; if you can't afford it don't have a demo — it would just upset you.

*I should like to thank David, Bill and Alan at Caxton for the use of the test machine, without which this test might have been delayed for several months; that's quite enough plugs for this month, isn't it?*

**END**

### Benchmark timings

BM1	1.7
BM2	5.0
BM3	12.5
BM4	12.5
BM5	14.0
BM6	26.0
BM7	40.0
BM8	6.0

## Technical specifications

Processor:	Twin Z80A (3.6 MHz)
Memory:	64k system RAM, 16k terminal RAM 32k ROM
Display:	12in b/w CRT, 80x24 chars, 9x15 dots/char, Softkey labels in lines 25-26.
Keyboard:	97 keys, ASCII standard main plus numeric, cursor, editing, and help pads.
Disks:	2x5in double sided double density 35 tracks 16 sectors (soft) 256k per drive. 2x8in 77 tracks 30 sectors (soft) 1.12Mb per drive.
Ports	2xRS232C serial, 1 HP-IB (IEEE 488)
Operating system:	CP/M 2.2
Languages:	Basic/125, Assembler

## BLUDNERS

Not a lot to report. The printers did their favourite trick of swapping two pages in last month's issue — pages 187 and 178, in fact.

Oh, and the editor Himself made a goof in his reply about PEEKing and POKEing on the BBC Computer. As with the Atom, the facilities exist but they're called '?' instead of PEEK and POKE. When asked to explain this colossal failure, Ed replied: 'Just testing!'

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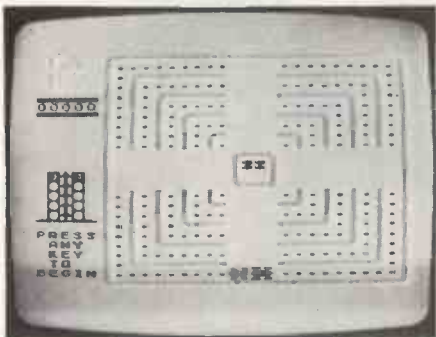
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Continued from page 107

yourself in by firing at the morgs jostling to get at you. The trick is to rush out from the centre and turn to shoot the morgs before they leap on you. Although morgs are very quick they are also quite dumb and will invariably present themselves right in your line of fire. The space bar immediately returns you to the central sanctuary and is aptly described as the panic button. The game is very well presented, although the horrible little tune which plays at the beginning and end of each game made me thankful for the volume control.

**ADDICTIVE QUALITY:** \*\*\*\*  
**USE OF GRAPHICS:** \*\*\*\*  
**RESPONSE SPEED:** \*\*\*\*  
**VALUE FOR MONEY:** \*\*\*



**GAME:** Carwars  
**PRICE:** £25.00  
**SUPPLIER:** TI

Another ex-arcade game, also to be released shortly, this involves driving a car around a rectangular track with five lanes. At four points on the track it is possible to change lanes; the idea is to avoid collision with a computer-controlled kamikaze car driving in the opposite direction. Points are accumulated by knocking out dots along the track; thus, to win each round you must drive each length of all the lanes. Your car can be slightly speeded up by pressing the enter or fire button. Although a high degree of skill is required to play this game, I've always found it rather limited. It does, however, tend to appeal — for a while at least — to younger players.

**ADDICTIVE QUALITY:** \*\*  
**USE OF GRAPHICS:** \*\*\*\*  
**RESPONSE SPEED:** \*\*\*  
**VALUE FOR MONEY:** \*\*



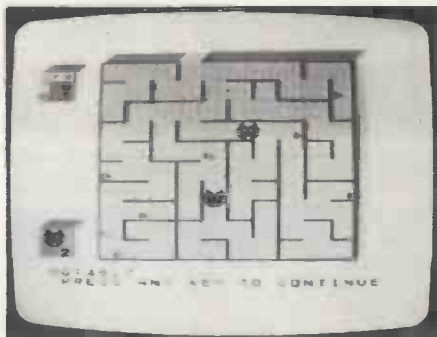
**GAME:** Five-A-Side Football  
**PRICE:** £24.95  
**SUPPLIER:** TI

This again uses the joystick in true 8-

way motion, though movement is rather slow and I found myself pressing harder and harder on the joystick in a vain attempt to speed things up. It takes some time to get the hang of, demanding that you keep a sharp eye out for the player you are controlling (marked with a small white circle). After a bit of practice, however, I played some good games. I should point out that this is a two-player game — you cannot play the computer. All the features of the real thing are there; tackles, interceptions, fouls, penalties and saves, each one punctuated by a cheer or a song from the electronic crowd.

The players don't actually kiss each other after scoring, but they do throw their hands in the air and if they won the match even give a little jump. You choose the length of your own game — so that half and full time are called automatically — and also get to give your team a name (up to eight characters). The only slight problem I had with this one was a disconcerting tendency for players (or bits of players!) to disappear for a few seconds every so often, but this proved innocuous. All in all an attractive game with plenty of mileage in it.

**ADDICTIVE QUALITY:** \*\*\*\*  
**USE OF GRAPHICS:** \*\*  
**RESPONSE SPEED:** \*  
**VALUE FOR MONEY:** \*\*\*\*



**GAME:** Amazing  
**PRICE:** £24.95  
**SUPPLIER:** TI

Out of all the games I tried on the 99/4, this one was the most popular with children (and groups of juvenile adults). You control a mouse let loose on a square maze to escape and/or eat lumps of cheese while being chased by cats. Choosing the options is almost as much fun as actually playing the game; with one or two players, several speeds for both cats and mice, zero to two cats — dumb or smart and standard or pouncing (three pouncing frequencies) — oh yes, and standard, complex, visible or invisible mazes with obstacles or mouse-holes. Mouse motion is controlled by the joysticks and really is 8-way. One word of warning: because the mice are so small, you'll definitely need a fairly sizeable TV if you're to play a complex maze without damaging your eyesight; my 14in portable was simply not adequate. Nevertheless I firmly recommend this one as a good family game.

**ADDICTIVE QUALITY:** \*\*\*\*

**USE OF GRAPHICS:** \*\*\*\*  
**RESPONSE SPEED:** \*\*\*  
**VALUE FOR MONEY:** \*\*\*\*



**GAME:** Blackjack & Poker  
**PRICE:** £24.95  
**SUPPLIER:** TI

In Blackjack (Pontoon), the computer always plays the bank. The (stud) poker is four-handed with the computer playing any hands not designated to a human player. It plays a reasonably good but rather predictable game. Although these games (particularly the poker) may be interesting from a programming point of view, personally at this price I'd rather use a standard pack of cards to actually play them; and the computer is a poor substitute for a human companion in a card school.

