

80p

Practical Computing

July 1981

Volume 4 Issue 7

Twinning schools and business

Reviews:

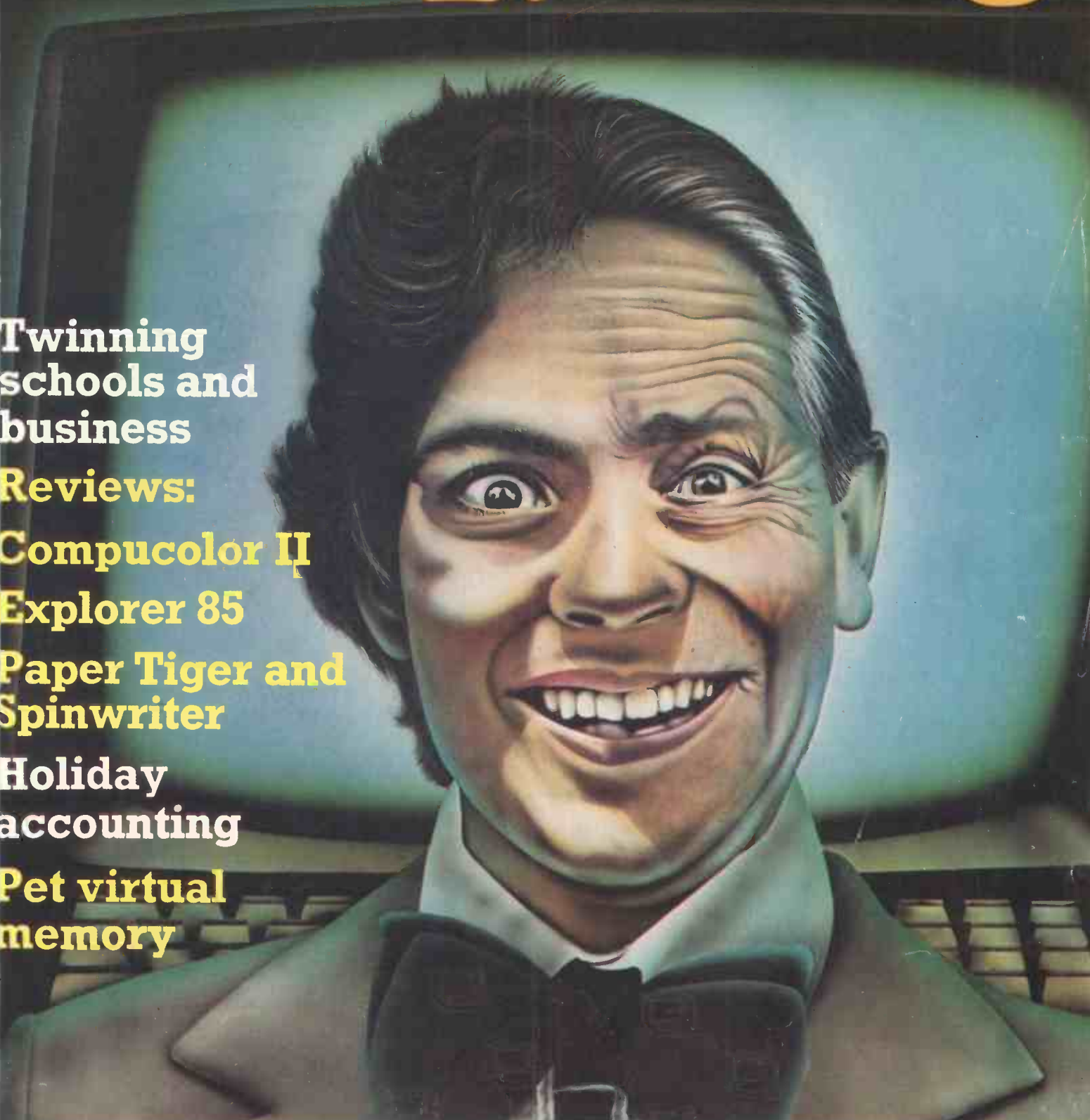
Compucolor II

Explorer 85

Paper Tiger and Spinwriter

Holiday accounting

Pet virtual memory



MicroCentre introduce System Zero

Basic System Zero £587
System Zero/D with DDF £2355

The System Zero is a small computer especially designed for dedicated applications. It is particularly useful in process control situations.

In the basic model you get Cromemco's famous Z-80A single card computer, 1k of RAM, 4k of ROM, Control Basic, and an attractive cabinet. The motherboard provides 3 extra card slots on the S-100 bus, for tailoring the system to particular applications. The basic model is designed for ROM-based programs, but it can be expanded by the addition of memory and I/O cards. It is fully compatible with all Cromemco peripherals, including floppy disks and hard disk systems. Suitably configured the System Zero can run any Cromemco operating system or software package.



New System Zero Computer with quad-capacity DDF disk drive. The system includes built-in diagnostics for a quick system test of memory, controller and disk drives

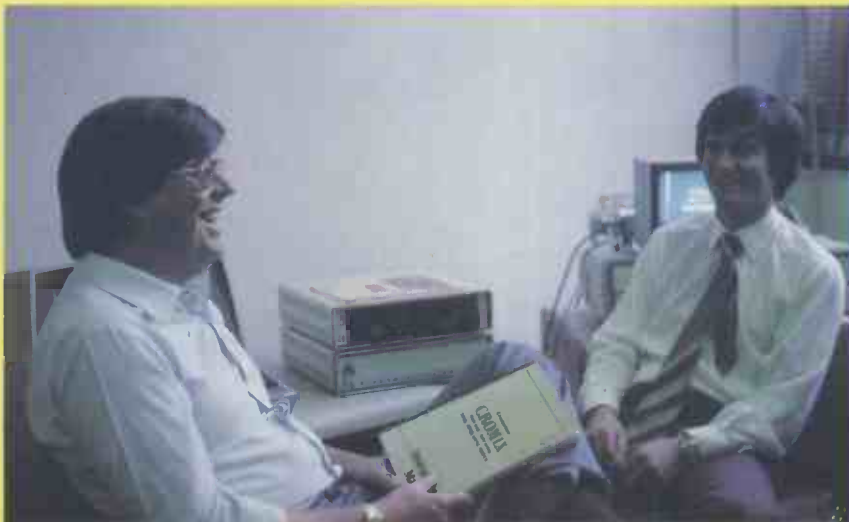
System Zero/D

This special version of the System Zero has 64k of fast RAM, and a model DDF dual disk drive. It includes two double-sided double-density 5 inch disk drives giving a total of 780k bytes storage; and RDOS-2, a new resident disk operating system with terminal and printer drivers, and self-test diagnostics.

The System Zero/D is an exceedingly inexpensive development computer ideal for setting up dedicated applications to run in the basic model. It will support Cobol, Fortran IV, Ratfor, Structured Basic, Lisp, RPG II, Word Processing, DBMS, and the full range of Cromemco's business applications software.

Operating system

The System Zero/D will run any Cromemco operating system provided sufficient memory is available. The minimum configuration of 4k ROM runs control Basic; with 64k RAM the system will run RDOS-2 or CDOS (compatible with CP/M); and with 128k the Zero/D will run the Cromix system (based on Unix).



At the recent UK launch of the System Zero Computer, Cromemco's Technical Director Roger Melen presented a System Zero/D with 128k memory running Cromix. Here he is seen discussing the system with MicroCentre Director Andrew Smith (right).

For  Cromemco... call the experts

MicroCentre
Tel: 031-556 7354

**LEADING UK
DISTRIBUTORS**

Complete Micro Systems Ltd.,
30 Dundas Street
Edinburgh EH3 6JN



Twinning schools and business—page 57.

Editor
Peter Laurie
Assistant Editor
Duncan Scot
Staff Writer
Bill Bennett
Production Editor
Toby Wolpe
Prestel Editor
Martin Hayman
Editorial Secretary
Tracy Ebbetts
Consultants
Technical **Nick Hampshire**
Software **Mike McDonald**
Editorial: 01-661 3500
Advertisement Manager
David Lake
Advertisement Executives
Philip Kirby
Ken Walford
Advertising: 01-661 3021
Midlands office:
David Harvett 021-356 4838
Northern office:
Geoff Aikin 061-872 8861
Advertisement Secretary
Mandy Morley
Publishing Director
Chris Hipwell

Published by IPC Electrical electronic Press Ltd, Quadrant House, The Quadrant, Sutton, Surrey, SM25AS. Tel: 01-661 3500. Telex/grams 892084 BIPRESG.

Typesetting and artwork by Bow-Towning Ltd, London EC1
Printed by Eden Fisher Ltd, Southend-on-Sea

Distributed by IPC Business Press (Sales and Distribution) Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Subscriptions: U.K., £10 per annum; Overseas £16 per annum; selling price in Eire subject to currency exchange fluctuations and VAT; airmail rates available on application to Subscription Manager, IPC Business Press (S & D) Ltd, Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. Tel 0444 59188.

© IPC Business Press Ltd 1981
ISSN 0141-5433

Would-be authors are welcome to send articles to the Editor but PC cannot undertake to return them. Payment is at £30 per published page.

Submissions should be typed or computer-printed. Hand-written material is liable to delay and error.

Every effort is made to check articles and listings but PC cannot guarantee that programs will run and can accept no responsibility for any errors.

CONTENTS

- 41** Editorial / What price software?
42 Feedback / ZX-81 complaint and praise; raising money for refugees; micros in medicine; alternative history of microcomputing
46 Printout / Government gives away Prestel sets: battery-backed RAM; second-hand micromarket; CP/M on Pet
55 Telesoftware / Martin Hayman reports on teletext art
57 Twinning / We propose a revolutionary scheme for bringing education and business together
58 Explorer 85 / The modular system from Newtronics
65 Compucolor II / Mike McDonald tests the colourful features of this computer and tries a selection of its software
72 Prokit / The professional software kit for the Pet
74 Paper Tiger / Printer review by Chris Bidmead
75 Spinwriter / A top-quality printer from NEC
77 Business software / A new series by Charles Somerville on how to write your own business software
79 Applications / How a seaside camp resorted to an Apple to handle its accounts
82 Star system / The first part of a complex space game by Bob Merry
91 Investment / Manage your capital investment with this program
94 Education / Rex Tingey presents a program for schools
98 Virtual memory / JA Forbes explains how to create that extra memory
101 Algorithms / Mark Walker analyses several sorting algorithms
105 Z-80 Zodiac
106 ZX-80/81 Line-up
108 Tandy Forum
109 6502 Special
111 Pet Corner
113 Apple Pie
114 Micromouse
119 Book Reviews
120 Pet Graphics / Part 2 of Nick Hampshire's series
125 Sort times / A comparison of bubble and other sort routines
132 Microcomputer Buyer's Guide
147 The Hexadecimal Kid / Page 10 of Richard Forsyth's parable
Prestel page number 357

IF YOU DON'T WANT A WORD PROCESSING DOCUMENT
THAT LOOKS LIKE THIS.

YOU NEED A PRINTER THAT PRINTS LIKE THIS.

The more your system can do, the better your terminal should be. That's why, if you're adding text editing capability to your data processing system, you should also think about adding a quality daisywheel terminal to replace the matrix terminal you're using now. And the best-quality terminal you can buy is one by Qume.

A printer for every application.

No matter what application you choose, Qume makes a printer to fit it.

Like our Sprint 5[®] KSR and RO, which have achieved the reputation for being the easy-to-use leader in letter-perfect terminals. You can have 50 different typestyles to use with it, including APL, scientific symbols and international character sets.

And there's the Sprint 5 Wide-Track[™] with RS-232C interface. The first character printer data terminal in the world capable of handling paper up to 28 inches wide. That's a full 264-column printing area. Sprint 5 Wide-Track adds an entirely new dimension to the printed word.

The best backup in the business.

Not only do we make the best printers, but we also provide the best support to back up

what we sell. That means excellent service to the OEM and the end user, and one of the best supplies programs in the business.

So if you're getting ready to upgrade your system, then it's time you upgraded your printer as well. To a Qume.

Ask about the NEW Sprint 7 and 9 models.

For more information contact your **Qume** [UK] AUTHORIZED DISTRIBUTOR

ACCESS DATA COMMUNICATIONS LTD.,
228 High Street, Uxbridge, Middlesex. Tel: (0895) 30831.

DAISY TERMINALS LIMITED, Bridge Road,
Haywards Heath, West Sussex. Tel: (0444) 57546.

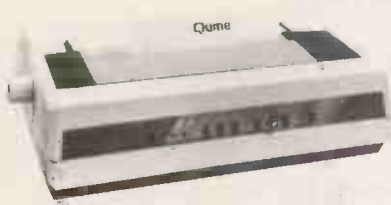
FACIT, Maidstone Road, Rochester, Kent.
Tel: (0634) 401721.

ISG DATA SALES LIMITED, Unit 9, Fairacres Ind. Estate,
Dedworth Road, Windsor, Berkshire. Tel: (07535) 57955.

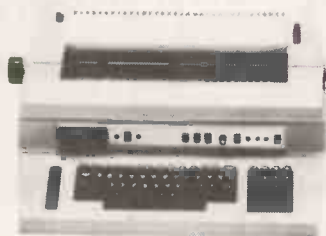
ROHAN COMPUTERS LIMITED, 52 Coventry Street,
Southam, Warwickshire. Tel: (092681) 4045.

Qume®

Qume (UK) Limited Tel: (0734) 584646. Telex: 849706.
A British Company of ITT



The NEW Sprint 9



• Circle No. 102

PRACTICAL COMPUTING July 1981

Comart Approved Dealers

Belfast
O & M Systems
95 Dublin Road
Tel: 0232 49440

Birmingham
Byteshop Computerland Ltd
94/96 Hursi St, B5 4TD
Tel: 021 622 7149

Cambridge
Cambridge Computer Stores
1 Emmanuel St, CB1 1NE
Tel: 0223 68155

Cornwall
Benchmark Computer Systems Ltd
Tremena Manor
Tremena Road
St Austell, PL25 5GG
Tel: 0726 610000

Dublin
Lendac Data Systems Ltd
8 Dawson St
Tel: 0001 372052

Glasgow
Byteshop Computerland Ltd
Magnet House
61 Waterloo St, G2 7BP
Tel: 041 221 7409

Leeds
Holdene Ltd
Manchester Unity House
11/12 Rampart Road
Woodhouse St
Tel: 0532 459459

London
Byteshop Computerland Ltd
324 Euston Road
London W1
Tel: 01-387 0505

Digitus
9 Macklin Street
Covent Garden WC2
Tel: 01 405 6761

Jarrogate
67 Tulsemere Road,
West Norwood,
London SE17
Tel: 01-670 3674

Manchester
Byteshop Computerland Ltd
11 Gateway House
Piccadilly Station Approach
Tel: 061 236 4737

NSC Computers
29 Hanging Ditch
Tel: 061 832 2269

Newbury
Newbear Computing Store
40 Bartholomew St
Tel: 0635 30505

Nottingham
Byteshop Computerland Ltd
92A Upper Parliament St,
NG1 6LF
Tel: 0602 40576

Sheffield
Hallam Computer Systems
451 Eccleshall Road, S11 9PN
Tel: 0742 663125

Southampton
Xitan Systems
23 Cumberland Place,
SO1 2BB
Tel: 0703 38740

Sudbury
Eurotec Consultants
Holbrook Hall
Little Waldingford
Tel: 0206 262319

Warwicks
Business & Leisure
Microcomputers
16 The Square
Kenilworth
Tel: 0926 512127

Watford
Lux Computer Services
108 The Parade
High Street
Watford WD11 2AW
Tel: 0923 29513

Comart Microcomputer dealers are located strategically throughout the country to give support, guidance and assistance. In the event of difficulty contact Comart direct.



Horizon Hard Disc adds a new dimension to cost effective data processing

With its parentage already established as the proven performer in its price range, North Star's Hard Disc Horizon is set to break new barriers in cutting the cost of data storage and retrieval.

It offers 18 Megabytes of on line storage, and at current prices that works out at less than 0.03p per byte. And, with up to 10 times the speed of operation of the more conventional floppy discs, and the convenience of storing all your data on-line, it's a basic price incentive that's amplified

even more in reduced operating costs and efficiency.

Add to that the new North Star Application Software, Word Processing, Information Management and Reporting System and you'll understand why we say that North Star is set for new horizons of application.

Find out the facts about expanding your North Star Horizon today!

The U.K. Leaders in Microcomputer Development, Application and Support.

comart

St Neots HUNTINGDON Cambs PE19 2AF
Tel (0480) 215005 Telex: 32514 Comart G.