**PRESENTATION:** \*\*  
**SPECIAL FEATURES:** \*  
**PLAYING SKILL:** \*\*\*\*  
**VALUE FOR MONEY:** \*

## General conclusion

As you can see, Texas Instruments offers a varied selection of games for its micro. At present, however, there is no external software source for this machine except the 99/4 Users Club (see insert). The TI games are clearly aimed at a family audience rather than 'arcade freaks' and if you're thinking of buying any you should carefully weigh up the mileage you're liable to get against your finances. If you're looking for a micro-computer to use predominantly as a games console, you can probably do better than the TI. The quality of the Invaders, however, suggests we may see more sophisticated offerings in the future. TI games modules are available through dealers.

Next month I shall be taking a look at some of the many games available for the popular Atari 400 microcomputer.

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**Volume 4 No 3**  
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Benchtest: Onyx C8002/Benchtest: Bigboard/Micro music software package/ALC circuit/Commons report/HP 34C/Programs: TRS80 Show Jumping, PET Grand Prix, PET Aircraft landing, PET Bouncy.



**Volume 4 No 5**  
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Benchtest: Pasca 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.



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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**  
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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, ZX81 Sketch Pad.



**Volume 4 No 8**  
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Benchtest: Tandy Model III/Viewdata update/WP Benchtest: Spellbinder/Printer survey/Micro-holism/Programs: ZX80 Othello; Easter Sunday; Apple Mondrian; MZ-80K Duck Shoot; PET Gomoku; MZ-80K Football.



**Vol 4 No 9**  
September 1981  
Benchtests: Tandy Color Computer, Commodore VIC/Checkouts: Hi Tech Speakeasy, Tanelt/Multi-user Benchtest: HMSOS/WP Benchtest: Memorite III/Word proc program for PET/Apple dealership run by spastics/Printer-facing extra/Calc Corner: Casio fx602p review/Programs: PET Arithmetic test, ZX80 Eldorado, 380Z Memory test.

**Volume 1 No 1, 1978**  
The 77-68/Practical hints on kit building/Nascom 1/Charity case study/Flowcharting/Pontoon flowchart

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Kit building/Basic — first steps/Case study — a software house/PET 2001/Research machines 380Z/School computing/E78 — Europa Bus.

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Benchtest: Compucolor II/Checkout: Heuristics Speech Lab/Testing Precognition/Pascal series — Part I/Programs: 6800 Time response, Apple memory test, Fx 201p spaceship, PET Orbit sim, PET digital clock, Acronyms.

**Volume 3 No 6**  
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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 IEEE-488 bus use/Programs: Naming Nascom files, 380Z Pictures, Fuel tank calculations — PET, PET large numeral generator, PET tank battle, Basic string handling routines/Pascal: Final instalment.

**Volume 3 No 12**  
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Benchtest: Microwriter/Printerfacing: Series — Part 1/Sharp PC-1211 speed-up/Programs: TRS-80 Tarot, PET Cat &

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speech link, Softy 2/Calc  
Corner: Texas TI51-III/  
Jeff Taylor on computer  
literacy projects/Introduc-  
ing T.J.'s Workshop/Control  
Your Own Substation  
pt 1/Programs: TRS-80  
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## Personal Computer



Vol 4 no 11  
November 1981  
Benchtests: Osborne 01,  
IBM Personal Computer.  
Checkout: Sharp IQ3100  
Microtranslator, Calc  
Corner: Casio fx702p.  
PCW Show report, Bench-  
mark Summary, Euro  
Micro Chess Champion-  
ship report, Programs:  
TRS-80 Sheepdog trial,  
ZX81 Sun and Planets.

## Personal Computer



Vol 4 No 12  
December 1981  
Benchtests: Sharp MZ-80B  
Philips P2000/School net-  
work/ BBC Micro inside  
story/ 'Turtle' Graphics  
for Apple/ Forth language/  
Curve fitting/ Calc corner:  
HP14C review/ Programs:  
PET Fantasy, ZX81 Battle-  
ships and cruisers.

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Vol 5 No 1 January 1982  
Benchtests: BBC Micro,  
Xerox 820/Frames of Re-  
ference (new series)/  
ZX81 Printer Checkout/  
Digital Drummer for PET/  
Calc Corner: Benchmarks/  
Programs: MZ-80K For-  
tune, TRS-80 Reaction  
Timing, ZX80 Labyrinth,  
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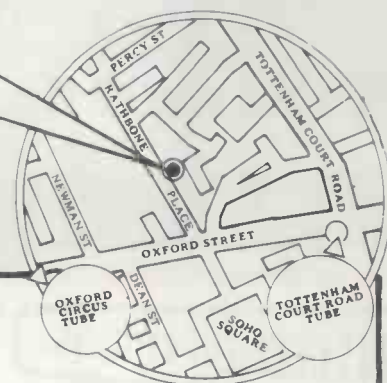


Vol 5 No 2 February 1982  
Benchtests: Sirius-I,  
Casio fx-9000p, Gemini  
Multiboard/Word Processor  
Benchmark: Script 2.0/  
Plotter Checkout:  
Watanabe/Hardware  
feature: High Density VDU  
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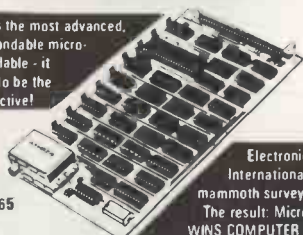
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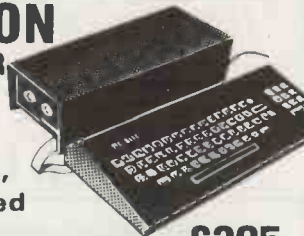
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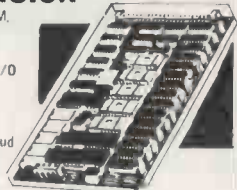
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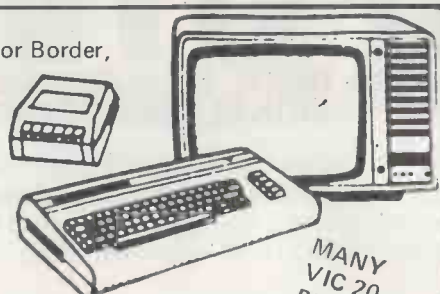
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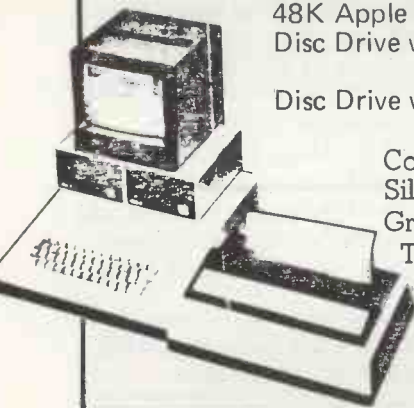


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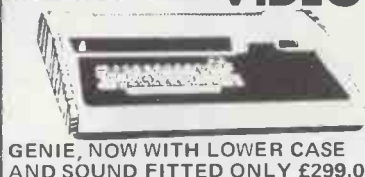
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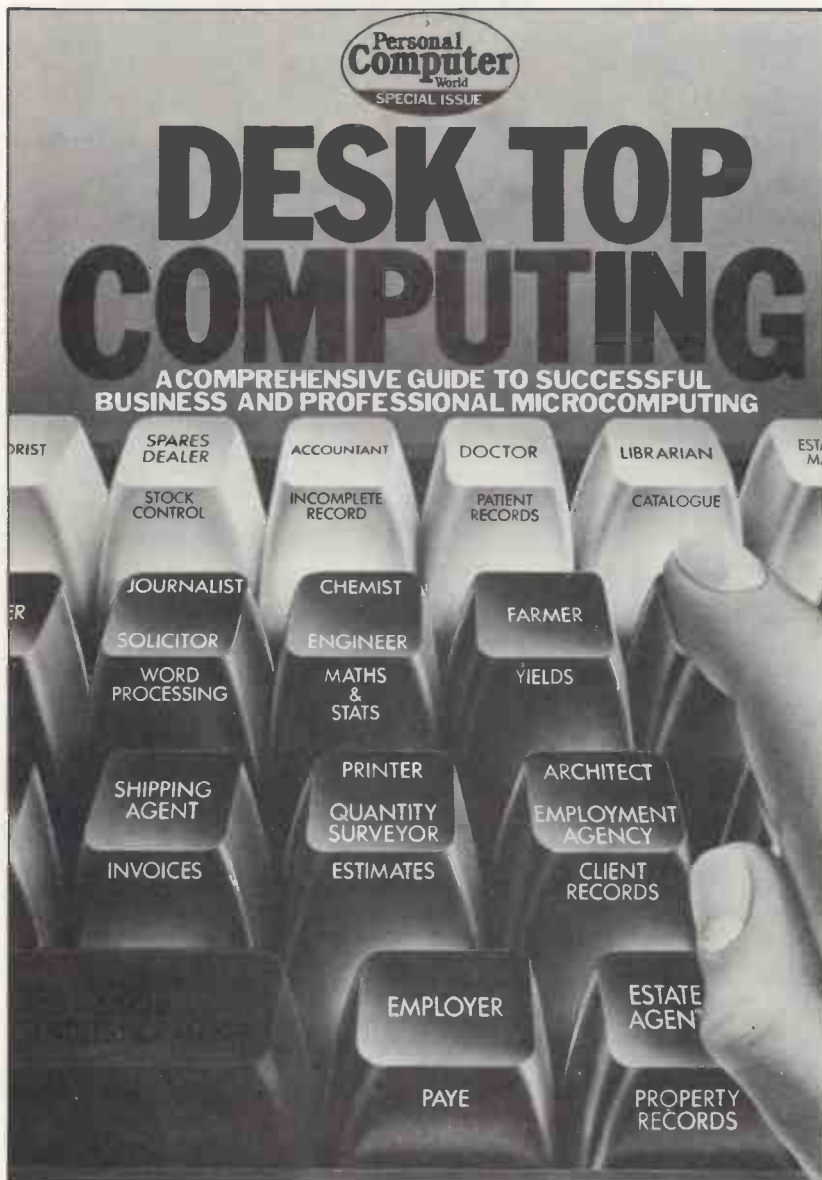
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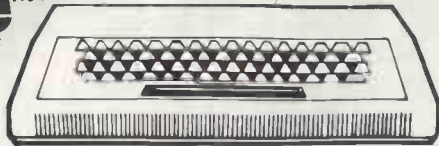
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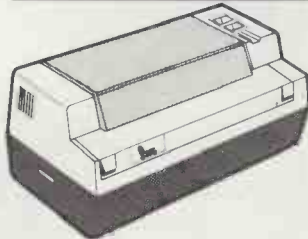
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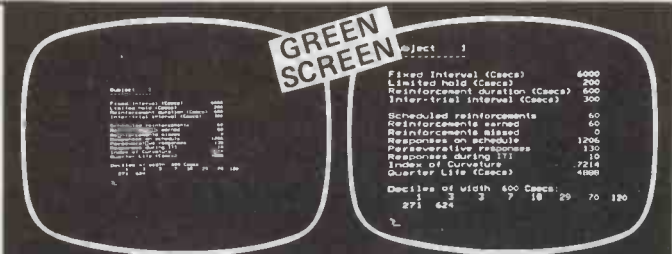