• Circle No. 103

Mail Order Software

from the world's leading microsoftware supplier

Software for most popular 8080/Z80 computer disk systems including

NORTH STAR HORIZON, VECTOR MZ, OHIO SCIENTIFIC, SUPERBRAIN, Z80 APPLE, CROMEMCO, RAIR BLACK BOX, DYNABYTE, SD SYSTEMS, RESEARCH MACHINES, EXIDY SORCERER, IMSAI, HEATH, and 8" IBM formats

Software with Manual / Manual Alone

Software with Manual / Manual Alone

Software with Manual / Manual Alone

DIGITAL RESEARCH

- CP/M* FDOS** — Diskette Operating System complete with Text Editor, Assembler, Debugger, File Manager and system utilities. Available for wide variety of disk system including North Star, Helios II, Micropolis, ICOM (all systems) and Altair. Supports computers such as Sorcerer, Horizon, Cromemco, Ohio Scientific, RAIR Black Box, Research Machines, Dynabyte, etc. from £75/£15
- CP/M version 2** (not all formats available immediately) £95/£15
- CP/M for Apple 11* Softcard** **NEW** Z80 Microsoft BASIC - 80 with high resolution graphics £250/£15
- MP/M** £195/£25
- MAC** — 8080 Macro Assembler. Full Intel macro definitions. Pseudo Ops include RPC, IRP, REPT, TITLE, PAGE, and MACLIB. Z-80 library included. Produces Intel absolute hex output plus symbols file for use by SID (see below) £55/£10
- SID** — 8080 symbolic debugger. Full trace, pass count and break-point program testing system with back-trace and histogram utilities. When used with MAC, provides full symbolic display of memory labels and equated values £45/£10
- ZSID** Includes Z80 mnemonics, requires Z80 CPU £50/£10
- TEX** — Text formatter to create paginated, page-numbered and justified copy from source text files, directable to disk or printer £45/£10
- DESPOOL** — Program to permit simultaneous printing of data from disk while user executes another program from the console £30/£1

MICROSOFT

- BASIC-80** — Disk Extended BASIC Interpreter Version 5, ANSI compatible with long variable names, WHILE/WEND, chaining, variable length file records £155/£15
- BASIC Compiler** — Language compatible with Version 5 Microsoft interpreter and 3-10 times faster execution. Produces standard Microsoft relocatable binary output. Includes Macro-80. Also linkable to FORTRAN-80 or COBOL-80 code modules £195/£15
- FORTRAN 80** — ANSI '66 (except for COMPLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO 80 (see below) £205/£15
- COBOL 80** — ANSI '74 Relocatable object output. Format same as FORTRAN-80 and MACRO-80 modules. Complete ISAM. Interactive ACCEPT DISPLAY, COPY, EXTEND £325/£15
- MACRO-80** — 8080/Z80 Macro Assembler. Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included £75/£10

- XMACRO-86** — 8086 cross assembler. All Macro and utility features of MACRO-80 package. Mnemonics slightly modified from Intel ASM86. Compatibility data sheet available £155/£15
- EDIT-80** — Very fast random access text editor for text with or without line numbers. Global and intra-line commands supported. File compare utility included £45/£10

EIDOS SYSTEMS

- KBASIC** — Microsoft Disk Extended BASIC version 4.51 integrated with KISS Multi-Keyed Index Sequential and Direct Access file management as 9 additional BASIC commands. KISS included as relocatable modules linkable to FORTRAN-80, COBOL-80, and BASIC COMPILER. Specify CP/M version 1.4 or 2.x when ordering. Requires 48K CP/M £295/£25
- To licensed users of Microsoft BASIC-80 (MBASIC) £215/£25

MICROPRO

- SUPER-SORT 1** — Sort, merge, extract utility as absolute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating, fixed point, exponential, field justified, etc. etc. Even variable number of fields per record! £125/£15
- SUPER-SORT II** — Above available as absolute program only £105/£15
- SUPER-SORT III** — As II without SELECT/EXCLUDE £75/£15
- WORD-MASTER Text Editor** — In one mode has super-set of CP/M's ED commands including global searching and replacing, forward and backwards in file. In video-mode, provides full screen editor for users with serial addressable-cursor terminal £75/£15
- WORD-STAR** — Menu driven visual word processing system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center, underscore and PRINT. Edit facilities include global search and replace, read/write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning £255/£15
- WORD-STAR/MAIL-MERGE** — As above with option for production mailing of personalised documents with mail list from Datastar or NAD £315/£15
- DATASTAR** — Professional forms control entry and display system for key-to-disk data capture. Menu driven with built-in learning aids. Input field verification by length, mask, attribute (i.e. uppercase, lowercase, numeric, auto dup., etc.). Built-in arithmetic capabilities using keyed data, constants and derived values. Visual feedback for ease of forms design. Files compatible with all CP/M-MP/M supported languages. Requires 32K CP/M £195/£25

GRAFFCOM

- PAYROLL** — Designed in conjunction with the spec for PAYE routines by HMI Taxes. Processes up to 250 employees on weekly or monthly basis. Can handle cash, cheque or bank transfer payments plus total tracking of all year to date figures. Prints emp master, payroll log, payslips and bank glos. Requires CBASIC-2 £475/£35
- COMPANY SALES** — Performs sales accounting function. Controls payments of invoices and prints sales ledger and aged debtors report. Suitable for any accounting period. Comprehensive VAT control and analysis of all sales invoices. Requires CBASIC-2 £425/£35
- COMPANY PURCHASES** — Performs purchase accounting function. Controls invoices, credit & debit notes. Prints purchase ledger, aged creditors report and payment advices. Comprehensive VAT control and analysis of all purchases. Interfaces with the ADD system. Requires CBASIC-2 £425/£35
- GENERAL ACCOUNTING** — Produces Nominal Ledger, Trial Balance, P/L and Balance Sheet. Define your own coding system. Interactive data entry plus optional data capture from Company Sales and Company Purchases. Requires CBASIC-2 £375/£35
- STOCK CONTROL** — Maintains stock records, monitors stock levels to ensure optimum stock holding. Details include stock desc., product code, unit, unit price, quantity on hand on order/minimum. Stock analysis reports can be weekly, monthly, quarterly etc. Interfaces with Order Entry Invoicing system. Requires CBASIC-2 £325/£35
- ORDER ENTRY & INVOICING** — Performs order entry and invoicing function. Handles invoices for services and consumable items, part orders and part quantities. Sales Analysis report shows sales movements and trends for user-defined period. Interfaces with Stock Control, ADD and Company Sales systems. Requires CBASIC-2 £325/£35
- ADD** — Complete control of all your names & addresses including suppliers, clients, enquiries etc. Assign your own coding system and select all output via the report generator. Will print anything from mailing labels to directories. Requires CBASIC-2 £225/£35
- TIME RECORDING SYSTEM** — Provides comprehensive control over manhour expenditures by job or account. Expense details can also be controlled. Up to 75 activities can be assigned and reports produced weekly/monthly showing movements and job account totals to date. Requires CBASIC-2 £375/£35
- LEASE RENTAL & HP SYSTEM** — Designed to control agreements and contracts that are payable at regular intervals by fixed amounts. Handles lease, rental, HP or maintenance agreements with payments by invoice, SO, or cash. Can be used with ADD and CSS for complete credit control system. Requires CBASIC-2 £375/£35

Also available in bundles, contact us for details.

STRUCTURED SYSTEMS GROUP

- **ANALYST** — Customised data entry and reporting system. User specifies up to 75 data items per record. Interactive data entry, retrieval and update facility makes information management easy. Sophisticated report generator provides customised reports using selected records with multiple level breakpoints for summarisation. Requires CBASIC-2, 24 x 80 CRT, printer and 48K system £125/£10
- **LETTERIGHT** — Program to create edit and type letters or other documents. Has facilities to enter; display, delete and move text, with good video screen presentation. Designed to integrate with NAD for form letter mailings. Requires CBASIC-2 £105/£15
- **NAD Name and Address selection system** — interactive mail list creation and maintenance program with output as full reports with reference data or restricted information for mail labels. Transfer system for extraction and transfer of selected records to create new files. Requires CBASIC-2 £45/£12
- **QSORT** — Fast sort/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created. Parameter file created optionally with interactive program which requires CBASIC-2. Parameter file may be generated with CP/M assembler utility £50/£12

SOFTWARE SYSTEMS

- **CBASIC-2 Disk Extended BASIC** — Non-interactive BASIC with pseudo-code compiler and runtime interpreter. Supports full file control, chaining, integer and extended precision variables etc. £75/£10

MICRO FOCUS

- **STANDARD CIS COBOL** — ANSI '74 COBOL standard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full ISAM file facility. Also, program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal £400/£25
- **FORMS 2** — CRT screen editor. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. Output is COBOL data descriptions for copying into CIS COBOL programs. No programming experience needed. Output program directly compiled by CIS COBOL (standard) £100/£12

- **APL/V80** — Concise and powerful language for application software development. Complex programming problems are reduced to simple expressions in APL. Features include up to 27K active workspace, shared files, arrays of up to 8 dimensions, disk workspace, copy object library. The system also supports auxiliary processors for interfacing I/O ports. Requires 48K CP/M and serial APL printing terminal or CRT £270/£20
- **PASCAL/M** — Compiler generates P code from extended language implementation of standard PASCAL. Supports overlay structure through additional procedure calls and the SEGMENT procedure type. Provides convenient string handling capability with the added variable type STRING. Untyped files allow memory image I/O. Requires 56K CP/M £195/£20
- **PASCAL/Z** — Z80 native code PASCAL compiler. Produces optimised portable reentrant code. All interfacing to CP/M is through the support library. The package includes compiler companion macro assembler and source for the library. Requires 56K and Z80 CPU. Version 3 includes all of Jensen/Virih £205/£15
- **PASCAL/MT** — Subset of standard PASCAL. Generates ROMable 8080 machine code. Symbolic debugger included. Supports interrupt procedures, CP/M file I/O and assembly language interface. Real variables can be BCD, software floating point, or AMD 9511 hardware floating point. Version 3 includes Sets, Enumeration and Record data types. Manual explains BASIC to PASCAL conversion. Source for the run time package requires MAC (See under Digital Research). Requires 32K £135/£20

- **TINY C** — interactive interpretive system for teaching structured programming techniques. Manual includes full source listings £45/£30
- **BDS C COMPILER** — Supports most major features of language, including Structures, Arrays, Pointers, recursive function evaluation, linkable with library to 8080 binary output. Lacks data initialization, long & float type and static & register class specifiers. Documentation includes "C" Programming Language book by Kernighan & Ritchie £60/£10
- **WHITESMITHS' C COMPILER** — The ultimate in systems software tools. Produces faster code than Pascal with more extensive facilities. Conforms to the full UNIX Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Compiler output in A-Natural source. Supplied with A-Natural. Requires 60K CP/M £325/£20
- **ALGOL 60 Compiler** — Powerful block-structured language featuring economical run time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling, direct disk address I/O etc. Requires Z80 CPU £110/£12
- **Z80 Development Package** — Consists of (1) disk file line editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file for CP/M LOAD, DDT or SID facilities £50/£12

- **ZDT — Z80 Debugger** to trace, break and examine registers with standard Zilog/Mostek mnemonic disassembly displays. Facilities similar to DDT £20 when ordered with Z80. Development Package £30/£7
- **DISTEL** — Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files. Intel or TDL Xitan pseudo ops optional. Runs on 8080 £35/£7
- **DISILOG** — As Distel to Zilog Mostek mnemonic files. Runs on Z80 only £35/£7
- **TEXTWRITER III** — Text formatter to justify and paginate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertion. Ideal for contracts manuals, etc. £75/£3
- **DATEBOOK** — Program to manage time just like an office appointment book but using the speed and memory of a computer. Keeps track of three appointment schedules (three dental chairs, three attorneys, etc.) at once. Appointments consist of name, reason for the appointment, the date and time, and the length of the appointment. System can be quickly customized for the individual user. Many helpful features for making, changing, finding, and reporting appointments. Requires 48K CP/M and 180K bytes diskette storage. Not available for Apple CP/M £185/£15
- **POSTMASTER** — A comprehensive package for mail list maintenance that is completely menu driven. Features included keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Compatible with NAD files. Requires CBASIC-2 £85/£10
- **XASM-68** — Non-macro cross-assembler with nested conditionals and full range of pseudo operations. Assembles from standard Motorola MC6800 mnemonics to intel hex £115/£15
- **XASM-65** — As XASM-68 for MOS Technology MCS-6500 series mnemonics £115/£15
- **XASM-48** — As XASM-68 for Intel MCS-48 and UPI-41 families £115/£15
- **XASM-18** — As XASM-68 for RCA 1802 £115/£15
- **WHATSIT?** — Interactive data-base system using associative tags to retrieve information by subject. Hashing and random access used for fast response. Requires CBASIC £70/£15
- **XYBASIC** Interactive Process Control BASIC — Full disk BASIC features plus unique commands to handle bytes, rotate and shift, and to test and set bits. Available in integer, Extended and ROMable versions. Integer Disk or Integer ROMable £165/£15
Extended Disk or Extended ROMable £215/£15
- **SMAL/80 Structured Macro Assembly Language** — Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs £40/£10
- **SELECTOR III-C2** — Data Base Processor to create and maintain multi key data bases. Prints formatted, sorted reports with numerical summaries or mailing labels. Comes with sample applications including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC Version 2. Supplied in source code £185/£12
- **IBM/CPM Utility Package** — has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files £125/£7
- **BASIC UTILITY DISK** — Consists of (1) CRUNCH-14 Compacting utility to reduce the size and increase the speed of programs in Microsoft Basic and TRS-80 Basic. (2) DPFUN — Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sin, arc sin, hyperbolic sin, hyperbolic arc sin, etc. Furnished in source on diskette and documentation £30/£10

- **THE STRING BIT** — Fortran character string handling. Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source £30/£10
- **BSTAM** — Utility to link one computer to another also equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex), with CRC block control check for very reliable error detection and automatic retry. We use it! It's great! Full wildcard expansions to send *.COM, etc. 9600 baud with wire, 300 baud with phone connection. Both ends need one. Standard and M versions can talk to one another £75/£5
- **BSTMS** — Intelligent terminal program for CP/M systems. Permits communication between micros and mainframes. Sends character data files to remote computers under complete control. System can record NEW or data sent from remote computer systems and data banks. Includes programs to EXPAND and COMPRESS binary files for transmission. This software requires a knowledge of assembler language for installation £115/£10
- **PLINK*** — Two pass disk-to-disk linkage editor/loader which can produce re-entrant, ROMable code. Can link programs that are larger than available memory for execution targeted on another machine. Full library capabilities. Input can be PSA Relocatable Binary Module, IDL Object Module or Microsoft REL files. Output can be a COM file, Intel hex file, TDL Object Module or PSA Relocatable file £75/£15
- **RECLAIM*** — A utility to validate media under CP/M. Program tests a diskette or hard diskette for hard disk surface for errors, reserving the imperfections as visible files, and permitting continued usage of the remainder. Essential for any hard disk. Requires CP/M version 2 £40/£5
- **STRING/80** — Character string handling plus routines for direct CP/M BDOS calls from FORTRAN and other compatible Microsoft languages. The utility library contains routines that enable programmes to chain a COM file, retrieve command line parameters, and search file directories with full wildcard facilities. Supplied as linkable modules in Microsoft format £50/£12
- **STRING/80** source code available separately £185/n.a.
- **VSORT** — Versatile sort/merge system for fixed length records with fixed or variable length fields. VSORT can be used as a stand-alone package or loaded and called as a subroutine from CBASIC-2. When used as a subroutine VSORT maximizes the use of buffer space by setting the TPA on disk and restoring it on completion of sorting. Records may be up to 255 bytes long with a maximum of 5 fields. Upper/lower case translation and numeric fields supported £105/£15
- **CBS** — Configurable Business System is a comprehensive set of programmes for defining custom data files and application systems without using programming language such as BASIC, FORTRAN, etc. Multiple key fields for each data file are supported. Set-up program customizes system to user's CRT and printer. Provides fast interactive data entry and retrieval with transaction processing. Report generator program does complex calculations with stored and derived data, record selection with multiple criteria, and custom formats. Sample inventory and mailing list system included. No support language required £185/£20
- **MAGIC WAND*** — Word processing system with simple, easy to use full screen text editor and powerful print processor. Editor has all standard editing functions including text insert and delete, global search and replace, block move and library files for boiler plate text. Print processor formatting commands include automatic margins, continuation, heading & footings, centred and justified text. Also prints with true proportional spacing, merges with data files for automatic form letters, and performs run-time conditional testing for varied output. Requires 32K CP/M and CRT terminal with addressable cursor £185/£20
- **T/MAKER** — Powerful new tool for preparing management reports with tabular data. Makes financial modeling projects easy. Do you want a weekly profitability report? Set up the table and compute. Just change the sales figures for next week and compute. You have a new T/MAKER includes a full screen editor for setting up tables which pages left, right, up and down. Compute includes standard arithmetic, percents, exponents, common transcendental functions, averages, maxima, minima, projections, etc. Requires 48K CP/M and CBASIC-2 £155/£15

Orders must specify disk type and format, e.g. North Star-Horizon single density.

Add 15% VAT to orders. Add £1 per item postage and packing

All orders must be prepaid. Make cheques POs etc payable to Lifeboat Associates.

Manual costs are deductible from subsequent software purchase

EFFECTIVE JANUARY 1981

The Software Supermarket is a trademark of Lifeboat Associates.



*CP M and MP M are trademarks of Digital Research
Z80 is a trademark of Zilog, Inc
UNIX is a trademark of Bell Laboratories.
WHATSIT? is a trademark of Computer Hardware.
Electric Pencil is a trademark of Michael Shrayer Software.
TRS-80 is a trademark of Tandy Corp.
Pascal M is a trademark of Sorcim.
Soft Card is a trademark of Microsoft.
Apple is a trademark of Apple Computer.
PLINK is a trademark of Phoenix Software Associates Ltd.
MAGIC WAND is a trademark of Small Business Application, Inc

(M) Modified version available for use with CP M as implemented on Heath and TRS 80 Model 1 computers

(L) User license agreement for this product must be signed and returned to Lifeboat Associates before shipment may be made.

Lifeboat Associates P.O. Box 125 London WC2H 9LU 01-836 9028/9

• Circle No. 104

System Specifications

Twin Z80A's with 4MHz Clock Frequency One Z80A (the host processor) performs all processor and screen related functions. The second Z80A is "down-loaded" by the host to execute disk I/O. When not processing disk data, the second Z80 may be programmed by the host for other processor relation functions.

8 bits

10 microseconds register to register

158

All interrupts are vectored

350K (700K on QD model) total bytes formatted on two double density drives. Optional 20.96 megabyte hard disk storage is available directly from Intertec.

250K bits/second

250 milliseconds. 35 milliseconds track-to-track.

4 1/4 inch mini-disk

300 RPM

32K bytes dynamic RAM. Expandable to 64K (socketed). 64K standard on QD model.

256 bytes of static RAM is provided in addition to the main processor RAM. This memory is used for program and/or data storage for the auxiliary processor.

1K bytes standard. Allows ROM "bootstrapping" of system at power-on. ROM storage is 2708 compatible and may be reprogrammed by the user for custom applications.

12-inch, specially focused. P4 phosphor, non-glare screen.

25 lines x 80 characters per line.

8 x 8 character matrix on a 8 x 10 character field.

Light characters on a dark background. Blinking or non-blinking.

20 MHz.

Reversed image (block cursor).

Memory-mapped at 38 kilobaud. Serial transmission of data at rates up to 9600 bps.

Simplified RS-232 asynchronous. Parallel interface available.

Universal RS-232 asynchronous. Synchronous interface optional.

Printed circuit edge connector provided for connection of optional S-100 bus adaptor. Adaptor features internally mounted cardguide for up to one S-100 type accessory.

Enables display of all incoming and outgoing control codes.

Choice of even, odd, marking, or spacing.

Half or Full Duplex. One or two stop bits.

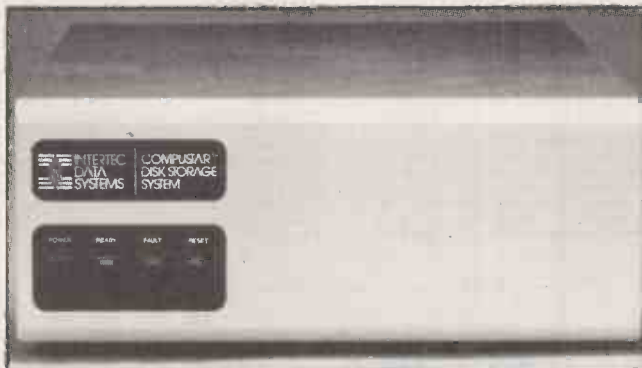
Direct positioning by either discrete or absolute addressing.



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 formator. 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 or 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!

WIDELY USED IN U.K./FRANCE/U.S.A. AND ENGLISH SPEAKING COUNTRIES FOR ITS OVERALL FLEXIBILITY AS A COMPLETE BUSINESS PACKAGE.



Our New CompuStar™ 10 Megabyte Disk Storage System (called a DSS) features an 8 inch Winchester drive packaged in an attractive, compact desktop enclosure. Complete with disk, controller and power supply. Just plug it into the Z80 adaptor of your SuperBrain and turn it on. It's so quiet, you'll hardly know it's there. But, you'll quickly be astounded with its awesome power and amazing speed. The secret behind our CompuStar DSS is its unique controller/multiplexor. It allows many terminals to "share" the resources of a single disk. So, not only can you use the DSS with your SuperBrain, you can configure multiple user stations using our new series of CompuStar™ terminals, called Video Processing Units or VPU's™.

The COMPUSTAR™ Family

VIDEO PROCESSING UNITS

Model 10 VPU

- 64K Internal Memory
- Integral CRT, CPU, & Keyboard
- Download programmable

Model 15 VPU (Universal Processing Unit)

- 64K Internal Memory
- Same features as VPU, less integral CRT and keyboard
- Can be used as a remote printer or a terminal interface device

Model 20 VPU

- 64K Internal Memory
- 350K Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

Model 30 VPU

- 64K Internal Memory
- 750K Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

Model 40 VPU

- 64K Internal Memory
- 1 1/2 MB Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

DISK STORAGE SYSTEMS (All feature our 255 user controller)

10 MB Winchester

- Shugart 8 inch mechanism
- Quiet, table-top operation
- Can be used with CompuStar or SuperBrain Video Terminals

32 MB Control Data CMD

- Cartridge Module Mechanism
- 16 MB fixed/16 MB removable
- Rack-mountable

96 MB Control Data CMD

- Cartridge Module Mechanism
- 80 MB fixed/16MB removable
- Rack-mountable

*** MAIN MENU DISPLAY ***

INCLUDES INVENTORY, DATABASE MANAGEMENT, INVOICING, MAILING ADDRESSES, STATEMENTS, SALES/PURCHASE LEDGER WITH OR WITHOUT AUTO STOCK UPDATE AND DOUBLE ENTRY JOURNALS INCLUDING NOMINAL LEDGER; PLUS A/C RECEIVABLE AND PAYABLE MAKING AUTO BANK ENTRIES.

- | | |
|--------------------------------|--------------------------------|
| 01 = ENTER NAMES AND ADDRESSES | 13 = PRINT CUSTOMER STATEMENTS |
| 02 = SALES INVOICES | 14 = PRINT SUPPLIER STATEMENTS |
| 03 = A/C RECEIVABLES | 15 = PRINT AGENT STATEMENTS |
| 04 = PURCHASE INVOICES | 16 = PRINT TAX STATEMENTS |
| 05 = A/C PAYABLES | 17 = RUN SEPARATE PROGRAMS |
| 06 = STOCK CONTROL | 18 = CHANGE VOCABULARY |
| 07 = ORDER CONTROL | 19 = PRINT YEAR AUDIT |
| 08 = BANK UPDATES | 20 = PRINT PROFIT/LOSS ACCOUNT |
| 09 = SALES LEDGERS | 21 = DISK DIRECTORIES |
| 10 = PURCHASE LEDGER | 22 = CASHFLOW FORECAST |
| 11 = INCOMPLETE RECORDS | 23 = PAYROLL (N/A AVAILABLE) |
| 12 = USER DATABASE AREA | 24 = DISK SWAP/EXIT SYSTEM |

WHICH OPTION

DATABASE FEATURES ARE:

WITHIN THE LIMITS OF TWELVE FIELDS AND 256 CHARACTERS PER RECORD, ANY FILE ARCHITECTURE CAN BE DESIGNED WITH COMPLETE FREEDOM OVER THE LINGUISTIC CONVENTIONS ASSIGNED TO EACH FIELD. THE FILE THEN CAN STORE 32000 RECORDS WHICH CAN BE SEARCHED BY THE RANDOM ACCESS NUMBER (RETRIEVED IN LESS THAN ONE SECOND) OR SEQUENTIALLY COMPARING FOR LEFT FIELD PARTS, FIELD-INKEYS; OR PARTS OF RECORD, AND THEN CHANGED, PRINTED, DELETED, SKIPPED.

GRAMA (WINTER) LTD/G.W. COMPUTERS LTD. ARE THE PRODUCERS OF THIS PACKAGE WHICH IS UNEQUALLED FOR ITS LEVEL OF TOTAL INTEGRATION, LINGUISTIC FLEXIBILITY AND MAXIMISED DISK/MEMORY CONSERVATION. AUTHOR TONY WINTER (M.D.; B.A.LIT; B.A.HON.PHIL; AND LECTURER)

PRICE OF PACKAGE IS 975.00 (EXCLUDING MENU ITEMS 19,20,22,23) OR 1075.00 FOR THE FULL PACKAGE (23 AVAILABLE END YEAR, 19,20,22 BEING CURRENTLY INCLUDED). REQUIRES MBASIC-80 AND RUNS ONLY ON HARDWARE ON OUR PRICE LIST.

DUE TO LONG TERM CONTRACTUAL COMMITMENTS, WE ARE ONLY GIVING RESTRICTED DEMONSTRATIONS BY APPOINTMENT AT ONE OF OUR LONDON OFFICES. WE EXPORT TO ALL COUNTRIES, TAKE AMEXCO, ACCESS AND BARCLAYCARD. CONTACT TONY WINTER ON 01.636.8210 OR 01.631.4818 AND IF UNAVAILABLE THEN LEAVE A CALL-BACK MESSAGE (CLEARLY STATING YOUR TELEPHONE NUMBER AND NAME) ON THE 24 HOUR ANSWER-PHONE, WE CALL BACK ANYWHERE IN THE WORLD.

WE EXPORT TO ALL COUNTRIES CALLERS ONLY BY APPOINTMENT
CONTACT TONY WINTER ON 01.636.8210

CORRESPONDENCE ONLY TO: 89 BEDFORD COURT MANSIONS, BEDFORD AVENUE, LONDON W.C.1.
NOTE!!! LEVEL 9.00 TOTALLY IN CORE PROGRAM LEAVES MASTER DRIVE FREE (SAVING OF 200 POUNDS HARDWARE).
IMPORTANT!!! NO HARDWARE IS ANY VALUE WITHOUT THE SOFTWARE, AND OUR SOFTWARE IS UNEQUALLED. WE GIVE YOU A DISCOUNT TO SET YOU GOING. JUST DECIDE ON THE SYSTEM YOU INTEND PURCHASING, AND TAKE 10% OF ITS VALUE OFF THE PRICE YOU WOULD HAVE TO PAY FOR THE SOFTWARE. YOU COULD GET THE SOFTWARE FREE WITH THE HARDWARE IF YOU CHOSE THE BEST SYSTEM WE SELL.

SUPERBRAIN *	SUPERBRAIN	COMPUSTAR *	COMPUSTAR	PRINTER *	PRINTER *	PRINTER
64K + 320 K DISK	1850.00	64K MDL 10 VPU	1595.00	OKI MICRO-80		395.00
64K + 700 K DISK	2195.00	64K MDL 15 PRNT	1495.00	CENTRONIC 737		425.00
64K + 1.5 M DISK	2795.00	64K MDL 20VPU	2295.00	EPSON MX80		395.00
EMULATOR TERML	495.00	64K MDL 30 VPU	2495.00	TEXAS 810		1395.00
INTERTUBE III TML	495.00	64K MDL 40 VPU	2795.00	DIABLO 630		1595.00
16 MEG CDC H.DISK	3950.00	10 MEG INTERTEC	2950.00	NEC 5530		1595.00
40 MEG CDC H.DISK	4750.00	32 MEG INTERTEC	7950.00	NEC 5510		1695.00
CORDLESS PHONES	135.00	96 MEG INTERTEC	8500.00	NEC 5525		1895.00
SHUGART DRIVES	95.00	BUS PROGRAM	975.00	QUME 5/55		1950.00
TRACTORS	150.00	BUS MANUAL	9.00	SHEET FEED		850.00
SHUGART 5 MEG DSK	1500.00	S100 CONTROLLER	750.00	CP.M (TM)		FREE.00
SYSTEM 1	3750.00	SYSTEM 2	5550.00	SYSTEM 3		7250.00
64K + 750 K DISK		64K + 5.3 M DISK		64K + 10.6 MEG		
CRT & S100 BUS		CRT & S100 BUS		CRT & S100 BUS		
IN 1 INTEGRAL UNJT		IN 1 INTEGRAL UNIT		IN 1 INTEGRAL UNIT		
MBASIC 80	150.00	FORTRAN-80	200.00	COBOL-80		320.00
CIS COBOL	420.00	PASCAL UCSD	275.00	WORD-STAR		195.00
MAIL MERGE	55.00	SUPER SORT	120.00	CBASIC		75.00
DATASTAR	190.00	BASCOMPILER	190.00	TEXTWRITER		75.00

OUR PRICE INCLUDES FREE: TRAINING SESSION. CABLES. EXTENDED WARRANTY IF REQD. CPM HANDBOOK. 10% OF HARDWARE PRICE OFF ANY SOFTWARE. DELIVERY. 6/12 MTH WARRANTY. RIBBONS & THIMBLES. BASIC MANUAL. 5/10/15/20 DISKS. 24/48 HOUR REPAIR. MANUALS. 2000 SHEETS PAPER.

IF YOU WISH TO MAKE THE WARRANTY TO 1 YEAR THEN ADD 5% OF HARDWARE COST. OTHERWISE NO MAINTENANCE SCHEDULE, SIMPLY ADD-HOC CHARGES AFTER WARRANTY EXPIRATION, SAME QUALITY SERVICE.

DUE TO LONG TERM CONTRACTUAL COMMITMENTS WE ARE ONLY ABLE TO GIVE RESTRICTED APPOINTMENTS AT ONE OF OUR LONDON OFFICES. CONTACT TONY WINTER ON TELS 01.636.8210 AND 01.631.4818. ALSO 24 HOUR ANSWER-PHONE. IF YOU JUST WANT LITERATURE THEN CLEARLY STATE YOUR NAME AND ADDRESS, WE WILL MAIL YOU A STANDARD INFORMATION PACK.

CALLERS ONLY BY APPOINTMENT AT ONE OF OUR LONDON OFFICES. TELS 01.636.8210 AND 01.631.4818 (TONY WINTER)



The Commodore PET offers you a safe passage through the primeval swamp of computerisation.



The miracle of microchip technology has made the main-frame computer seem like a dinosaur. But how many microcomputers will go the same way?

Without good software and support a micro-computer is less capable than your office calculator. So as competition grows amongst manufacturers in this industry, only those with the finest software and the best supporting facilities will survive.

SHARE A SECURE FUTURE WITH A COMMODORE PET

We at Commodore have been producing high technology

products for over 20 years. And unlike most other manufacturers of micro-computers, we make everything ourselves (including the silicon chips) to keep our costs to a minimum.

These cost savings are passed on to you in excellent value for money. So you can now buy a self-contained Commodore PET microcomputer for £450, or a complete business system (including Floppy Disk Unit and High Speed Printer) starting from as little as £2000.*

However, computer hardware can only be as good as the software available. That's why, to maintain our position as

Britain's most popular microcomputer, we have made sure that the quality and versatility of our software is second to none.

LARGEST, FINEST CHOICE OF SOFTWARE...

To complement our microcomputers, we have the finest and most comprehensive range of programs available in the U.K. today. This covers everything from such important business applications as Payroll, Stock Control, Accounting, Filing, Mailing; to our series in the field of Education. Each program is thoroughly tried, tested and tailored to BRITISH needs. You won't catch us palming you off with an irrelevant American version!

...AT SURPRISINGLY LOW PRICES

With over 30,000 Commodore PETs employed in Britain, the demand for programs is tremendous. And through mass-production we are able to keep our costs to you surprisingly low. So you can buy a Petpack program (on cassette) for between £5 and £50, while business programs (on disk) range from between £50 and £500.

OUR OWN UNIQUE TRAINING COURSES

Commodore programs are designed with operational simplicity in mind. Commands are in plain English and guidance is built into each package. So that even a stranger to computers can quickly feel at home with a PET.

Nevertheless, to maximise the potential of your Commodore system, you will find a certain amount of training of immense value. Of the well-known names in microcomputers, Commodore is the only one to offer a

range of training courses and seminars. And these have already proved of great benefit to thousands of PET users.

KEEP IN TOUCH WITH THE PET USERS' NEWSLETTER

Another unique way in which Commodore helps you get the most out of your microcomputer is by publishing the regular PET Users' Newsletter. For an annual subscription of only £10 you can keep up-to-date with developments and share new ideas and applications with over 3,000 PET users.

WORDPROCESSOR AS WELL AS COMPUTER

In addition to Commodore's own high quality range of hardware and software, there are compatible products of other manufacturers which have gained our official stamp of approval.



Look out for this sign.

You'll find it on such famous programs as WORDPRO and WORDCRAFT, which turn your PET into a first-class wordprocessor; as well as on hardware like the MUPET system, which allows a number of PETs to be run with a single, letter-quality printer.

PROFESSIONAL DEALER SUPPORT COUNTRYWIDE

When you consult a Commodore dealer, you won't find yourself talking to a typewriter salesman. Our dealers are qualified to examine your needs, and to demonstrate which hardware and software will suit you best. Trained engineers are at hand and a 24-hour field maintenance service is available countrywide.

LONDON AREA

Adda Computers Ltd,
W13, 01-579 5845
Advanced Management Systems,
EC2, 01-638 9319
C.S.S. (Business Equipment)
Ltd, E8, 01-254 9293
Centralex - London Ltd,
SE13, 01-318 4213
Computer Sales & Software
Centre Ltd,
ILFORD, 01-554 3344
Cream Computer Shop,
HARROW, 01-863 0833
Da Vinci Computer Shop,
EDGWARE, 01-952 0526
Henderson Bennett,
SE25, 01-654 5609
Home and Business Computers,
E12, 01-472 5107
L & J Computers,
NW9, 01-204 7525
Logic Box Ltd,
SW1, 01-222 1122
Merchant Systems Ltd,
EC4, 01-353 1464
Micro Computer Centre,
SW14, 01-878 7044
Micro-Facilities Ltd,
HAMPTON HILL, 01-979 4546
Sumlock Bondain Ltd,
EC1, 01-250 0505
Sumlock Bondain Ltd,
EC4, 01-626 0487

HOME COUNTIES

Millhouse Designs Ltd,
ALTON, 84517
H.S.V. Ltd,
BASINGSTOKE, 62444
MMS Ltd,
BEDFORD, 40601
D.D.M. Direct Data Marketing
Ltd, BRENTWOOD, 214168

Amplicon Micro Systems Ltd,
BRIGHTON, 562163
T & V Johnson (Microcomputers
Etc) Ltd, CAMBERLEY, 20446
Cambridge Computer Store,
CAMBRIDGE, 65334
Wego Computers Ltd,
CATERHAM, 49235
Dataview Ltd,
COLCHESTER, 78811
Amplicon Micro Systems Ltd,
CRAWLEY, 26493
S.M.G. Microcomputers,
GRAVESEND, 55813
South East Computers,
HASTINGS, 426844
Bromwall Data Services Ltd,
HATFIELD, 60980
Alpha Business Systems,
HERTFORD, 57425
Commonsense Business Systems
Ltd, HIGH WYCOMBE, 40116
Kingsley Computers Ltd,
HIGH WYCOMBE, 27342
Brent Computer Systems,
KINGS LANGLEY, 65056
Computopia Ltd,
LEIGHTON BUZZARD, 376600
South East Computers Ltd,
MAIDSTONE, 681263
J.R. Ward Computers Ltd,
MILTON KEYNES, 562850
Sumlock Bondain (East Anglia)
Ltd, NORWICH, 26259
T & V Johnson (Microcomputers
Etc) Ltd, OXFORD, 721461
C.S.E. (Computers),
READING, 61492
Slough Microshop,
SLOUGH, 72470
Business Electronics,
SOUTHAMPTON, 738248
H.S.V. Ltd,
SOUTHAMPTON, 22131
Super-Vision,
SOUTHAMPTON, 774023

Symtec Systems Ltd,
SOUTHAMPTON, 38868
Stuart R Dean Ltd,
SOUTHEND-ON-SEA, 62707
The Computer Room,
TUNBRIDGE WELLS, 41644
Orchard Computer Services,
WALLINGFORD, 35529
Photo Acoustics Ltd,
WATFORD, 40698
Microchips,
WINCHESTER 68085
P.P.M. Ltd,
WOKING, 80111
Petatec Electronic Services
Ltd, WOKING, 69032
Oxford Computer Systems,
WOODSTOCK, 812838

MIDLANDS & S. HUMBERSIDE

C.B.S. Consultants,
BIRMINGHAM, 772 8181
Computer Services Midlands
Ltd, BIRMINGHAM, 382 4171
Marchant Business Systems Ltd,
BIRMINGHAM, 706 8232
Micro Associates,
BIRMINGHAM, 328 4574
Peach Data Services Ltd,
BURTON-ON-TRENT, 44968
Jondane Associates Ltd,
COVENTRY, 664400
Davidson-Richards Ltd,
DERBY, 366803
Allen Computers,
GRIMSBY, 40568
Caddis Computer Systems Ltd,
HINCKLEY, 613544
Machsize Ltd,
LEAMINGTON SPA, 312542
Arden Data Processing,
LEICESTER, 22255

Roger Clark Business Systems
Ltd, LEICESTER, 20455
Low Electronics,
MATLOCK, 2817
A.J.R. Office Equipment Services
Ltd, NOTTINGHAM, 206647
Betos (Systems) Ltd,
NOTTINGHAM, 48108
PEG Associates (Computer
Systems Ltd), RUGBY, 65756
Walters Computer Systems Ltd,
STOURBRIDGE, 70811
System Micros Ltd,
TELFORD, 460214