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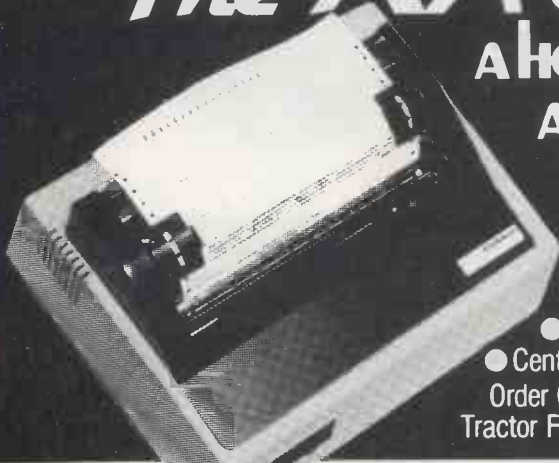
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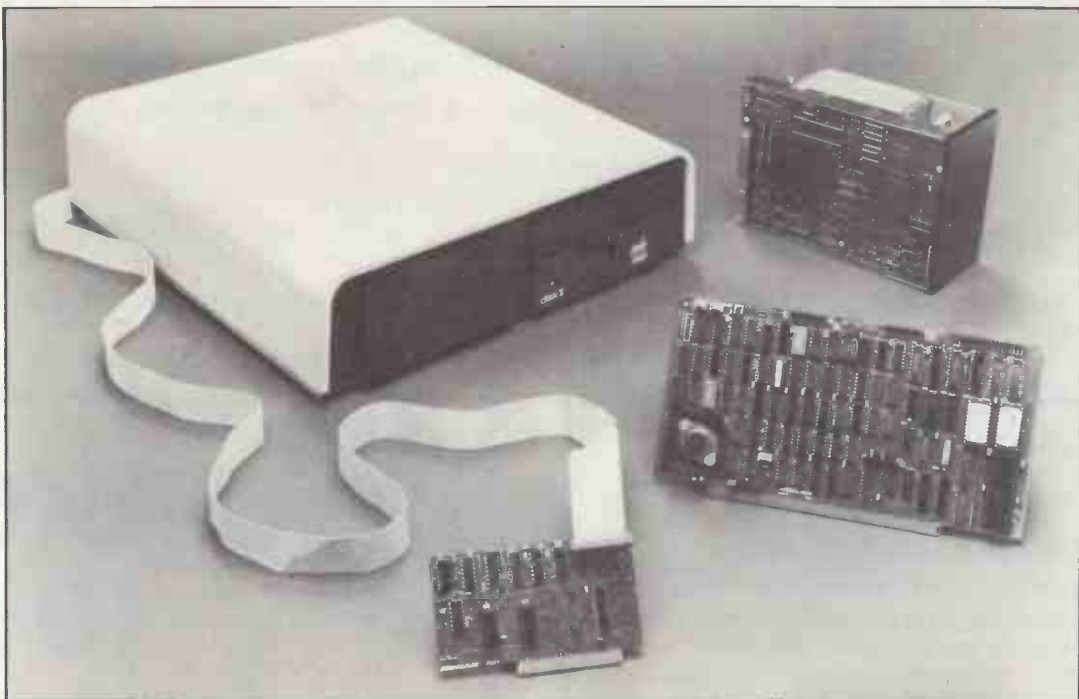
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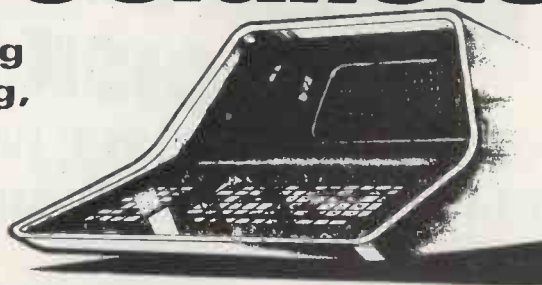
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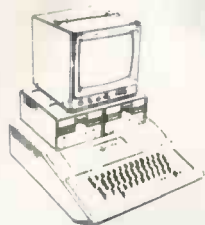
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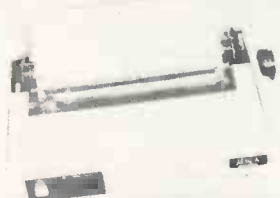
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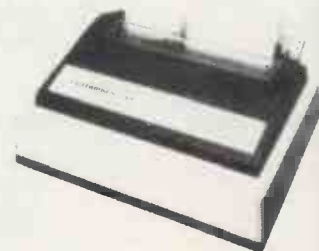
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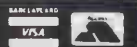
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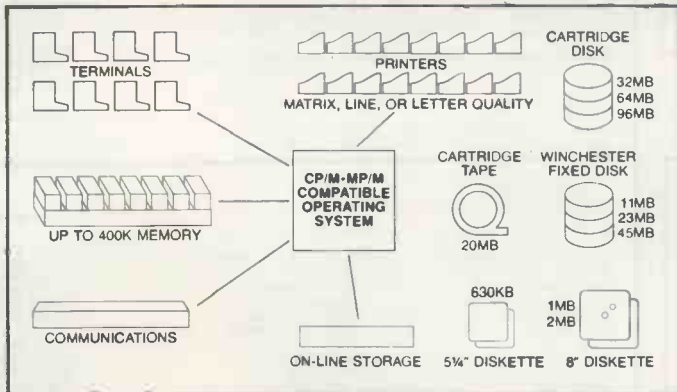