YORK & N. HUMBERSIDE

Ackroyd Typewriter & Adding
Machine Co. Ltd,
BRADFORD, 31835
Microprocessor Services,
HULL, 23146
Holdene Ltd,
LEEDS, 459459
South Midlands Communications
Ltd, LEEDS, 782326
Yorkshire Electronics Services
Ltd, MORLEY, 522181
Computer Centre (Sheffield) Ltd,
SHEFFIELD, 53519
Hallam Computer Systems,
SHEFFIELD, 663125
Holbrook Business Systems Ltd,
SHEFFIELD, 484466

NORTH EAST

Currie & Maughan,
GATESHEAD, 774540
Elfton Ltd,
HARTLEPOOL, 61770
Dyson Instruments,
HETTON, 260452
Fiddes Marketing Ltd,
NEWCASTLE, 815157

Format Micro Centre,
NEWCASTLE 21093
Intex Datalog Ltd,
STOCKTON-ON-TEES, 781193

S. WALES & WEST COUNTRY

Radan Computational Ltd,
BATH, 318483
C.S.S. (Bristol) Ltd,
BRISTOL, 779452
T & V Johnson (Microcomputers
Etc) Ltd,
BRISTOL, 422061
Sumlock Tabdown Ltd,
BRISTOL, 276685
Sigma Systems Ltd,
CARDIFF, 34869
Reeves Computers Ltd,
CARMARTHEN, 32441
A.C. Systems,
EXETER, 71718
Milequip Ltd,
GLOUCESTER, 411010
Jeffrey Martin Computer Services
Ltd, NEWQUAY, 2863
Devon Computers,
PAIGNTON, 526303
A.C. Systems,
PLYMOUTH, 260861
J.A.D. Integrated Services,
PLYMOUTH, 62616
Business Electronics,
SOUTHAMPTON, 738248
Computer Supplies (Swansea),
SWANSEA, 290047

NORTH WEST & N. WALES

B & B (Computers) Ltd,
BOLTON, 26644
Tharstern Ltd,
BURNLEY, 38481

Megapalm Ltd,
CARNFORTH, 3801
Catlands Information Systems
Ltd, CHESTER, 46327
Catlands Information Systems
Ltd, WILMSLOW, 527166

LIVERPOOL

Aughton Microsystems Ltd,
LIVERPOOL, 548 7788
Stack Computer Services Ltd,
LIVERPOOL, 933 5511

MANCHESTER AREA

Byte Shop Computerland,
MANCHESTER, 236 4737
Computastore Limited,
MANCHESTER, 832 4761
Cytek (UK) Ltd,
MANCHESTER, 872 4682
Executive Reprographic Ltd,
MANCHESTER, 228 1637
Professional Computer Services
Ltd, OLDHAM, 061-624 4065

SCOTLAND

Gate Microsystems Ltd,
DUNDEE, 28194
Holdene Microsystems Ltd,
EDINBURGH, 668 2727
Gate Microsystems Ltd,
GLASGOW, 221 9372
Robox Ltd,
GLASGOW, 8413
Thistle Computers (Macmicro),
INVERNESS, 712774
Ayrshire Office Computers,
KILMARNOCK, 42972
Thistle Computers,
KIRKWALL, 3140

N. IRELAND

N. Ireland Computer Centre,
HOLLYWOOD, 6548

This list covers dealers participating in our advertising. *Prices quoted ex. VAT.

For your free literature pack send off the coupon to the address below.

Name _____ Position _____

Address _____

Intended application _____

Commodore

Commodore Information Services, 818 Leigh Road, Slough, Berks. SL1 4BD

VERSATILITY

is the

VERSATILITY

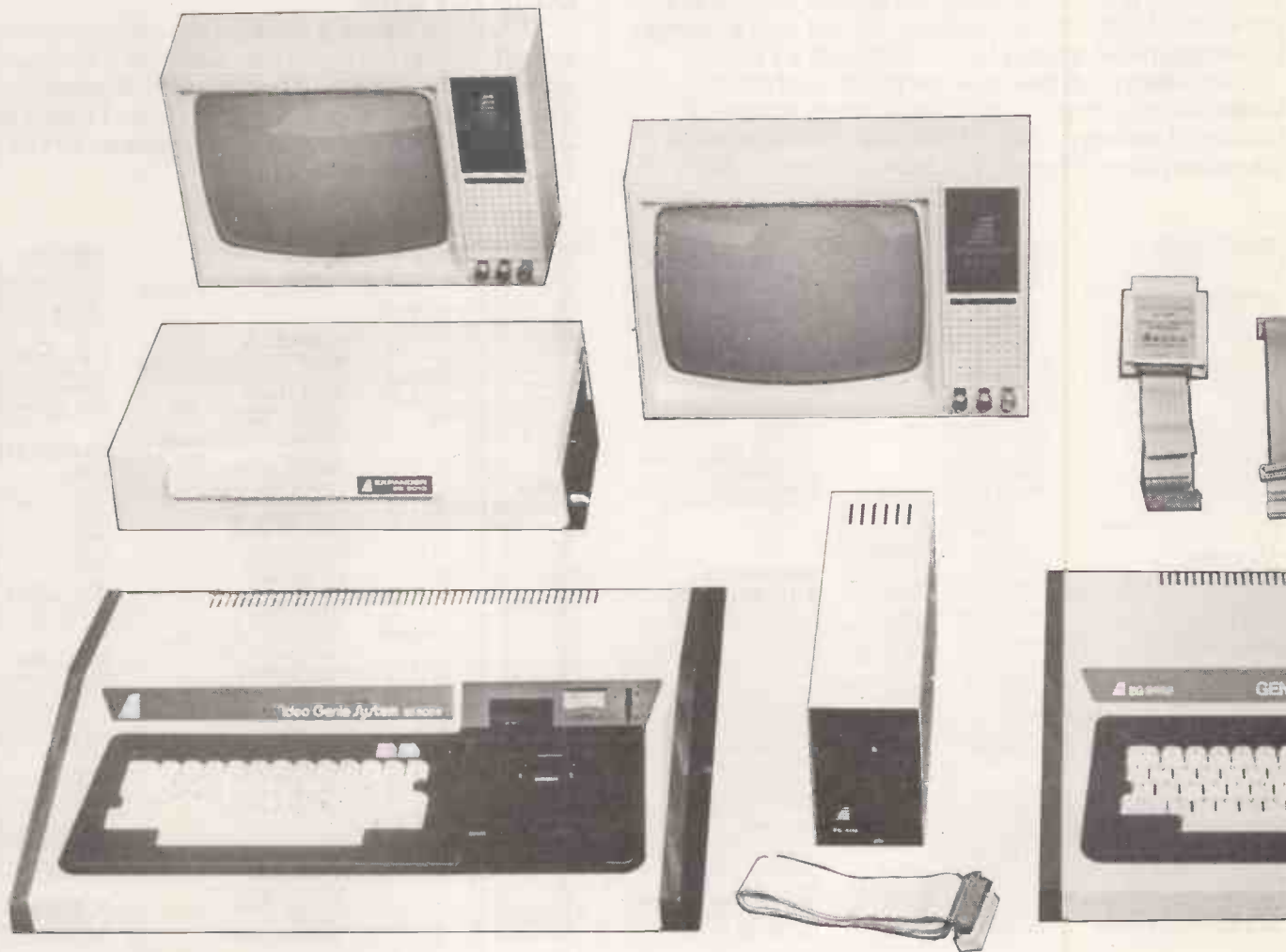
All computer systems are versatile, some however are more expandable and adaptable than others. The video Genie System now has a full range of expansion peripherals available at your dealer.

SOFTWARE

A computer is useless without software, the Video Genie System utilises the renowned Microsoft Level II BASIC and is software compatible with the TRS-80 level II. Thus a huge range of programs are available from many sources to further enhance the versatility of the system.

EXPANDABILITY

Many items not shown are also available to match the Video Genie System, send for full details, or better still, visit your local dealer and ask him about the exciting new Genie II!



ILLUSTRATED

693003 Computer system £325.00, 693013 expansion box (without RS232) £195.00, 69100 12" monitor £69.00, 69101 12" green tube monitor £79, 69400 single disk drive £225.00, 693016 printer lead £ The new Genie II 693016 printer interface £35.00, 693018C quad disk cable, 693015 32K RAM card (S100)

ALL PRICES ARE RECOMMENDED RETAIL EXCLUDING VAT

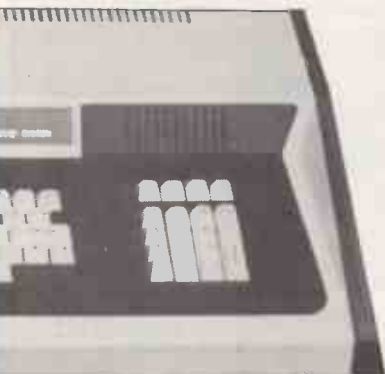
LOWE ELECTRONICS

CHESTERFIELD ROAD, MATLOCK, DERBYSHIRE

KEY

Dealers

AVON Microstyle	Bath	0225 334659/ 319705	LONDON (WEST) Ecobits	Shepperton	09322 20826
BEDFORD Computopia Comserve Cavern Electronics	Leighton Buzzard Bedford Milton Keynes	0525 37660 0234 216749 0908 314925	NORTH EAST 3-Line Computing Derwent Radio Briers Computer Services General Northern Microcomputers	Hull Scarborough Middlesbrough Hartlepool	0482 859169 0723 65936 0642 242017 0783 863871
BERKSHIRE P. C. P.	Reading	0734 589249	NORTHANTS Arden Data Processing	Peterborough	0733 49577
BUCKS Photo Acoustics	Newport Pagnell	0908 610625	NOTTS University Radio Stores Midland Microcomputers East Midland Comp. Services	Nottingham Nottingham Arnold	0602 45466 0602 298281 0602 267079
CAMS Cambridge Micro Computers	Cambridge	0223 314666	NORFOLK Anglia Computer Centre	Norwich	0603 29652
CHESHIRE Hewart Electronics	Macclesfield	0625 22030	OXFORD Magnus Microcomputers	Kidlington	08675 6703
CUMBRIA Kendal Computer Centre	Kendal	0539 22559	SCOTLAND Computer and Chips Scotbyte Computers Esco Computing Silicon Centre	St. Albans Edinburgh Glasgow Edinburgh	0334 72569 031 343 1005 041 204 1811 031 332 5277
DERBYS. Kays Electronics T. Crossley Lowe Electronics	Chesterfield Chesterfield Matlock	0246 31696 0246 850357 0629 4995	SOUTH Catronics Gemsoft Castle Electronics Gamer	Wallington Woking Hastings Brighton	01 669 6700/1 04862 22881 0424 437875 0273 698424
DORSET Blandford Computers	Blandford Forum	0258 53737	SOUTH WEST Diskwise Ltd. Electrosure	Callington Exeter	05793 3780 0392 56280 56687
ESSEX Emprise Compuskill Infolab	Colchester Romford Chelmsford	0206 865926 0708 751906 0245 357111	West Devon Electronics	Yeiverton	082 285 3434
GLOS. MPL Computers Petrie Systems	Cheltenham Cheltenham	0242 582090 0242 584060	SUFFOLK Rebvale Computers Marshlon Electronics Microtek	Bury St. Edmunds Ipswich Ipswich	095 381 316 0473 75476 0473 50152
HERTS Photo Acoustics Watford Electronics	Watford Watford	0923 406698 0923 40588/ 37774	SUSSEX Nestra Electronics	Chichester	0243 512861
Q Tek Systems Comp Shop	Stevenage New Barnet	0438 65385 01 441 2922	WALES MRS Communications Morrison Computer Centre Tryfan Computers	Cardiff Swansea Bangor	0222 616936/7 0792 795817 0248 52042
KENT Matrix Computer Systems	Beckenham	01 658 7508/ 7551	WEST MIDLANDS Ward Electronics Allen TV Services Microprint	Birmingham Stoke on rent Stoke on Trent	021 554 0708 0782 616929 0782 48348
Optelco Business Systems Thanet Electronics The Computer Room SMG Microcomputers	Rayleigh Hempstead Herne Bay Tunbridge Wells Gravesend	0268 774089 0635 362652 02273 63859 0892 41645 0474 55813	YORKS Advance TV Services Amateur Radio Shop Thomas Wright Allan M. Plainer Ltd. Quadrapphenia Scene and Heard Spot Computer Systems Photo Electrics	Shipley Huddersfield Bradford Leeds Sheffield Hallifax Doncaster Sheffield	0274 585333 0484 20774 0274 663471 0532 688397 0742 77824 0422 59116 0302 25159 0742 538 65
LANCS Microdigital Micro Peripherals	Liverpool Burnley	051 227 2535 0282 32209/ 53629	EIRE Compshop D.B. Microcomputers	Dublin Limerick	74933 061 42733
Leisurronics Harden Microsystems ABC Supplies HR Control Systems Computercat Micro Chip Shop Micro Chip Shop	Blackpool Blackpool Levenshulme Chorley Leigh Fleetwood Preston	0253 27091 0253 27590 061 431 9265 02572 75234/5 0942 601818 03917 79480 0722 22669 79511	NORTHERN IRELAND Business Electronic Equipment	Belfast	0232 46161
Micro Chip Shop Sound Service	Blackpool Burnley	0253 403 122 0282 38481	JERSEY G.B. Organs St. Saviour		0534 26788/ 23564
LEICS Eley Electronics Arden Data Processing Kram Electronics	Leicester Leicester Anstey	0533 871522 0533 22255 053721 3575	Stop press Crodon Computer Centre, 01-689 1280; CSSC 01-554 3344; Electric Servicing Co. 0602 783938; Henry's Radio 01-402 6822; Interface Components Ltd. 02403 22307; Mansfield Computer & Electronics 0623 31202; Tarrant Electronics 0952 812134.		
LONDON (CENTRAL) Sumlock Bondain, EC1	London	01-250 0505			
LONDON (NORTH) Radio Shack NW6 Comp. Shop, 311 Edgware Rd. Chromasonic Electronics, N19 Davinci Computers, Edgware Comp Shop, New Barnet NI, Tottenham	London London London London London London	01-624 7174 01 262 0387 01 833 3705 01 952 0526 01 441 2922 01 808 0377			



EUROPE'S LARGEST SELECTION OF MICROCOMPUTER SOFTWARE, BOOKS AND MAGAZINES FOR THE HOBBYIST, EDUCATIONALIST, PROFESSIONAL AND RETAILER

BOOKS

BY OSBORNE

Introduction to Microcomputer Series	
Vol 0: Beginners Book	£5.95
Vol 1: BASIC Concepts	£8.25
Vol 2: Some Real Microprocessors	£18.95
Vol 2: Updating supplement set Nos. 1-6	£18.95
Vol 3: Some Real Support Devices	£11.95
Vol 3: Updating supplement set Nos. 1-6	£18.95
1 Updating supplement (Specify for Vol 2 or 3)	£4.00
PET and the IEEE 488 (GPIB) Bus	£9.95
6800 Programming for Logic Design	£6.30
8080 Programming for Logic Design	£6.30
Z80 Programming for Logic Design	£6.30
Z80 Assembly Language Programming	£10.75
Z8000 Assembly Language Programming	£13.50
6502 Assembly Language Programming	£10.75
8080A/8085 Assembly Language Programming	£7.95
6800 Assembly Language Programming	£7.95
6809 Assembly Language Programming	£12.25
Accounts Payable and Accounts Receivable	£13.50
Payroll with Cost Accounting	£13.50
General Ledger	£13.50
Some Common BASIC Programs	£8.95
Practical BASIC Programs	£9.25
8089 I/O Processor Handbook	£4.50
The CRT Controller Handbook	£4.50
The 68000 Microprocessor Handbook	£4.00
Apple User's Guide	£TBA
CP/M User's Guide	£TBA
16 Bit Microprocessor Handbook	£13.25
8086 Book	£11.25

GENERAL

See Magazines and Subscriptions!		See Osborne Books!	
Microprocessors from Chips to Systems			£7.90
Microprocessor Interfacing Techniques			£10.60
IC OP-AMP Cookbook			£8.95
RTL Cookbook			£4.25
Ciarcias Circuit Cellar			£5.50
Buyers Guide to Microsoftware			£2.40
Calculating with BASIC			£4.95
Computer Programs that Work (in BASIC)			£3.95
Dr Dobbs Journal Volume 1			£13.95
Dr Dobbs Journal Volume 2			£13.95
Dr Dobbs Journal Volume 3			£13.95
Best of Byte			£8.95
Scelbi BYTE Primer			£8.95
Best of Creative Computing, Vol 1			£6.95
Best of Creative Computing, Vol 2			£6.95
Program Design			£4.25
Programming Techniques: Simulation			£4.25
Numbers in Theory and Practice			£5.50
PIMS—A Database Management System			£6.50
Best of Interface Age—Software			£9.95
Programming the Z8000			£10.55
CPM Handbook			£9.45
K2 FDOS			£13.95
Microsoft BASIC University Software Inc., Listings:			
Home and Economics Programs			£15.00
Education and Scientific Programs			£20.95
Small Business Programs			£29.50

FOR THE Z80

See Osborne Books!	
Z80 Instruction Handbook (Wadsworth)	£3.25
Programming the Z80 (Zacs)	£10.05
Z80 Software Gourmet Guide and Cookbook	£9.30
32 BASIC Programs for the TRS-80 (Level II) 16K	£10.10
Introduction to the T-Bug (Guide to TRS-80 Machine Language Monitor)	£4.50
30 Programs for the Sinclair ZX80	£6.95
Z80 Microcomputer handbook	£7.50

FOR THE 6800

See Magazines and Subscriptions!		See Osborne Books!	
6800 Software Gourmet Guide and Cookbook			£7.15
6800 Tracer—An aid to 6800 Program Debugging			£3.95
Tiny Assembler			£5.75
RA 6800 ML—An M6800 Relocatable Macro Assembler			£15.95
Link 68—An M6800 Linking Loader			£5.50
MONDEB—An Advanced M6800 Monitor Debugger			£3.50