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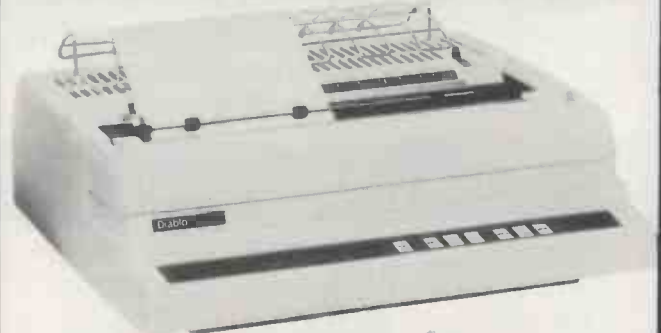
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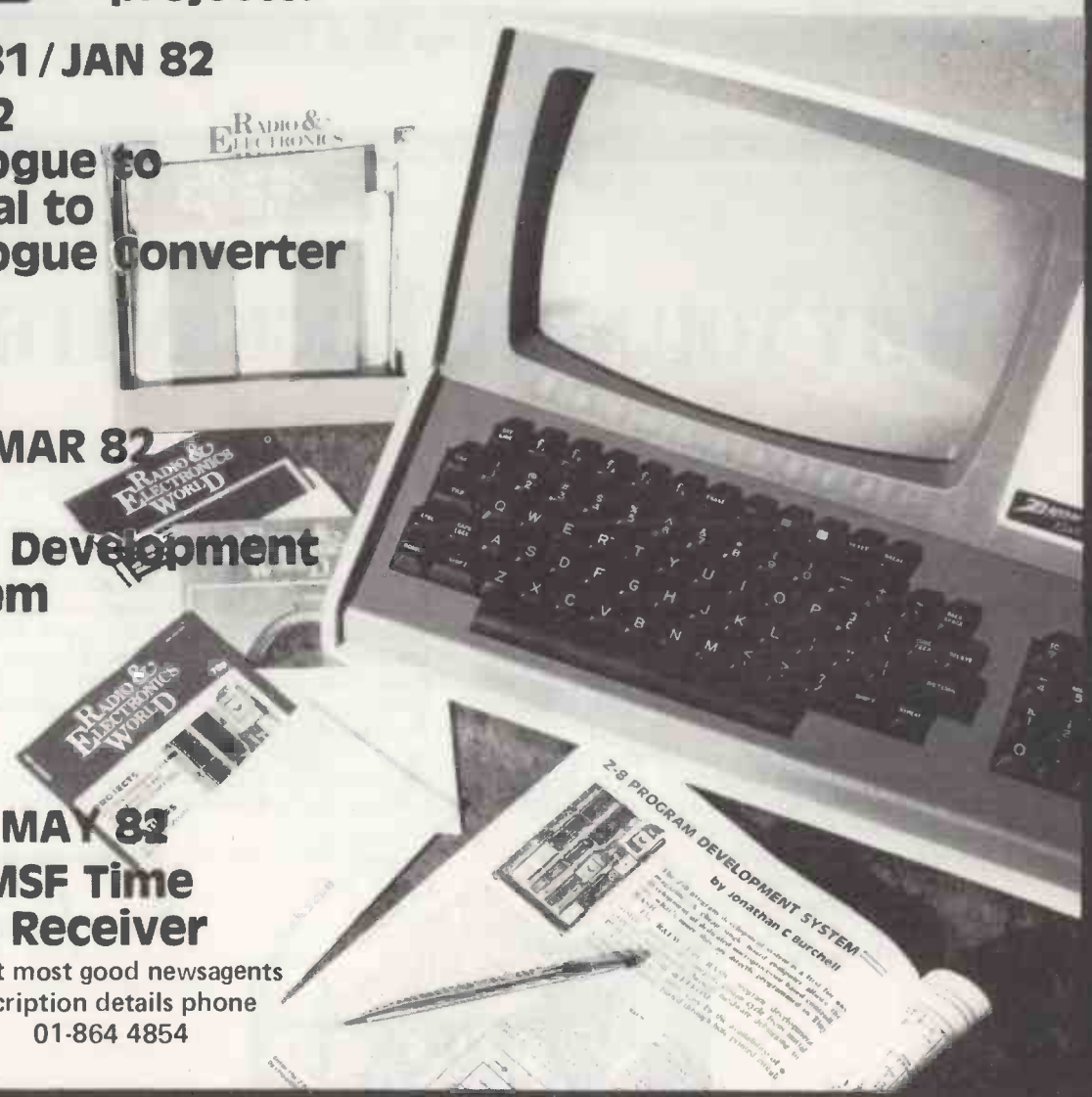
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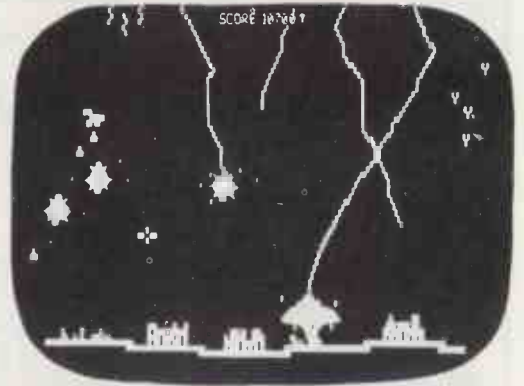
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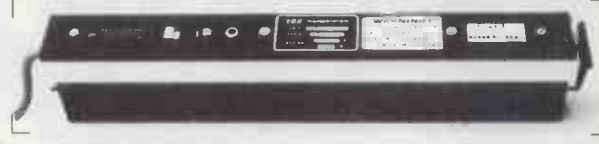
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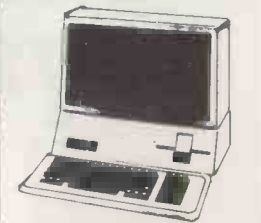
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**The Sinclair ZX80 is innovative and powerful.  
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the most out of it.**

# Get in sync



SYNC magazine is different from other personal computing magazines. Not just different because it is about a unique computer, the Sinclair ZX80 (and kit version, the MicroAce). But different because of the creative and innovative philosophy of the editors.

## A Fascinating Computer

The ZX80 doesn't have memory mapped video. Thus the screen goes blank when a key is pressed. To some reviewers this is a disadvantage. To our editors this is a challenge. One suggested that games could be written to take advantage of the screen blanking. For example, how about a game where characters and graphic symbols move around the screen while it is blanked? The object would be to crack the secret code governing the movements. Voila! A new game like Mastermind or Black Box uniquely for the ZX80.

We made some interesting discoveries soon after setting up the machine. For instance, the CHR\$ function is not limited to a value between 0 and 255, but cycles repeatedly through the code. CHR\$(9) and CHR\$(265) will produce identical values. In other words, CHR\$ operates in a MOD 256 fashion. We found that the "=" sign can be used several times on a single line, allowing the logical evaluation of variables. In the Sinclair, LET X=Y=Z=W is a valid expression.

Or consider the TL\$ function which strips a string of its initial character. At first, we wondered what practical value it had. Then someone suggested it would be perfect for removing the dollar sign from numerical inputs.

Breakthroughs? Hardly. But indicative of the hints and kinds you'll find in every issue of SYNC. We intend to take the Sinclair to its limits and then push beyond, finding new tricks and tips, new applications, new ways to do what couldn't be done before. SYNC functions

on many levels, with tutorials for the beginner and concepts that will keep the pros coming back for more. We'll show you how to duplicate commands available in other Basics. And, perhaps, how to do things that can't be done on other machines.

Many computer applications require that data be sorted. But did you realize there are over ten fundamentally different sorting algorithms? Many people settle for a simple bubble sort perhaps because it's described in so many programming manuals or because they've seen it in another program. However, sort routines such as heapsort or Shell-Metzner are over 100 times as fast as a bubble sort and may actually use less memory. Sure, 1K of memory isn't a lot to work with, but it can be stretched much further by using innovative, clever coding. You'll find this type of help in SYNC.