CONCERNING LANGUAGE

A Practical Introduction to PASCAL	£3.95
The PASCAL Handbook	£10.05
Beginners guide to UCSD PASCAL	£7.50
Introduction of PASCAL (Including UCSD PASCAL)	£9.10
BYTE Book of PASCAL	£16.25
SCELBAL—BASIC Language Interpreter (Source Code)	£10.00
Instant BASIC	£7.50
BASIC BASIC	£6.50
Advanced BASIC	£6.00
Users Guide to North Star BASIC	£10.00
Microsoft BASIC (a guide)	£6.50
Secret Guide to Computers	£4.00
Fifty BASIC Exercises	£9.10

FOR THE 6502

See Magazines and Subscriptions!	
Best of Micro, Vol 2	£5.50
Programming the 6502 (Zacs)	£9.10
6502 Applications	£9.10
6502 Software Gourmet Guide and Cookbook	£7.25
The PET Revealed	£10.00
Library of PET Subroutines	£10.00
32 BASIC Programs for the PET	£10.10
First Book of KIM	£7.00
PET/CBM Personal Computer Guide (2nd edition)	£10.00

FOR THE 8080

See Osborne Books!	
8080 Hex Code Card	£1.95
8080 Octal Code Card	£1.95
8080 Software Gourmet Guide and Cookbook	£7.15
8080/8085 Software Design	£6.75
8080 Standard Monitor	£8.95
8080 Standard Assembler	£8.95
8080 Standard Editor	£8.95
8080 Special Package: Monitor, Editor, Assembler	£20.00
BASEX: A simple Language and Compiler for the 8080	£5.50

FOR FUN

BASIC Computer Games	£5.00
More BASIC Computer Games	£5.50
8080 Galaxy Game	£6.95
SUPER-WUMPUS—A Game in 6800 Assembler Code & BASIC	£4.25
Computer Music Book	£6.75
Computer Rage (a Board Game)	£6.95
Introduction to TRS-80 Graphics	£5.75
Take My Computer Please . . . (Fiction)	£3.25
Introduction to Low Resolution Graphics for PET, Apple TRS-80	£5.50
Starship Simulation	£4.50
Microsoft BASIC: University Software Inc., Listings:	
Fun and Games Programs 1	£9.50
Fun and Games Programs 2	£9.50
6502 Games	£9.10

FOR THE NOVICE

See Magazines and Subscriptions!		See Osborne Books!	
Getting Down to Business with Your Microcomputer			£5.50
Getting Involved with Your Own Computer			£6.50
How to Profit from Your Personal Computer			£5.50
Microcomputer Potpourri			£1.95
Hobby Computers are Here			£3.00
New Hobby Computers			£3.00
Understanding Microcomputers and Small Computer Systems			£6.95
Understanding Microcomputers and Small Computer Systems and Audio Cassette			£8.75
How to Make Money with Your Microcomputer			£5.75
From the Counter to the Bottom Line			£10.00
Buying a Business Computer			£9.75
You Just Bought a Personal What?			£7.95

MAGAZINES

MAGAZINE SUBSCRIPTIONS (all processed within 3 weeks)	
Micro 6502 Journal (12 issues)	£14.50
68 Micro (12 issues)	£18.00
Personal Computing (12 issues)	£18.00
Interface Age (12 issues)	£25.50
Dr Dobbs Journal (12 issues)	£16.00
Recreational Computing (6 issues)	£11.50
BYTE (12 issues)	£33.00
Creative Computing (12 issues)	£22.00
Kilobaud Microcomputing (12 issues)	£26.00
Compute for the 6502 (12 issues)	£22.00
80' Microcomputing (12 issues)	£25.00
S-100 Microsystems (for CPM users) (6 issues)	£10.50

MAGAZINE BACK ISSUES

Micro 6502 Journal	£1.75
Personal Computing	£1.95
Interface Age	£2.95
Dr Dobbs Journal	£1.95
Computer Music Journal	£3.75
Recreational Computing	£1.95
BYTE	£3.25
Creative Computing	£1.95
Calculators and Computers	£1.95
Kilobaud Microcomputing	£3.25
Compute—for the 6502	£2.25
68' Micro	£1.95
80-Microcomputing	£2.95
On Computing	£1.95
S-100 Microsystems	£1.95
Magazine Storage Box (holds 12)	£2.00

BYTE NIBBLE REPRINTS:

a) A TMS-9900 Monitor	£3.50
b) BASIC Cross-Reference Generator	£1.25
c) A Micro Word Processor	£4.50
d) 'Tiny' PASCAL in 8080 Assembly Language ('e needed to use this)	£13.00
e) A 'Tiny' PASCAL Compiler	£13.50
f) An APL Interpreter in PASCAL	£13.00
g) Computer Assisted Flight Planning	£2.35
h) Computerized Wine Cellar	£2.00
i) The Design of an M6800 Lisp Interpreter	£13.00

8-11 CAMBRIDGE HOUSE, CAMBRIDGE ROAD, BARKING, ESSEX IG11 8NT, ENGLAND.
Telephone: 01-591 6511 Telex: 892395

SOFTWARE

		Software & Manual	Manual Only
Byrom Software	BSTAM—Utility to link one microcomputer to another also using BSTAM BSTMS—Utility to link a micro to a mini or mainframe	£95/5	£95/10
Compiler Systems	CBASIC v2.07	£65/15	
Computer Plus	FMS 80 (File Management System)	£395/25	
CP/M User Library	42 Volumes—Price per volume 8" disc (one volume per disc) 5" disc (one volume per 2 discs) Index	£4 £8 £1	
Creative Computing	CS-9001 BASIC Games 1 CS-9002 BASIC Games 2 CS-9000 BASIC Games 1 and 2 CS-9003 ADVENTURE I.O. CS-9004 BILINGUAL Original Adventure CS-9005 BASIC Games 3 CS-9006 BASIC Games 4 CS-9007 BASIC Games 3 and 4 CS-9008 BASIC Games 1, 2, 3 and 4	£12 £12 £22 £12 £12 £12 £22 £40	
Digital Research	(Most formats now available) MPM 1.1 CP/M86 CP/M 2.2 CP/NET SID ZSID MAC TEX DESPOOL PL/1	£175/18 £145/25 £90/18 £110/12 £45/12 £55/12 £55/12 £45/12 £30/5 £325/25	
Information Unlimited	WHATSIT (Database Management System) on North Star on CP/M on APPLE 2:48k (requires int Basic) on APPLE 2:32k (requires int Basic) on ITT 2020 (see Apple)	£59 £75 £72 £59	
KLH Systems	Spooler for CPM systems v3.0	£65/5	
MPI Ltd.	Multiforth OMNIX—UNIX like multiuser, multitasking operating system for Z80 i.e. IMS, Cromemco PAYROLL	£65/20 £495/30 £500/15	
Micah Inc.	CP/M for CDOS Users: Program to Expand CP/M system to be compatible with Cromemco CDOS software	£59/5	
Michael Shryer Inc.	Electric Pencil Word Processor SSII for tty etc DSII for Diablo TRS-80 Cassette/disc	£100 £100 £105 £50	
Microfocus Ltd.	CIS COBOL version 4.3 FORMS 2	£425/25 £100/10	

		Software & Manual	Manual Only
Micropro Inc.	WORD-MASTER 1.7A TEX-WRITER 2.6 WORD-STAR 2.25 MAIL-MERGE 2.25 WORD-STAR with MAIL-MERGE SUPER-SORT: Version 1 Version 2 DATASTAR 1.1	£70/20 £35/15 £240/35 £70/10 £310/45 £120/20 £100/20 £185/20	
Microsoft Inc.	BASIC-80 BASIC Compiler 5.24 FORTRAN-80 3.42 COBOL-80 4.3 M/SORT 1.0 EDIT-80 2.0 MACRO-80 3.42 MICROSEED MULISP MUMATH 2.02 XMACRO-86 XFORTRAN-86	£175/17 £195/17 £220/17 £355/17 £70/11 £45/11 £80/11 £TBA/20 £TBA/20 £140/20 £185/11 £410/17	
Microtech Exports	Reformatter CPM ↔ IBM CPM ↔ DEC	£95/15 £95/15	
MT Microsystems	Pascal MT 5.2 Library Sources Softbus	£150/20 £100/ £105/	
Northshare	Multi-user system for Horizon Users 5.2	£40/5	
Osborne & Associates	Accounts Payable & Accounts Receivable General Ledger Payroll with Cost Accounting	£50/14 £50/13 £50/14	
Phoenix Software Associates (For Z80 only)	PLINK—Disc to disc link loader PASM—Macro assembler PEDIT—Line editor with Macros BUG—Very powerful debug Package with all the above	£65/15 £65/15 £65/15 £65/15 £175/30	
Structured Systems (All Converted to UK Standard)	Sales Ledger Purchase Ledger Nominal Ledger Stock Control Letterright Analyst (File management Reporting System) NAD (Name and Address selection system) OSORT	£350/15 £350/15 £350/15 £350/15 £95/10 £115/10 £50/10 £50/10	
Supersoft Inc.	DIAGNOSTICS 1 DIAGNOSTICS 2 TERM	£40/7 £50/7 £65/5	
TDL Software (Technical Design Labs)	Business Basic ZTEL (Text Editing Lang.) MACRO II (Z80 Macro Assembler) LINKER DEBUG II (for 8080/Z80)	£80 £35 £35 £35 £45	
Tiny-C Associates	Tiny-C language for 8080, 8085, Z80 systems	£50/35	

• Circle No. 108

ORDER INFORMATION

Software prices reflect distribution on 8" single density discs. If a format is requested which requires additional discs a surcharge of £4 per additional disc will be added.

Please add £3.00 for postage, packing and insurance plus VAT on ALL software items (including manuals) purchased. For overseas please add £4.50 per item.

If required, 'OVERNITE' service is available for an extra charge of £8.50.

Most software on this Advertisement is available from stock and a 72-hour return service is thereby offered on most prepaid orders. When ordering CP/M software please specify the format you require otherwise software will be dispatched on an 8" single density disc.

For more information on any of these items, please phone, write or visit. (We are open during office hours).

All publications are published in the U.S.A. and are stocked in Britain by L.P. Enterprises: M.P.I. Ltd.

We aim to keep all of these books in stock and as a result of this most mail orders are despatched by return of post.

MAIL ORDER TELEPHONE ORDER VISIT

Send Cash, Cheque, Postal Order, IMO, ACCESS or Barclaycard number to Microcomputer Products International Ltd, Room P.C. 11 Cambridge House, Cambridge Road, Barking, Essex IG11 8NT.

All Payment must be in sterling and drawn against a UK bank.

Subscriptions are processed to start with the next current issue, after the date of order.

Please add £0.75 for postage on EACH book ordered.

These details are all current as of April 1981.

Prices are subject to change without notice, due to fluctuation in the dollar rate.

Catalogue £1.00, deducted from your first purchase.

OEM
terms
available

ELECTRONIC GAMES

COLOUR CARTRIDGE T.V. GAME



SEMI-PROGRAMMABLE T.V. GAME
+ 4 Cartridges + Mains Adaptor
Normal Price £73
NOW REDUCED TO: £39.50
inc. VAT

DATABASE T.V. GAME



FULLY PROGRAMMABLE CARTRIDGE T.V. GAME
14 Cartridges available
Normal Price £87.86
NOW REDUCED TO: £59
inc. VAT

ATARI T.V. GAME



The most popular T.V. Game on the market with a range of over 40 cartridges including SPACE INVADERS with over 112 games on one cartridge.
£95.45
inc. VAT

SPACE INVADERS



Hand-held Invaders Games available £19.95
+ Invaders Cartridges available to fit ATARI/RADOFIN/ACETRONIC/PHILIPS G7000
+ Cartridges also available for MATTEL/TELENG/ROWTRON/DATABASE/INTERTON

CHESS COMPUTERS



MANY UNITS ARE COVERED BY THE EXCLUSIVE SILICA SHOP 2 YEAR GUARANTEE

We carry a range of over 15 different Chess computers:
Electronic Chess £29.95
Chess Traveller £39.95
Chess Challenger 7 £79.00
Sensory 8 £119.00
Sensory Voice £259.00
SPECIAL OFFERS:
VOICE CHESS CHALLENGER
Normal Price £245 NOW £135.00
SARGON 2.5/BORIS 2.5
Normal Price £273.70 NOW £199.95
All prices include V.A.T.

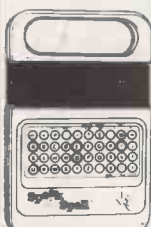
TELETEXT



ADD-ON ADAPTOR £199

THE RADOFIN TELETEXT ADD-ON ADAPTOR
Plug the adaptor into the aerial socket of your colour T.V. and receive the CEEFAX and ORACLE television information services.
THIS NEW MODEL INCORPORATES:
+ Double height character facility
+ True PAL Colour
+ Meets latest BBC & IBA broadcast specifications
+ Push button channel change
+ Unnecessary to remove the unit to watch normal TV programmes
+ Gold-plated circuit board for reliability
+ New SUPERIMPOSE News Flash facility

SPEAK & SPELL



Normal Price £49.95
NOW REDUCED TO:
£39.50 inc. VAT
Teach your child to spell properly with this unique learning aid. Fully automatic features and scoring. Additional word modules available to extend the range of words.

ADDING MACHINE OLYMPIA HHP 1010



Normal Price £57.21
NOW REDUCED TO:
£34 inc. VAT
Uses ordinary paper! No need to buy expensive thermal paper!
Fast adding PRINTER/CALCULATOR. 2 lines per second. 10 digit capacity. Uses normal adding machine rolls. Battery or mains operated.
Size 9 1/4" x 4 1/4" x 2 1/4"
(Mains adaptor extra)

24 TUNE ELECTRONIC DOOR BELL



Normal Price £19.70
NOW REDUCED TO:
£12.70 inc. VAT
Plays 24 different tunes with separate speed control and volume control. Select the most appropriate tune for your visitor, with appropriate tunes for different times of the year!

MATTEL T.V. GAME



The most advanced T.V. game in the world. 20 cartridges available. Add-on KEYBOARD coming soon to convert the MATTEL to a home computer with 16K RAM, fully expandable and programmable in Microsoft Basic. Other accessories will be available later in the year.
£199.95 inc. VAT

HAND HELD GAMES EARTH INVADERS



These invaders are a breed of creature hitherto unknown to man. They cannot be killed by traditional methods — they must be buried. The battle is conducted in a maze where squads of aliens chase home troops. The only way of eliminating them is by digging holes and burying them.
£23.95 inc. VAT

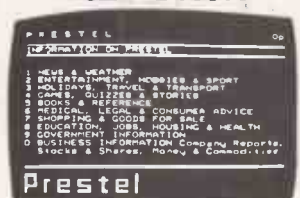
THE OLYMPIA — POST OFFICE APPROVED TELEPHONE ANSWERING MACHINE WITH REMOTE CALL-IN BLEEPER

This telephone answering machine is manufactured by Olympia Business Machines, one of the largest Office Equipment manufacturers in the U.K. It is fully POST OFFICE APPROVED and will answer and record messages for 24 hours a day. With your remote call-in bleeper you can receive these messages by telephone wherever you are in the world. The remote call-in bleeper activates the Answer/Record Unit, which will at your command repeat messages, keep or erase them, and is activated from anywhere in the world, or on your return to your home or office. The machine can also be used for message referral, if you have an urgent appointment, but are expecting an important call, simply record the 'phone number' and location where you can be reached. With optional extra



bleepers (£13 each) this facility can be extended to colleagues and members of the family. Using a C90 standard cassette you can record as many as 45 messages. The announcement can be up to 16 seconds long and the incoming message up to 30 seconds long. The machine is easy to install and comes with full instructions. It is easily wired to your junction box with the spade connectors provided or alternatively a jack plug can be provided to plug into a jack socket. Most important, of course, is the fact that it is fully POST OFFICE APPROVED. The price of £135 (inc. VAT) includes the machine, an extra-light remote call-in bleeper, the microphone message tape, A/C mains adaptor. The unit is 9 3/4" x 6" x 2 1/2" and is fully guaranteed for 12 months. The telephone can be placed directly on the unit — no additional desk space is required.
£135 inc. VAT

PRESTEL VIEWDATA

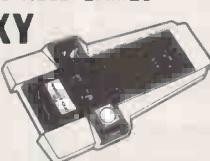


The ACE TELCOM VDX1000 Prestel/Viewdata adaptor simply plugs into the aerial socket of your television and enables you to receive the Prestel/Viewdata service in colour or black & white.
Features:
— Simplified controls for quick, easy operation
— Special graphics feature for high resolution
— State-of-the-art microprocessor controller
— Standard remote telephone keypad with Prestel keys - #
— Auto dialler incorporated for easy Prestel acquisition
— True PAL colour encoder using reliable IC — chroma filter and delay line incorporated for minimum picture interference/maximum fidelity
— Includes convenient TV — Prestel switchbox
— Easily connected to standard home or office telephone lines
— Fully Post Office approved

SPECIAL PRICE £228.85 inc. VAT

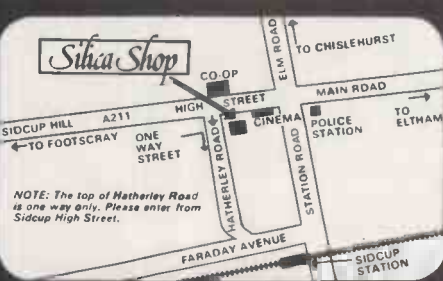
HAND HELD GAMES GALAXY 1000

GALAXY 1000

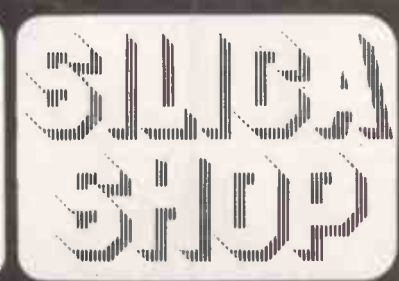


The 2nd generation Galaxy Invader. The invaders have re-grouped and have a seemingly endless supply of spacecraft whilst the player's arsenal is limited to just 250 missiles to be launched from 3 missile stations. You have to prevent the invaders landing or from destroying your home defences.
£19.95 inc. VAT

FOR FREE BROCHURES — TEL: 01-301 1111



For free illustrated brochure and reviews on our range of electronic games, please telephone 01-301 1111. Free delivery service available. To order by telephone please quote your name, address and ACCESS-BARCLAYCARD number and leave the rest to us. Post and packing Free of Charge Express 48hr delivery service available.
* CALLERS WELCOME — Demonstrations daily at our Sidcup shop, open from 9am-6pm, Monday-Saturday (Early Closing Thursday 1pm — Late Opening Friday 8pm)
* 2 YEAR GUARANTEE — All goods are covered by a full year's guarantee and many are further covered by our exclusive Silica Shop 2 year Guarantee.
* MONEY BACK UNDERTAKING — If you are unsatisfied with your purchase and return it within 7 days we will give you a full refund.
* AFTER SALES SERVICE — Available on all machines out of guarantee.
* COMPETITIVE PRICES — We are never knowingly under-sold.
* HELPFUL ADVICE — Available on the suitability of each machine.
* CREDIT FACILITIES — Full credit facilities available over 12, 24 or 36 months at competitive rates of interest.
* PART EXCHANGE SCHEME — available on second hand machines.
* CREDIT CARDS WELCOME — Access Barclaycard, Diners Club, American Express
SILICA SHOP LIMITED
1-4 The Mews, Hatherley Road, Sidcup, Kent DA14 4DX
Telephone: 01-301 1111 or 01-309 1111



Your search for the right price stops here.



Pet

Well known for making short work of accounting, word processing, mailing lists. A great buy from NSC.



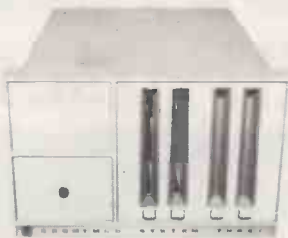
Apple

You know what the Apple system will do but you don't know the deal we're offering. Come and see for yourself.



Rair

The exciting new 3/30 system offering 5 mb of fixed disc storage on brand new 5¼" Winchester drives. 64K Machine £4,313 incl. VAT. Full range of black box systems available. Rental terms available.



Cromemco

We can now supply the Cromix operating system for single and multi user working. The first big system operating system to be offered on a small system—the only system which offers up to 63K memory space per user.



Acorn Atom

Now available ex-stock. Special offer to ZX80 owners: We will take your ZX80 in part exchange for an Atom.

Used Bargain: Second hand ZX80's from £50.



North Star Horizon

A complete word processing system extendible from 32K-56K RAM, with up to four mini disc drives, 4MHz Z80A processor, serial and parallel I/O ports and extended BASIC. Full range of accounting packages available. You can lease this very popular system for as little as £25 per week.

Bargain Offers



South West Technical Products

56K 6809 based system, with twin 8" disc drives and Centronics 779 printer. From £3,163 incl. VAT, while stocks last. Keenest prices around on individual boards and peripherals.

48K Apple for £695

Buy a 16K Apple from NSC Computer Shops now and get 32K FREE.

After Sales Service

When you buy from NSC Computer Shops you have the opportunity to take advantage of a special service contract on favourable terms.

Order by post with confidence

Instead of calling personally at NSC Computer Shops you can send cash with order. Orders are despatched by carrier, please telephone for details of delivery charges.

BOOKS: Send s.a.e. for our full price list, or call in at our shop to see our wide range of publications.

Most of our prices are heavily discounted and therefore payment must accompany the order. Credit card payments will be accepted. Please quote credit card number and type of card.

WE WILL NOT BE KNOWINGLY UNDERSOLD.

NSC COMPUTER SHOPS

Computing to suit your size.

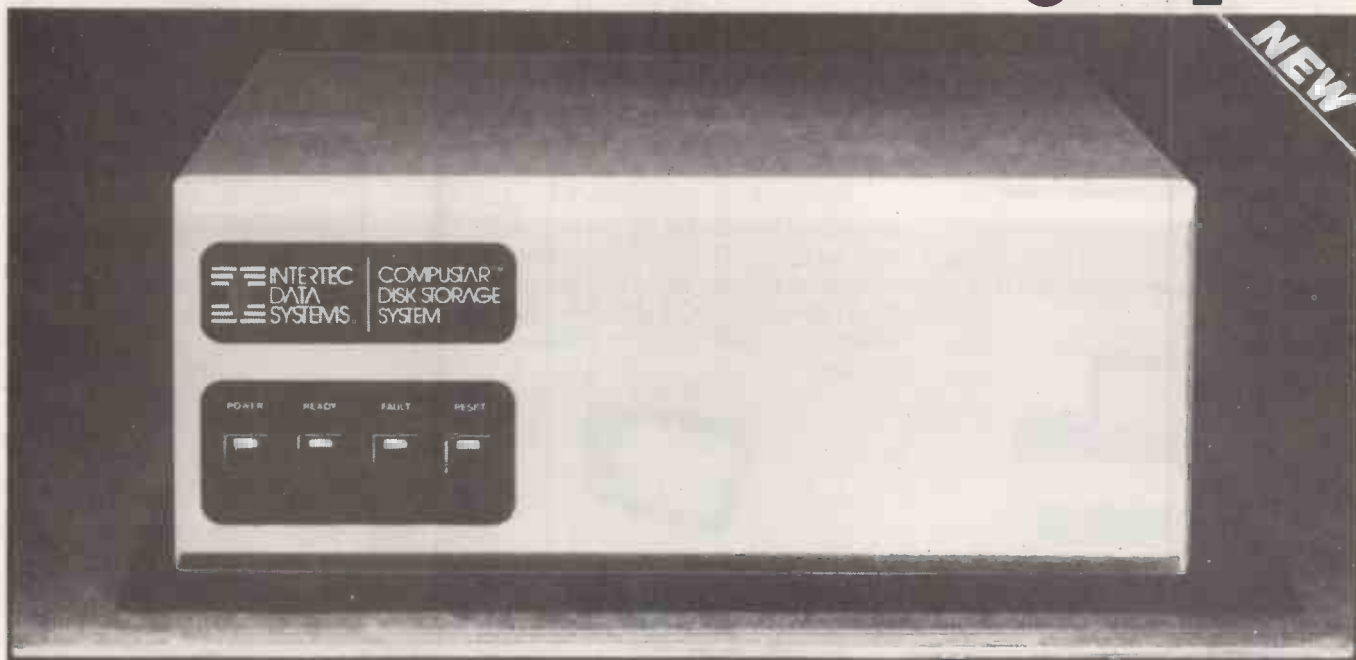
NSC Computer Shops, 29 Hanging Ditch, Manchester M4 3ES. Ring 061-832 2269 for further information.

• Circle No. 110

micronetworks

SOLVE THE STORAGE SHORTAGE

with ten multi-user megabytes



COMPUSTAR™

Our New CompuStar™ 10 Megabyte Disk Storage System (called a DSS) features an 8 inch Winchester drive packaged in an attractive, compact desktop enclosure. Complete with disk, controller and power supply. Just plug it into the Z80 adaptor of your SuperBrain and turn it on. It's so quiet, you'll hardly know it's there. But, you'll quickly be astounded with its awesome power and amazing speed.

The secret behind our CompuStar DSS is its unique controller/multiplexor. It allows many terminals to "share" the resources of a single disk. So, not only can you use the DSS with your SuperBrain, you can configure multiple user stations using our new series of CompuStar™ terminals, called Video Processing Units or VPU's™.

Whether you need an extra 10 megabytes for your SuperBrain or an enormous multi-user network, the CompuStar™ DSS solves your storage shortage problems. Sensibly. And economically. Plus, your investment is protected by a nationwide service network with outlets in most major U.S. cities. Providing efficient on-site or depot maintenance.

Get a demonstration of this extraordinary new system today. Call or write:

MICRO NETWORKS LTD.
60 PALL MALL, LONDON
Tel. 01-839 3701

DISK STORAGE SYSTEMS

10 MB Winchester £2,945

- Shugart 8 inch mechanism
- Quiet, table-top operation
- Can be used with CompuStar or SuperBrain Video Terminals

VIDEO PROCESSING UNITS

Model 10 VPU £1,595

- 64K Internal Memory
- Integral CRT, CPU, & Keyboard
- Download programmable

Model 20 VPU £2,195

- 64K Internal Memory
- 350K Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

Model 30 VPU £2,595

- 64K Internal Memory
- 750K Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

Model 40 VPU £2,895

- 64K Internal Memory
- 1 1/2 MB Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

ALSO

SUPERBRAINS

Model DD £1,845

- 64K RAM Memory
- 320K Dual Disk Capacity
- Dual Serial Ports
- Integral CPU, Disks & Keyboard

Model QD £2,195

- 64K RAM Memory
- 670K Dual Disk Capacity
- Dual Serial Ports
- Integral CPU, Disks & Keyboard

Model DT £2,595

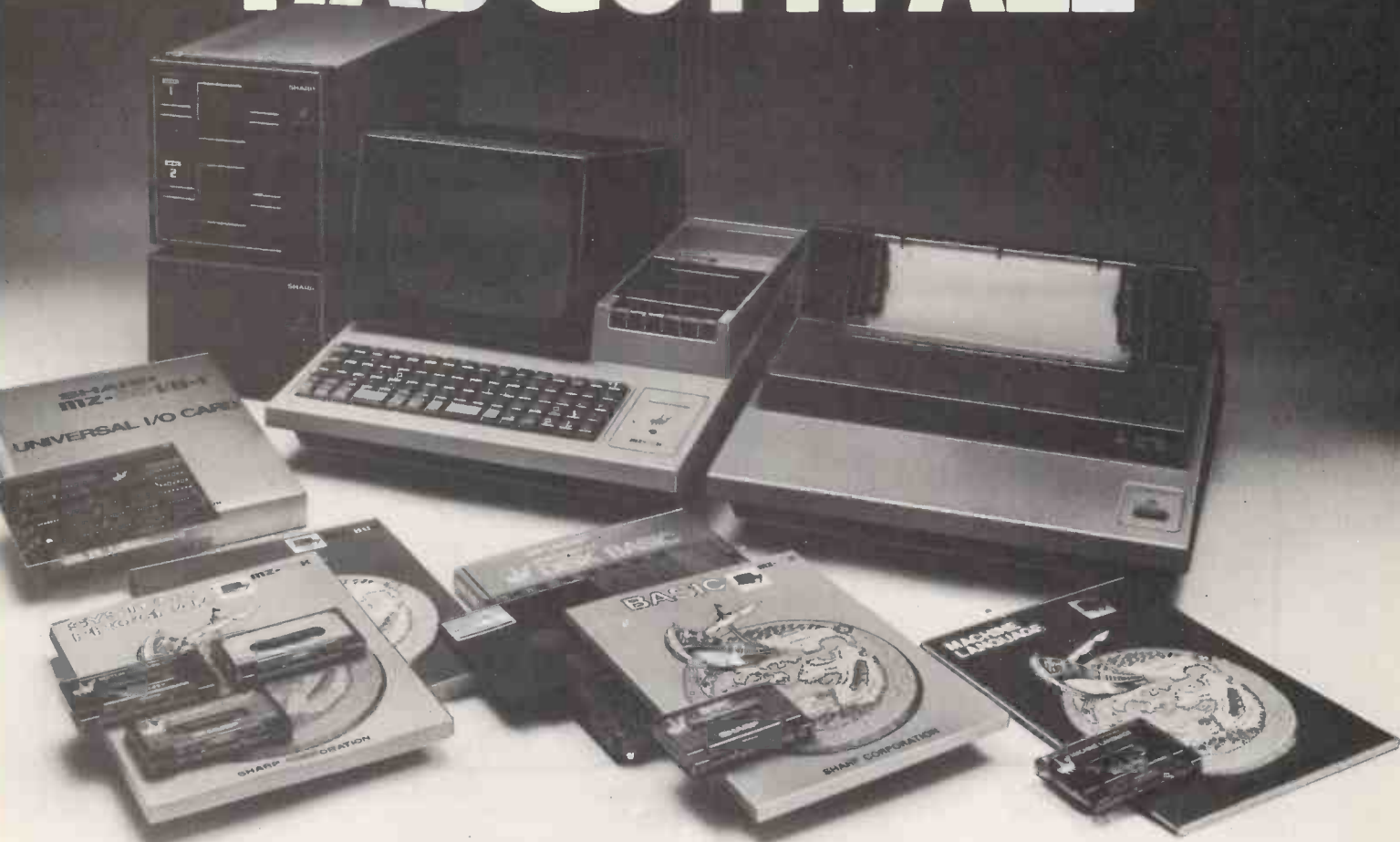
- 64K RAM Memory
- 1.52 MB Dual Disk Capacity
- Dual Serial Ports
- Integral CPU, Disks & Keyboard

FULL RANGE OF SOFTWARE AND PRINTERS ALSO AVAILABLE.

Visit our Showroom at:
60 PALL MALL
and see the Complete Range

DEALERS' ENQUIRIES INVITED

THE SHARP MZ-80K HAS GOT IT ALL



Since its introduction the Sharp MZ-80K has proved to be one of the most successful and versatile microcomputer systems around. Sharp now have a comprehensive range of products ready to make the powerful MZ-80K with its Printer and Disc Drives even more adaptable.

Products include: - Universal Interface Card, Machine Language and Z-80 Assembler packages, CP/M* plus a comprehensive range of software.

*Trade mark of Digital Research Ltd.

You'll find all the help and advice you need about the MZ-80K at your Specialist Sharp Dealer in the list below.

If there is no dealer in your area, or if you require any further information write to:-



Computer Division,
Sharp Electronics (UK) Ltd.,
Sharp House, Thorp Road,
Newton Heath,
Manchester M10 9BE.

Computers that talk your language.

GET IT ALL HERE ...

AVON
BCG SHOP EQUIPMENT LTD
Bristol, Tel: 0272 425338
DECIMAL BUSINESS M/Cs LTD
Bristol, Tel: 0272 294591
BEDFORDSHIRE
H.B. Computers (Luton) Ltd
Luton, Tel: 0582 416887
BERKSHIRE
Newbear Computing Store Ltd
Newbury, Tel: 0635 30505
BIRMINGHAM
Camden Electronics
Small Heath, Tel: 021-773 8240
E.B.S. Ltd
Birmingham 1, Tel: 021-233 3045
Electronic Business Systems Ltd
Birmingham, Tel: 021-384 2513
Jax Rest Ltd.,
Birmingham, Tel: 021-328 4908
Newbear Computing Store Ltd
Birmingham B26, Tel: 021-707 7170
BUCKINGHAMSHIRE
Interface Components Ltd
Amersham, Tel: 02403 22307
CHESHIRE
Charlesworth of Crewe Ltd
Crewe, Tel: 0270 56342
Cash Register Services
Chester, Tel: 0244 317549
Cheshire Computer Services Ltd
Levenshulme, Tel: 061-225 4763
Fletcher Worthington Ltd
Hale, Tel: 061-928 8928
Newbear Computing Store Ltd,
Stockport, Tel: 061-491 2290
Ors Group Ltd
Warrington, Tel: 0925 67411

CLEVELAND
Hunting Computer Services Ltd
Stockton-on-Tees, Tel: 0642 613021
DERBYSHIRE
Lowe Electronics Ltd
Matlock, Tel: 0629 2817
DEVON
Crystal Electronics Ltd
Torquay, Tel: 0803 22699
EXETER
Peter Scott (Exeter) Ltd
Exeter, Tel: 0392 73309
DORSET
South Coast Business M/Cs
Ferndown, Tel: 0202 893040
ESSEX
Prorole Ltd
Westcliff-on-Sea, Tel: 0702 335298
GLOUCESTERSHIRE
Gloucestershire Shop Equipment Ltd
Gloucester, Tel: 0452 36012
HAMPSHIRE
Advanced Business Concepts
New Milton, Tel: 0425 618181
Xitan Systems Ltd
Southampton, Tel: 0703 39890
KENT
Video Services (Bromley) Ltd
Bromley, Tel: 01-460 8833
LANCASHIRE
B & B Computers Ltd
Bolton, Tel: 0202 26644
H. R. Control Systems Ltd
Chorley, Tel: 02572 75234
Sound Service
Burnley, Tel: 0282 38481
Sumita Electronics Ltd
Preston, Tel: 0772 55065
The Micro Chip Shoppe
Blackpool, Tel: 0253 403122

LEICESTERSHIRE
Gilbert Computers
Lubenham, Tel: 0858 65894
Leicester Computer Centre
Leicester, Tel: 0533 556268
Mayes Hi Fi
Leicestershire, Tel: Leics. 22213
LINCOLNSHIRE
Howes Elect. & Autom. Servs.
Lincoln, Tel: Lincoln 32379
Z. R. Business Consultants
Lincoln, Tel: 0522 680087
LONDON
Bridgewater Accounting
Whetstone, Tel: 01-446 0320
Butel-Comco Ltd
Hendon, Tel: 01-202 0262
Central Calculators Ltd
London EC2, Tel: 01-729 5588
Digital Design & Development
London W1, Tel: 01-387 7388
Euro-Calc Ltd
London WC1, Tel: 01-405 3223
Euro-Calc Ltd
London EC2, Tel: 01-729 4555
Euro-Calc Ltd
London W1, Tel: 01-636 5560
Lion Computer Shops Ltd
London W1, Tel: 01-637 1601
Personal Computers Ltd
London EC2, Tel: 01-626 8121
Scope Ltd
London EC2, Tel: 01-247 8506
Sumlock Bondain Ltd
London EC1, Tel: 01-253 2447
MANCHESTER
Sumlock Electronic Services Ltd
Manchester M3, Tel: 061-834 4233
Sumlock Software Ltd
Manchester M3,
Tel: 061-228 3502

MERSEYSIDE
Microdigital Ltd
Liverpool, Tel: 051-227 2535
Sota Communication Systems
Liverpool L14, Tel: 051-480 5770
NORFOLK
Sumlock Bondain (East Anglia)
Norwich, Tel: 0603 26259
NORTHAMPTONSHIRE
H. B. Computers Ltd
Kettering, Northamptonshire,
Tel: 0536 520910
NORTHERN IRELAND
O & M Systems
Belfast, Tel: 0232 49440
The Microcomputer Centre (N.I.)
Belfast, Tel: Belfast 682277
NOTTINGHAMSHIRE
Keen Computers Ltd
Nottingham, Tel: 0602 583245
Mansfield Business M/C Ltd
Mansfield, Tel: 0623 26610
OXFORDSHIRE
Oxford Computer Store
Oxford, Tel: 0865 45172
REPUBLIC OF IRELAND
O'Connor Computers Ltd
Galway, Tel: 0009 61173
Tomorrows World Ltd
Dublin 2, Tel: 0001 776861
SALOP
Computer Corner
Shrewsbury, Tel: 0743 55166
SCOTLAND
A & G Knight
Aberdeen, Tel: 0224 630526
Business and Electronics M/Cs
Edinburgh, Tel: 031-226 5454