## Lots of Games and Applications

Applications and software are the meat of SYNC. We recognize that along with useful, pragmatic applications, like financial analysis and graphing, you'll want games that are fun and challenging. In the charter issue of SYNC you'll find several games. Acey Ducey is a card game in which the dealer (the computer) deals two cards face up. You then have an option to bet depending upon whether you feel the next card dealt will have a value between the first two.

In Hurtle, another game in the charter issue, you have to find a happy little Hurtle who is hiding on a 10 X 10 grid. In response to your guesses, the Hurtle sends our a clue telling you in which direction to look next.

One of the most ancient forms of arithmetical puzzle is called a "boomerang." The oldest recorded example is that set down by Nicomachus in his *Arithmetica* around 100 A.D. You'll find a computer version of this puzzle in SYNC.

## Hard-Hitting, Objective Evaluations

By selecting the ZX80 or MicroAce as your personal computer you've shown that you are an astute buyer looking for good performance, an innovative design and economical price. However, selecting software will not be easy. That's where SYNC comes in. SYNC evaluates software packages and other peripherals and doesn't just publish manufacturer descriptions. We put each package through its paces and give you an in-depth, objective report of its strengths and weaknesses.

SYNC is a Creative Computing publication. Creative Computing is the number 1 magazine of software and applications with nearly 100,000 circulation. The two most popular computer games books in the world, *Basic Computer Games* and *More Basic Computer Games* (combined sales over 500,000) are published by Creative Computing. Creative Computing Software manufactures over 150 software packages for six different personal computers.

Creative Computing, founded in 1974 by David Ahl, is a well-established firm committed to the future of personal computing. We expect the Sinclair ZX80 to be a highly successful computer and correspondingly, SYNC to be a respected and successful magazine.

## Order SYNC Today

Right now we need all the help we can get. First of all, we'd like you to subscribe to SYNC. Subscriptions are posted by air directly from America and cost just £10 for one year (6 issues), £18 for two years (12 issues) or, if you really want to beat inflation, £25 for three years (18 issues). SYNC is available only by subscription; it is not on newstands. We guarantee your satisfaction or we will refund the unfulfilled portion of your subscription.

Needless to say, we can't fill up all the pages without your help. So send in your programs, articles, hints and tips. Remember, illustrations and screen photos make a piece much more interesting. Send in your reviews of peripherals and software too—but be warned: reviews must be in-depth and objective. We want you to respect what you read on the pages of SYNC so be honest and forthright in the material you send us. Of course we pay for contributions—just don't expect to retire on it.

The exploration has begun. Join us.

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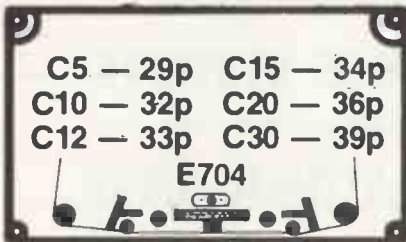
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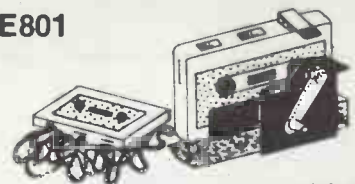


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ARE KNIGHTS MAD? — SHARP MZ-80B £899

Dear Microfans,

At a recent Sharp Dealers meeting it was suggested that Knights were mad to sell the MZ-80B at £899. Only one dealer supported us by indicating that he too wanted to cut the price — the other seventy plus wanted to get the full £1045 + VAT. OK we confess Knights are mad. Mad enough to sell the B for £899. Mad enough to have written our KNIGHT COMMANDER for the B (it adds renumber, trace, dump variables, single step etc to Basic), mad enough to be just back from our second visit to Sharp Japan in 6 months thus ensuring our customers have exclusive Sharp items. Mad enough to sell the MZ-80K at £345 with Basic and Pascal or at £399 with Basic, Pascal, Forth, Fortran, and machine code. Mad enough to have sold Sharp for eight years and never ever to have charged for any servicing to any of our Sharp customers.

Write for our latest price lists and software catalogue. Our latest newsletters detail the new Sharp single floppy, the PC1511 hand held micro and colour printer and all the latest news from Japan which the sane dealers are waiting to hear.

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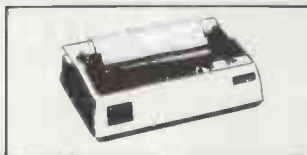
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ZX81 built + mains adaptor £60.83 (Post £2.95 extra).

## PRINTERS

Buy any of the below and get a free interface kit and word processor program for UK101 or Superboard. Seikosha GP80A £199. Centronics 737 £335. OKI Microline 80 £295. OKI Microline 82A £399. Epson MX70T £259. Epson MX80T £359. Epson MX80F/T1 £399. Epson MX80F/T2 £449.

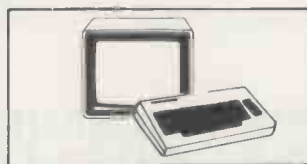


## SHARP COMPUTERS

MZ80K 20K £380, 36K £394, 48K £408. PC1211 £82. 46 sample programs for £15. We can supply any Epson printer to run direct from the MZ80K without i/o box for £39 plus printer price.

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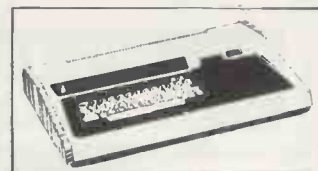
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8k ROM +2k RAM kit £120. built £150. 12k ROM + 12k RAM kit £168. built £198. 4k extension ROM £25. Power supply £8.87.



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Postage £3.50 on computers, £4.50 on printers and 45p on other orders. Lists 27p post free. Please add VAT to all prices. Official credit orders welcome.