Micro Centre
Edinburgh, Tel: 031-556 7354
Microforth
Dunfermline, Tel: 0383 34954
Moray Instruments Ltd
Elgin, Tel: 0343 3747
Pointer Business Equip Ltd
Glasgow, Tel: 041-332 3621
Robox Data Systems Ltd
Glasgow, Tel: 041-221 5401
Tyseal Computers Ltd
Aberdeen, Tel: 0224 573111
SOMERSET
Norsett Office Supplies Ltd
Cheddar, Tel: 0934 742184
SOUTH HUMBERSIDE
Silicon Chip Centre
Grimsby, Tel: 0472 45353
SOUTH WALES
City Radio
Cardiff, Tel: 0222 28169
STAFFORDSHIRE
W. B. Computer Services
Cannock, Tel: 0543 75555
SUFFOLK
C. J. R. Microtek Co. Ltd
Ipswich, Tel: 0473 50152
SURREY
Petalect Electronic Services
Woking, Tel: 04862 69032
R.M.B. Ltd
Croydon, Tel: 01-684 1134
Saradan Electronic Services
Wallington, Tel: 01-669 9483
T & V Johnson (Microcomputers)
Camberley, Tel: 0276 20446

SUSSEX
Gamer
Brighton, Tel: 0273 698424
Jax Rest Ltd.,
Brighton, Tel: 0273 687667
M & H Office Equipment
Brighton, Tel: 0273 697231
TYNE & WEAR
P.M.S. Ltd
Sunderland, Tel: 0783 480009
WALES
Limrose Electronics Ltd
Wrexham, Tel: 097 883 5555
Morriston Computer Centre
Swansea, Tel: 0792 795817
Sigma Systems Ltd
Cardiff, Tel: 0222 21515
WARWICKSHIRE
Business & Leisure Microcomputers
Kenilworth, Tel: 0926 512127
WORCESTERSHIRE
Capricorn Computer Systems
Worcester, Tel: 0905 21541
YORKSHIRE
Bits & P.C.s
Wetherby, Tel: 0937 63744
Datron Micro-Centre Ltd
Sheffield, Tel: 0742 585490
Huddersfield Computer Centre
Huddersfield, Tel: 0484 20774
Neccos (D.P.) Ltd
Darlington, Tel: 0325 69540
Quadraphenia Ltd
Sheffield, Tel: 0742 77824
Ram Computer Services Ltd
Bradford, Tel: 0274 391166



**CRYSTAL ELECTRONICS
CC ELECTRONICS**

**MZ80K owners — are you XTAL followers?
NO! Then please read on.**

XTAL BASIC (SHARP)

Takes 5K less memory, has all the features of SHARP BASIC PLUS Multi dim strings, error trapping, logical operators, machine code monitor, more flexible peripheral handling, improved screen control, increased list control, auto run, If.. then.. else — and it doesn't stop there — it grows. You can extend the commands and functions at will — 10K, 12K, 16K, BASIC?

SHARP to XTAL BASIC conversion program is included.
£40 plus VAT

Bi-directional serial board for your SHARP RS232 compatible < 150 Baud to > 2400 Baud adjustable. 5,6,7,8 Bit words, plugs into MZ801/O £99.50 plus VAT. Includes software for bi-directional use in XTAL BASIC, software for using SHARP BASIC with serial printer and self-diagnostic software for testing Baud rate etc.

GIVE US A TRY
CRYSTAL ELECTRONICS is the home of XTAL BASIC
ACCLAIMED BY MANY

Members of Computer Retailers Association & Apple Dealers Association

Shop open 0930-1730 except Saturday & Sunday
40 Magdalene Road, Torquay, Devon, England. Tel: 0803 22699
Telex 42507 XTAL G

Access and Barclaycard welcome.



• Circle No. 113

MASTER THE MIGHTY MICRO

The London Micro Centre Ltd.,
47, Lower Belgrave Street,
London, SW1W 0LS.
Tel. 01-730-8791.

TAILOR-MADE SOFTWARE.

The micro should fit your company, not your company the micro. We can produce programs and systems that do exactly what you want for your business.

RENT A MICRO.

We also rent microcomputers and peripherals for home and office use. A complete micro system with full wordprocessing is £12.50/week

Training courses in wordprocessing, microoperating and programming are available for everyone from businessmen to hobbyists.

Price exclude VAT An EMG company

• Circle No. 114

PROBABLY THE UK'S GREATEST RANGE OF COMPUTER BOOKS AND MAGAZINES

**that's our claim
and we've yet to be proved wrong**

Call in and look for yourself or send SAE for our catalogue -



Lion Micro Computers

Lion House, 227 Tottenham Court Road,
London W1P 0HX. Tel: 01-580 7383

• Circle No. 115

The Microcomputer with one of the world's biggest names **The ITT 2020**

This is micro computing at its most compact and versatile best. Complete, self-contained – ready to plug in and startlingly simple to operate. With easy typewriter style keyboard, the ITT Floppy Disk Drive Unit with 116k capacity

suitable for continuous business use, for fast, uncomplicated data retrieval – at low cost, to make life easier for almost any type of smaller business or professional situation. To store and display – at the touch of a few keys – anything from address files to a whole year's financial records. All backed by the advanced technology of one of the *biggest* names in electronics today, ITT. With a countrywide advice and after-sales service to match.

ITT

World-wide Technology

ITT Consumer Products (UK) Ltd.,
Chester Hall Lane, Basildon, Essex.
Tel: Basildon 3040 Ext. 196-198





UTILITIES

AOPT:

Applesoft Program Optimizer is a 2.2K machine language utility that will substantially reduce the size of the program without affecting the operation of the program.

£19.95

APLUS:

Applesoft — Plus Structured Basic is a 4K machine language utility that adds structured programming commands to Applesoft basic. For example 'DO CURVE-FIT'

£19.95

CRAE:

A co-resident Applesoft Editor. Global changes & finds. Quote (copy) a range of lines. Append, Renumber, Modify, 15 commands in all.

£14.95

CRAE & MCAT:

Editor (as above) & MCAT which creates a sorted Master Catalog.

£19.95

APPLE PROTECTOR III:

Protect your programs against pirating. The protected disks cannot be copied by presently available commercial copy programs.

£60

SDC III:

Super Disk Copy III is a menu driven program that allows manipulation of all types of files, under DOS 3.1, 3.2, & 3.3 COPY single files, DOS, entrie disk, UNDELETE, FIX, filesizes etc. Allow files to be transferred back to DOS 3.2.

£24.95

DISK RECOVERY:

This utility will examine all the sectors on the disk, BAD BLOCK SCAN option. And the REDO VTOC option may correct "messed-up" disks. Repair your disk.

£19.95

DOS PLUS:

This utility adds 8 new commands to APPLE DOS. Three are built-in & 5 are user-definable. Now you can 'flip' between DOS 3.3 & DOS 3.2 while a program is running !!

£19.95

Add 15% V.A.T. Postage & Packing Free
Write or phone for full catalogue of available software.
Dealer Enquiries Welcome.
Contact: — S.B.D. SOFTWARE
15 Jocelyn Road, Richmond TW9 2TJ. Tel: 01-948 0461
Telex: 22861

• Circle No. 117

THE STARS FROM MICROPRO for your CP/M System

Wordstar £225 + VAT
What you see on the screen is what you will get at printout. The No. 1 Wordprocessing system.

MailMerge £65 + VAT
Gives WordStar capability to merge data from external files for personalised letters etc.

Datastar £165 + VAT
Sophisticated system for Forms Creation, Data Entry, Retrieval and Updating. Menu-driven and easy to use. No programming knowledge required.

SuperSort £125 + VAT
Sort, Merge and Select Data. Incredibly fast.

New £225 + VAT
WordStar now available for 48K Apple II with Videx Videoterm Board and MicroSoft Card.

ALL ORDERS MUST BE PREPAID.
SPECIFY DISC FORMAT REQUIRED.
ADD £1 PER ITEM FOR POSTAGE AND PACKING.

LEGADATA

182 HUTTON ROAD, BRENTWOOD, ESSEX, CM15 8NS.

TEL: 0277 217367

• Circle No. 118

ADVANCED COMPUTER EQUIPMENT (LEEDS) LTD

95 MEADOW LANE LEEDS 11 TEL 0532 446960

LEEDS COMPUTER CENTRE

PRICES SHATTERED

COMMODORE PET

ALL WITH 12 MONTHS WARRANTY

32K PROFESSIONAL KEYBOARD £575
DUAL DISK DRIVE 347K..... £625
CASSETTE DECK C2N £ 50
PRINTER 4022 MATRIX TRACTOR..... £395

SHARP Z-80

ALL WITH 12 MONTHS WARRANTY

48K WITH 34K USER RAM £474
36K WITH 22K USER RAM £450
20K WITH 6K USER RAM £410
DISK DRIVES, PRINTERS ETC.

PRINTERS

BD80/132 BI DIRECTIONAL MATRIX..... £495
IEEE PARALLEL OR RS232 INTERFACE
RICOH — RP1600 DAISYWHEEL
SPECIAL PRICE £1,150

APPLE II PLUS 12 MONTHS WARRANTY

48K AUTO START £695
DISK WITH CONTROLLER..... £375
DISK WITHOUT CONTROLLER £295
9" MONITOR B/W..... £ 80

SUPERBRAIN

64K WITH SINGLE DENSITY 320K DISK ... £1,650
64K WITH DOUBLE DENSITY 700K DISK ... £2,150
FULLY INTEGRATED ACCOUNTS PACKAGE . £950
OPERATING SYSTEM * MBASIC *
COBOL * FORTRAN

SUNDRIES

DATA TAPES SUPER QUALITY (10) £ 4.35
5 1/4" CERTIFIED VERBATIM (10) £27.00
PLAIN LISTING PAPER 2000 SHEETS £12.50
BOOKS * GAMES * PROGRAMS * GALORE
VISICALC * DESKTOP PLANNER
SPECIAL OFFER

PLEASE ADD VAT TO ALL GOODS EXCEPT BOOKS — CASH AND CARRY OR 24HR DELIVERY — YOUR CHOICE
ALL EQUIPMENT IS FACTORY FRESH AND FULLY TESTED IN OUR OWN WORKSHOPS
STANDARD CONDITIONS OF SALE APPLIES TO ALL PRODUCTS

• Circle No. 119

High Resolution Professional



From Telefusion

- 750 line resolution
- 10 MHz frequency response
- Looping video input
- UHF input connectors. 75 ohm.
- Compact construction suitable for rack mounting
- Suitable for apple nascom etc.

Complete price to include packing, delivery and VAT

£96.60

Please make cheques, P.O., etc. payable to Telefusion Ltd.

11", 14", 17", 23" monitors also available. Plus rack kits and colour monitors for graphics. Details on request. Trade enquiries welcome.



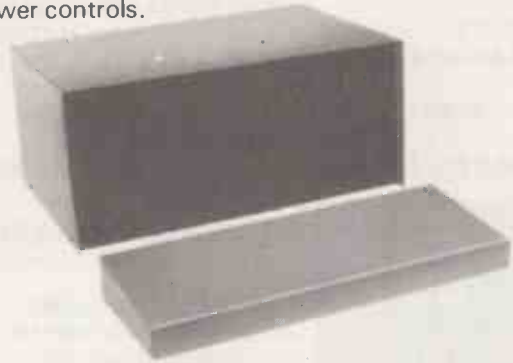
TELEFUSION

Telefusion Limited, Engineering Division, Unit 11, Barr's Fold Close, Wingates Industrial Estate, Westhoughton, Bolton BL5 3XH. Telephone: 0204 66393.

• Circle No. 120

Rugged steel instrument cases for monitors, boards, floppys etc. Hammer finished in grey, red, green, or blue with black front and rear panels. Lift off top and detachable front and rear.

Matching separate keyboard units which can be fitted to main housing to become integral unit. Keyboard units have room for most boards up to 8¾", cassette and power controls.



INSTRUMENT CASE

	width	height	depth	Price
EC24	24½"	11"	15"	£27.50 + VAT
EC15	15"	11"	15"	£24.50 + VAT

Post & Packing £4.50

KEYBOARD UNIT

EK24	24½"	2-3"	9"	£18.50 + VAT
EK15	15"	2-3"	9"	£16.50 + VAT

Post & Packing £3.25

STATE MODEL NO. AND COLOUR

BCM EMIT
LONDON WC1N 3XX
Tel: 01-404 5011

• Circle No. 121

NewBear

Computing Store Ltd



**BETTER PRICES!
BETTER DELIVERY!
WIDEST RANGE OF
SOFTWARE**

For the best deal from the largest sharp dealer phone Newbear (0635) 30505



MZ-80K

ACORN

PROM PROGRAMMERS

PROM ERASERS

KEYBOARDS

5¼ AND 8"

DISC DRIVES

WIDEST RANGE

OF BOOKS IN U.K.

Apple II plus



For ex-stock delivery 12 months warranty

and Bear care
Bear Bargains

NORTH STAR



★ HORIZON

Installed on your site with full field service anywhere in U.K. fully C.P.M. compatible. Chosen by Newbear for its reliability and performance.

64K Dual Drive Quad	£1995.00
North Star Horizon	
Newbury Laboratory 7009 terminal	£795.00
Citoh8300 R.M. Printer	£499.00
CPIM 2.2.	£95.00

Please send urgently:

Sharp
North Star Horizon Cat.
Booklist Citoh N.L. Terminals
Please contact me Phone No.

Name
Address

PC7/81

NEWBEAR COMPUTING STORE LTD. (HEAD OFFICE)
40 BARTHOLOMEW STREET, NEWBURY, BERKS
TEL. (0635) 30505 TELEX 848507 MCS
FIRST FLOOR OFFICES, TIVOLI CENTRE, COVENTRY ROAD, BIRMINGHAM. TEL. 021 707 7170
220-222 STOCKPORT ROAD, CHEADLE HEATH, STOCKPORT. TEL. 061-4912290

• Circle No. 122

MACHINE LANGUAGE MADE SIMPLE ZX80 AND ZX81

This new book is a must for any **SINCLAIR** user who wants to make full use of his **SINCLAIR ZX80** and **ZX81**. Go beyond Basic into the world of **MACHINE LANGUAGE PROGRAMMING** and open computer horizons you never thought possible! Learn how to use the **SINCLAIR** computer's own language and finally find out what PEEK and POKE is all about!

MORE COMPUTING POWER IN LESS SPACE! FASTER RUNNING PROGRAMS!



Written for the complete beginner as well as for the experienced **SINCLAIR** user, **MACHINE LANGUAGE MADE SIMPLE** has over 120 pages packed with programming techniques, hints and tips.

WRITE YOUR OWN MACHINE LANGUAGE PROGRAMS...

* USEFUL BASIC PROGRAM TO EDIT MACHINE LANGUAGE * COMPLETE DESCRIPTION OF THE INSTRUCTIONS GROUPED BY SUBJECT AND BY USEFULNESS * NUMEROUS SAMPLE MACHINE LANGUAGE ROUTINES DESIGNED SPECIFICALLY FOR THE SINCLAIR 80 & 81 * SIMPLE EASY TO USE LOOK UP TABLES.

£8.95 (plus 50P p&p)

Please send me copies **MACHINE LANGUAGE MADE SIMPLE FOR YOUR ZX80 & ZX 81.** Orders to: 131 Trafalgar Rd. London SE10

Correspondence: Glebe Cottage, Glebe House, Station Rd, Cheddington, Leighton Buzzard, Bedfordshire LU7. Please enclose cheque or P.O. for £9.45 per copy. Orders outside the UK £9.95.

NAME

ADDRESS

PC7/81

• Circle No. 123

FIVE NEW SENSES

FOR YOUR MICRO



**IEEE STANDARD
A-D CONVERTERS
D-A CONVERTERS
RELAY UNITS
APPLE INTERFACES**

CIL
electronics Ltd

WORLD'S
FIRST STRAIN
GAUGE DIL
AMP

Decoy Rd, Worthing, Sussex,
Tel: Worthing (0903) 200673

• Circle No. 124

V. & T. ELECTRONICS

**ZX81 EXPANSION COMPLETELY
INTERNAL. USES RELIABLE STATIC
RAM. EX-STOCK.**

2K	£12.00	4K	£25.00
		KIT	BUILT
NASCOM 2		225	250
16K RAM BOARD		110	120
3 AMP POWER UNIT		32.50	37.50
GRAPHICS ROM			15
8 x 4116s TO 32/48/64K			12
V&T ASSEMBLER ON TAPE			12.50
VERO 19" FRAME/OR MICROCASE			27.50
I/O BOARD (FREE BASIC RAM)		45	55
(UP TO 32K + BASIC)		55	67.50

V & T ASSEMBLER

FULLY RELOCATABLE ON TAPE
FOR ALL NASCOM MONITOR

PIO Option	£12	Zeap Eprom	£50
UART Option	£16	Tape	£30
CTC Option	£14	Nas Dis	£37.50
NAS SYS 3	£40	Naspen	£30

MEMORY

1 x 6116 200 ns SRAM 2k x 8	£12.00
8 x 4116 200 ns SRAM	£11.00
TRS80 U/GRADEKIT	£13.00
1 x 2114 200 ns SRAM	£1.50
1 x 4118 250 ns SRAM 1K	£6.00
1 x 2708 x 1K x 8 EPROM	£2.25
1 x 2716 5V 2K x 8 EPROM	£3.00
1 x 2532 5V 4K x 8 EPROM	£10.00

ALL FULL SPEC. DEVICES

NEW!

64 CHARACTER PER LINE CONVERSION
FOR V.D.U. FEATURES:-

*PROPORTIONAL GRAPHICS * REVERSE VIDIO *SCREEN BLANKING
*EXACT 50 HZ FRAME RATE NO MORE WOBBLE

READY BUILT AND

TESTED £30

82 CHESTER RD LONDON N19 5BZ TEL (01) 263 2643

• Circle No. 125

THE Video Genie EG3000 Series

WITH *16K user RAM plus extended 12K Microsoft BASIC in ROM *Fully TRS-80 Level II software compatible *Huge range of software already available *Self contained, PSU, UHF modulator, and cassette *Simply plugs into video monitor or UHF TV *Full expansion to disks, and printer *Absolutely complete just fit into mains plug.