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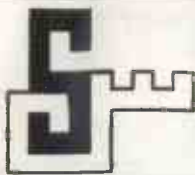
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6802	ZN1040E	115	74157	75	LS92	35	LS668	175	4501	28
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6804	ZN1040E	670	74159	90	LS95	45	LS673	550	4503	50
6805	ZN1040E	520	74160	60	LS96	120	LS674	750	4504	105
6808	ZN1040E	165	74162	62	LS107	43	LS674	750	4505	65
6809	ZN1040E	95	74163	64	LS109	30	LS674	750	4507	40
6810	ZN1040E	70	74164	64	LS113	40	LS674	750	4508	265
6820	ZN1040E	225	74165	62	LS114	35	LS674	750	4510	68
6821	ZN1040E	120	74166	62	LS112	44	LS674	750	4511	68
6840	ZN1040E	70	74167	185	LS122	44	LS674	750	4512	75
6843	ZN1040E	975	74170	168	LS123	55	LS674	750	4512	75
6845	ZN1040E	150	74172	290	LS124	60	LS674	750	4513	139
6847	ZN1040E	150	74173	65	LS125	30	LS674	750	4514	195
6850	ZN1040E	75	74175	72	LS126	30	LS674	750	4515	198
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8202	ZN1040E	170	74192	70	LS157	35	LS674	750	4532	110
8212	ZN1040E	425	74193	65	LS158	36	LS674	750	4532	110
8214	ZN1040E	170	74193	65	LS160	41	LS674	750	4532	110
8216	ZN1040E	200	74194	75	LS161	41	LS674	750	4536	295
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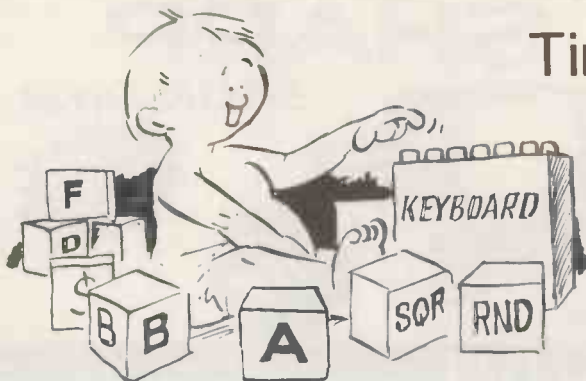
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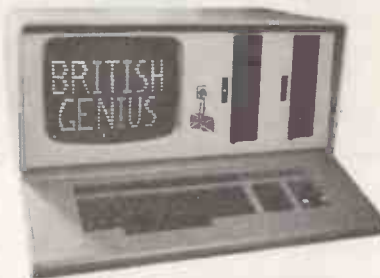
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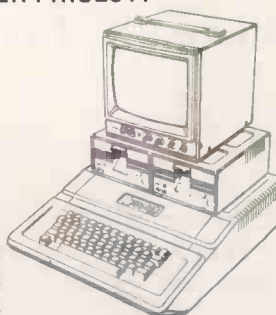
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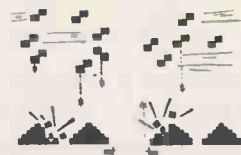
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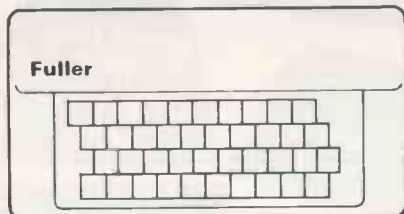


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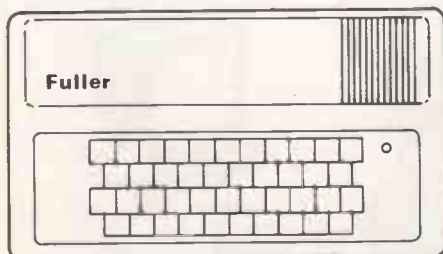
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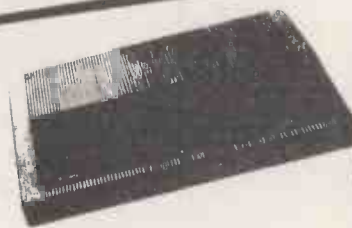


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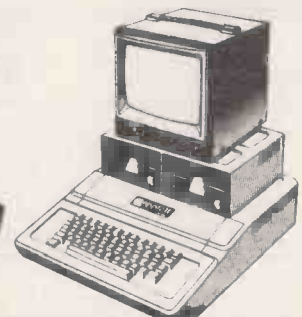


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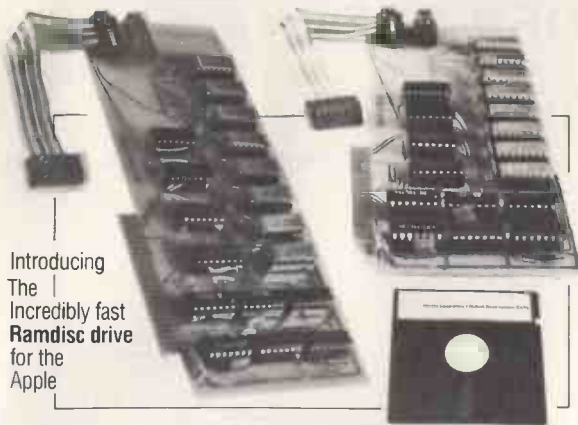
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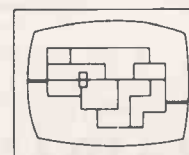
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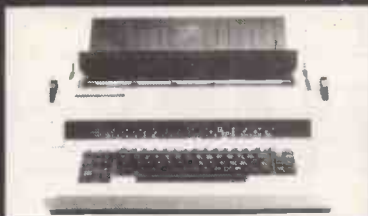
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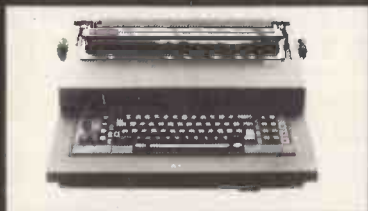
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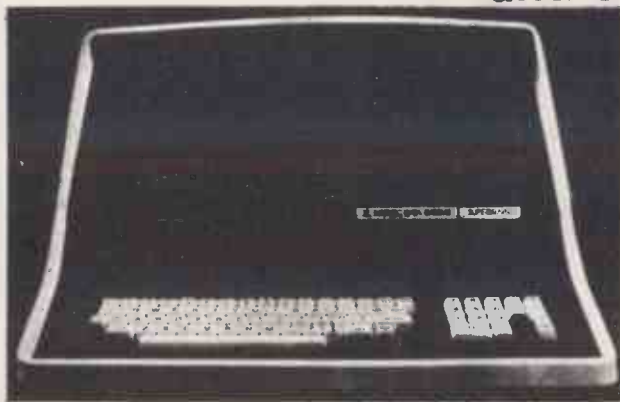
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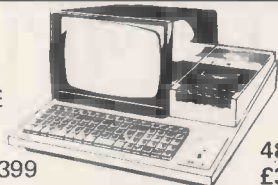
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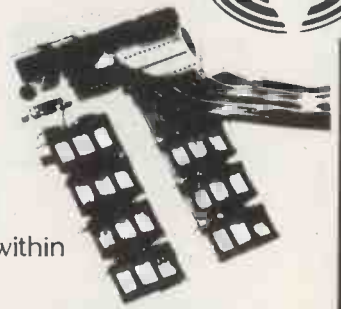
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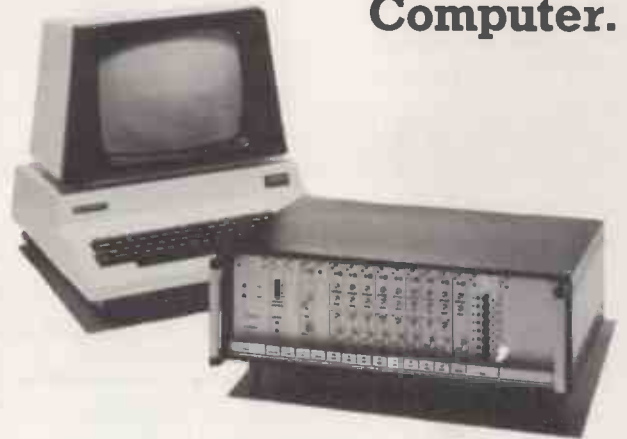
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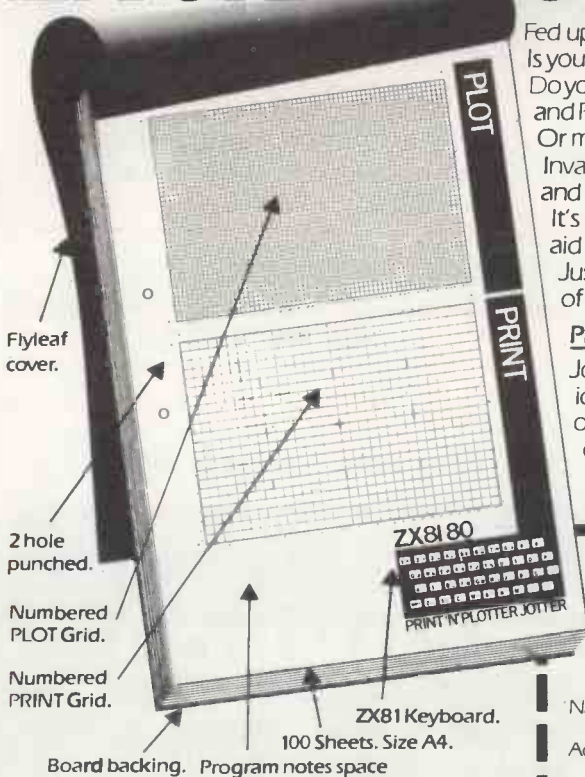
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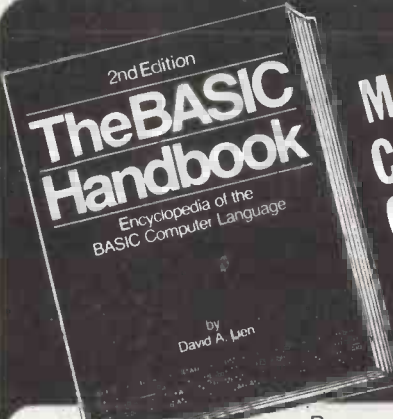
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If you saw the first episode of the BBC's computer series, you might have noticed a BBC computer being used to receive Prestel pages. But our spy in the studio informs us that at the time the scene was filmed the Prestel interface for the Beeb Micro wasn't ready and so the shot was faked with the aid of a Tantal unit hidden under the table. . . Unfortunate names time: Sord, the Japanese micro company which aims to wipe out Apple, has just set up a subsidiary called Orange Computer Products. That, coupled with Sord's intention to open shops called 'Pips Inns', would be bad enough, were it not for the fact that OCP is based in Dublin. . . We

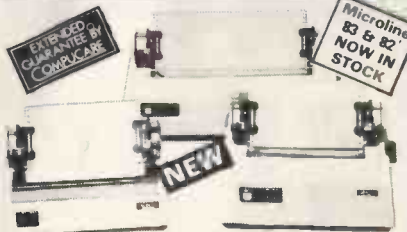
see that 'Inside Trader', the thinly-disguised gossip columnist of *Microcomputer Sprintout*, has had to resort to publishing the contents of the in-tray to fill up space. . . Industry whispers say that Apple is soon to launch a portable computer. . . We received a copy of Tandy's *Applications Software Sourcebook* (£3.95 from Tandy dealers and stores). It lists some 500-plus products and on the very last page, at the very end of the listings, is, of course, The Last One. Its entry includes: 'Language: Anglo Saxon (English)'. . . The *Sourcebook* also details a game from Molimerx called 'Shuttle' which gives a 'very life-like simulation of the first

Columbia shuttle flight'. Does this mean your wall tiles fall off when you play it? . . . An unkind colleague has at last come up with a nickname for the BBC Computer: 'The Late One'. . . One of our spies reports seeing a Superbrain, Epson printer and other bits being smuggled guiltily into IBM's offices in Wigmore Street, London, recently. . . David Tebbutt reports receiving some very odd phone calls

from 'gentlemen' who were interested to see, in his Jim Warren profile, a mention about taking off clothes and getting into hot tubs. . . And now, another 'Chip Chat' exclusive: printed here is the first product from Tebbo's new company, Caxton. To run it you need MBasic and an Epsom MX-80 printer (yes, David, we spotted the bug and corrected it!).

```

10 REM SNOWFALL BY DAVID TEBBUTT
20 LPRINT CHR$(27);CHR$(49);CHR$(15);
30 FOR N=1 TO 128
40 LPRINT CHR$(INT(RND(1)*(223-166))+166);
50 NEXT N
60 LPRINT " "
70 GOTO 30
    
```



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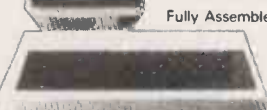
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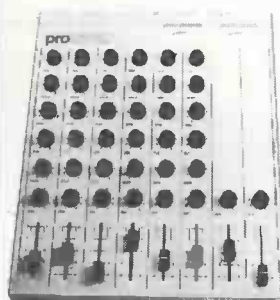
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