16K **£299** + VAT

GP80 The most compact 80 column impact graphic-dot printer available - at a very compact price

by seikosha

Graphics, Normal and Double- Width Characters can be printed on the same line. Pine Feed Tractor is equipped as standard.

Two Line-Feed Commands (1/6 and 1/9 inch)

Print on Plain Paper with two copies

Continuous Self-Inking Ribbon for easy handling

Centronics type Parallel Interface standard

Wide Range of Optional Interface Boards

Self-Test Programme standard



£225 + VAT

SUPERBRAIN

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 or Word Processing, SuperBrain is tops in its class.

320K £1850 700K £2400
1.5Mb £2750

COMMODORE COMPUTERS

PET 8K £415
PET 16K £525
PET 32K £650
PET 8032 £895

DISK DRIVES

4040 £695

PRINTERS

EPSON TX80B (inc. I/F & cable) £299
EPSON MX80T £395
ANADIX DP8000 £495
ANADIX DP9500 £895
ANADIX DP9501 £995

VIDEO MONITORS

10" BLACK & WHITE £85
10" GREEN SCREEN £95

Aculab

Floppy Tape
The tape that behaves like a disk.

Connects directly to TRS-80 level 2 keyboard. Operating and file handling software in ROM 8 commands add 12 powerful functions to level 2 BASIC. No buttons, switches or volume controls. Full control of all functions from keyboard or program. Maintains directory with up to 32 files on each tape.

for all TRS 80 & Video Genie owners

TRS80 version: **£165**

Video Genie: **£170**

Please add £10 Securicor delivery charge to all computers etc.
Plus 15% VAT on all prices.

Acorn Atom



Now available ready built from £150 plus VAT and p.d.c.

Unique in concept — the home computer that grows as you do!

Special features include

- *FULL SIZED KEYBOARD
- *ASSEMBLER AND BASIC
- *TOP QUALITY MOULDED CASE
- *HIGH RESOLUTION COLOUR GRAPHICS

Simple to build, simple to operate. A powerful, full facility computer with all the features you would expect.

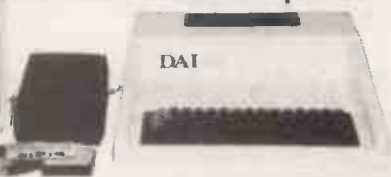
Just connect the assembled computer to any domestic TV and power source and you are ready to begin.

Full-sized QWERTY keyboard
6502 Microprocessor Rugged injection-moulded case 2K RAM
8K HYPER-ROM 23 integrated circuits and sockets Audio

cassette interface UHF TV output Full assembly instructions

£120 + VAT

The Second Generation Personal Computer



Highest performance - lowest price

- *48K (8080A)
- *16 Colours or shades of Grey
- *Multiple High Resolution Graphics Modes (64 x 71, 129 x 159, 255 x 335)
- *Character mode (60 x 24)
- *Split Screen Modes

- *Full ASCII Upper & Lower Character Set
- *Unique graphical — Sound Commands for Smooth Music, random frequencies & enveloped sound!

DAI Personal Computer

*RS232 I/F at only **£595** + VAT

Paper Tiger 460

The Paper Tiger 460 sets new standards by incorporating many features previously only available on units costing much more.

Features like a specially developed nine wire 'staggered column' head which overlaps the dots of each matrix character with just one pass of the printhead giving a dense, high quality print image without reducing the units 160 c.p.s. print speed.

It also offers a bi-directional logic seeking device to enhance its print optimisation characteristics and wide range of 'print versatility' features such as mono or proportional spacing, automatic justification, programmable horizontal and vertical tabbing, and 'fine' positioning for word processing applications.

Paper Tiger 560

£795 + VAT

The Paper Tiger 560 is the first printer which bridges the gap between conventional matrix and 'daisy wheel' types offering quality printing at a relatively low price.

Full 'width' 132 column printing at 160 c.p.s., a unique nine wire 'staggered' print head, bi-directional printing, an inbuilt tractor feed and a host of selectable features set it apart from ordinary matrix printers.

Plus for even greater versatility a full dot plot graphics facility if supplied which includes a 2K buffer.

£995 + VAT

Books & bits

Books — Manuals —

Diskettes — ribbons — Paper — chips (2114 x 2 1K) £4 pair.
RS232 to Centronics interfaces £40 etc. etc.
A variety of second-hand computer equipment usually available, spares, repairs and service.

MicroStyle

9 St. Peter's Terrace, Lower Bristol Road, Bath, BA2 3BT
Telephone: (0225) 334659. After Hours: (0761) 33283

New Showroom
OPENS 1st JUNE AT
29 BELVEDERE, BATH.
2 minutes from town centre

• Circle No. 126

LEENSHIRE LIMITED

COMPUTER MONITORING and CONTROL SYSTEMS

Leenshire specialises in designs that meet the Customers exact requirements for Industrial, Commercial and Business applications.

Stand alone, closed loop slave operation or intelligent terminals including Minicomputer and Microprocessor based systems including Colour Graphic Monitoring and Teletext formatting.

Leenshire offers a dedicated cost-effective service from Consultancy, through feasibility and Development to Manufacture.

For further information contact:

Leenshire Limited
Moorside Road
Winnall
Winchester
SO23 7RX

Tel: 0962 61475/ 6



• Circle No. 127

3D COMPUTERS

SYSTEMS

2SUPERBRAIN 2HARP MZ-80K 2UNDRIES
2HARP PC-3201 2SERVICE 2UPPORT

SOFTWARE

3D COMPUTERS are suppliers of COMPLETE SYSTEMS based on SHARP and Intertec SUPERBRAIN microcomputers and are now appointed distributors for MICROEASE software products for SUPERBRAIN and SHARP PC-3201.

EASYFILER™

Complete information storage and retrieval system. User defined file formats, report formats and record selection criteria. Records can be accessed by key or searched for by selection by multiple conditions on multiple fields. Reports are output on printer or screen with totalling and breakpoints. Files of extracted records may be produced for input to Wordstar/Mailmerge.

Applications: Library, Cataloguing, Indexing Systems; Market research and analysis; Selective mailshots; Personnel records; Employment and Estate Agency; Laboratory records etc. **£275.00**

EASYPLANNER™

Comprehensive resource scheduler. Jobs partitioned into discrete activities or processes are allocated over resources such as equipment and a workforce with variable skills levels. Schedules produced to obtain optimum utilisation of resources. Immediate rescheduling possible if equipment fails or workforce reduced. Capacity and resource planning.

Applications: Shop floor control; Service management; Project planning; Timetables; Staff allocation etc. **£400.00**

EASYTIMER™

Time recording and monitoring system. Assignments or jobs can be broken down into sub-jobs and activities. Charge rates may be set by activity and employee. Budgets may be allocated. Selective reporting on time spent and budget status produced on demand. Totals by Account, Job and Employee. Overspends on budget highlighted.

Applications: Engineering, Advertising, Management Consultancies; Project management; Accountants; Solicitors; Architects etc. **£400.00**

Callers welcome at our COMPUTER SHOP on the A3, Kingston By-Pass. Open Saturdays. Dealer enquiries welcome

230 TOLWORTH RISE SOUTH, TOLWORTH, SURBITON, SURREY KT5 9NB
Tel: 01-337 4317 Telex: 945966 AIRCLA G

• Circle No. 128

Tomorrow's Micro Computer Today.



Z89 - OVERVIEW

- 48 KB or 64 KB RAM.
- Extendable to 20 MB Storage.
- 2 x Z80 Micro. based.
- 24 + 1 Line at 80 characters/L.
- Serial and Parallel I/Os.
- Professional Keyboard.
- 512 x 256 Hi Res Graphics (M X 89).
- Accessible Data Bus.
- Prom Programmer.
- FCC approved.

ASSEMBLER
BASIC
FORTRAN
PASCAL
COBOL

Several disk operating systems including CP/M

Extensive standard application programs, including: Stock Control, Order Processing and Invoicing; Payroll; Company Sales; Company Purchases; General Accounting; W/P; VisiCalc and much, much more.

Zenith data systems

THE QUALITY GOES IN
BEFORE THE NAME GOES ON.



Educational and OEM Terms available.

Please send information on:

- Computer Printers
 Terminal Software

Name

Company

Address

Heath Electronics (U.K.) Ltd, Bristol Road, Gloucester GL2 6EE. (0452 29451)

Computer Centre, 233 Tottenham Court Road, London. (01-636 7349).

• Circle No. 129

COMPUTER STORES

get a bigger **BYTE** of the market
add impulse sales to your profits
by stocking Sams books



The customers who walk through your door are in the market for all types of computer products. Even if they are not quite ready to buy that new computer they are more than ready to spend a few pounds on a book devoted to a topic of special interest. And what about the customer who has just bought a home computer from you? An extra £5 or so on a book that shows how to get the most out of new equipment only makes sense - and extra profit for you.

When you stock the popular range of Sams books you provide a new and valuable service to customers, who will return again and again to browse and buy.

For full information about stocking Sams books and increasing your sales please telephone **Roy Jones or Jeremy Dicks** on (Hemel Hempstead) **0442 58531** or complete the form below.

To: Roy Jones, Prentice-Hall International,
66 Wood Lane End, Hemel Hempstead,
Hertfordshire, HP2 4RG, England

Please send me full details on stocking Sams books

Name _____

Address _____

PC7

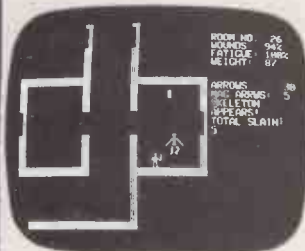
Prentice-Hall  **International**

exclusive distributors of
Howard W. Sams books in the UK and Europe

APPLE :: PET :: TRS Software



DUNJONQUEST Temple of Apshai



Temple of Apshai during play on the Apple computer.

Graphics!
(Apple uses high-resolution & color!)
Real time!
A fantasy role-playing experience!
For ages 10 through adult
Complexity: Intermediate
Playing time: 30 minutes to forever!
For one player

Now, you can enter a universe in which quick wit, the strength of your sword arm and a talisman around your neck might be what separates you from a pharaoh's priceless treasure—or the death-grip mandibles of a giant mantis.

"Temple..." is a role-playing game (RPG) that catapults you into a world of magic and monsters—doomed cities and damsels in distress. More than a game, it's an alter-ego experience. In an RPG, complex factors that make up a human being are abstracted into a few basic characteristics: strength, constitution, dexterity, intelligence and ego. Via your role-playing character, you'll venture into an essentially unknown world, and be at home with the likes of skeletons, zombies, spiders and wraiths. You'll bargain with a tight-fisted innkeeper for the weapons and armor you'll need in the dunjon.

When you play the "Temple of Apshai," you'll be both a character within and a reader of the epic you're actually helping to create. In this labyrinth, the choice is always yours... fight or flee, parry or thrust, slay the monsters or see if they'll listen to reason.

After you've bargained for your sword, armor, shield and your bow and arrows, most of your time in the dunjon will be spent exploring the 200 rooms on four different levels... trying to find 80 types of treasures of priceless worth. But wait—the treasures are surrounded by traps—needles, daggers, flames and bottomless pits—closely guarded by monsters vile and noxious. Do you dare to thrust your broadsword at the giant leech, the skeletal bat, the zombies or the ghouls with mouths full of razor fangs?

We invite you to project yourself into the labyrinth. See and touch the treasures, hear and smell the creatures that inhabit the place. Discover for yourself the fantasy world of Apshai!

TRS80
16k LII;
PET 32k
Cass
14.95

TRSDOS
32k;
APPLE
48k
(Disk)
16.95

All prices
include p & p
and V.A.T.



ALGRAY

ALGRAY House, 33 Bradbury Street, Barnsley,
South Yorkshire Tel: Barnsley (0226) 83199



• Circle No. 131

CENTRAL LONDON NEWEST MICRO-CENTRE

YOUR SEARCH FOR THE BEST DEAL ENDS HERE

Apple Computer
Sells and Service

BETTER PRICES!



APPLE
PLUS
APPOINTED DEALERS
APPLE SOFTWARE

Business	
Visicalc	75.00
Mailing System	55.00
Word Processing	45.00
Write-on	60.00
Retail Inventory	40.00
Disk Inventory	25.00
Data Base	10.00
Education	
Algebra I	7.50
Function Plot (2-dim)	15.00
Statistical Analysis	15.00
Paddle Graphics	20.00
Typing Tutor	7.50
Games	
Bridge	10.00
Fastgammon	15.00
American Football	10.00
& many others	

Tandy

COMPUTER CENTRE

FULL RANGE OF TRS-80
COMPUTERS, DISC DRIVES
SOFTWARE & PRINTERS
AVAILABLE.

SPECIAL OFFER

SAVE £100!! ON
16K LII CPU £295.00
NORMAL PRICE £395.00

SHARP

MZ-80K, 40K £459
PC1211 Pocket computer £75
CE 121 Comtte Interface £13

Add 15% VAT
DELIVERY IS PAID AT COST

APPLE USER CLUB
WRITE FOR MEMBERSHIP

DEANS Of
Kensington

191, KENSINGTON HIGH STREET, LONDON W.8.
Tel. 01-937 7896 Ext. 3.

• Circle No. 132

MAGIC WAND

Wordprocessing for CP/M Systems

- * Easy to use full text Editor
- * Full text formatting features
- * Merges with external files for form letters etc.
- * True proportional spacing
- * Self-teaching disc and manual

Requires 32k RAM and cursor addressable terminal.
Specify disc format, terminal and printer.

NEW £175
Vers. available for Apple II w/MicroSoft Card

ADD VAT AT 15% and £1 P and P
STRICTLY CASH WITH ORDER

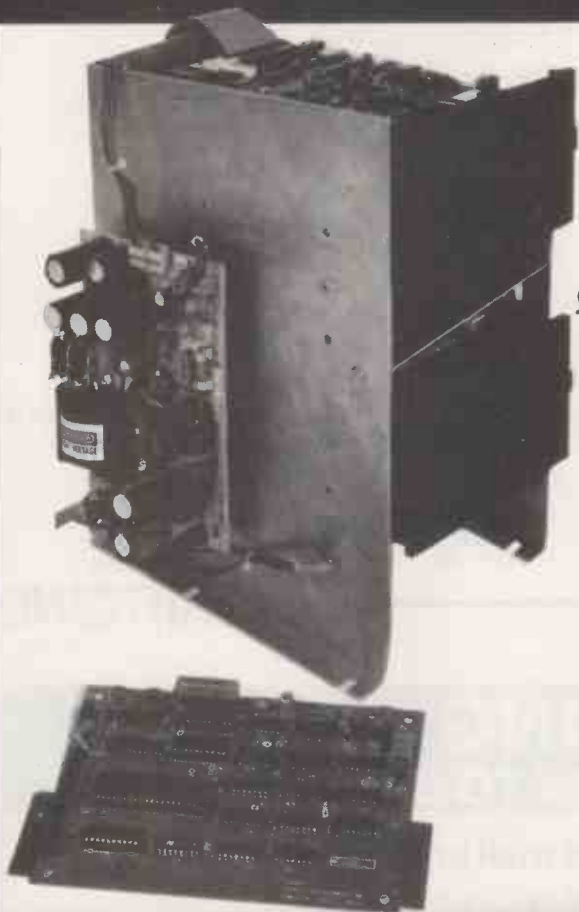
LEGADATA

182 HUTTON ROAD, BRENTWOOD, ESSEX, CM15 8NS.

TEL: 0277 217367

• Circle No. 133

TRS 80 MODEL III DUAL DENSITY DISK DRIVE UPGRADE KITS



Kit comes assembled and tested as illustrated. Full installation instructions given. Kit includes:—

2 x 40 TRACK DUAL DENSITY DRIVES

OR 2 x 80 TRACK DUAL DENSITY DRIVES
DISK CONTROLLER BOARD

240 VOLTS AC SWITCHED MODE POWER SUPPLY

ALL CONNECTORS AND CABLES

PRICES

KIT WITH 2 x 40 TRACK DRIVES **£599**

KIT WITH 2 x 80 TRACK DRIVES **£729**

Call your nearest dealer for more information:

RADIO SHACK LTD.,
188, Broadhurst Gardens,
London NW6.
Tel: 01 624-7174

COMPSHOP LTD.,
14, Station Road,
New Barnet, Herts.
Tel: 01 441-2922

COMPSHOP LTD.,
311, Edgware Road,
London W2.
Tel: 01 262-0387

**LONDON COMPUTER
CENTRE**, 43, Grafton
Way, London W1.
Tel: 01 388-5721

N.I.C.,
61, Broad Lane,
London N15
Tel: 01 808-0377

**CROYDON COMPUTER
CENTRE**, 29a, Brigstock
Road, Thornton Heath,
Surrey
Tel: 01 689-1280

P J EQUIPMENT LTD.,
3, Bridge Street,
Guildford,
Tel: 0483-504801

**R.D.S. ELECTRICAL
LTD.**, 157-161, Kingston
Road, Portsmouth
Tel: 0705-812478

**TANDY HASTINGS
LTD.**, 48, Queens Road,
Hastings,
Tel: 0424-431849

**MICROWARE
COMPUTING
SERVICES**, 57, Queen
Charlotte Street, Bristol
Tel: 0272-279560

SEVET TRADING,
14, St. Paul's Street,
Bristol
Tel: 0272-697757

PARWEST LTD.,
58, Market Place,
Chippenham
Tel: 0249-2131

ENSIGN,
13-19, Milford Street,
Swindon, Wilts.
Tel: 0793-42615

EMPRISE LTD.,
58, East Street,
Colchester
Tel: 0206-865926

**CAMBRIDGE
COMPUTER STORE**,
1, Emmanuel Street,
Cambridge.
Tel: 0223-65334

I.C. ELECTRONICS,
Flagstones,
Stede Quarter,
Biddenden, Kent
Tel: 0580-291816

MICRO CHIP SHOP,
190, Lord Street,
Fleetwood, Lancs.
Tel: 03917-79511

MICRO CHIP SHOP,
197, Waterloo Road,
Blackpool.
Tel: 0253-403122

MICRO CHIP SHOP,
93, Friargate,
Preston, Lancs.
Tel: 0772-22669

**HARDEN MICRO-
SYSTEMS**, 28/30, Back
Lord Street, Blackpool.
Tel: 0253-27590

**NORTH WEST
COMPUTER
CONSULTANTS LTD.**,
241, Market Street,
Hyde, Cheshire
Tel: 061-366-8624

**HEWART MICRO-
ELECTRONICS**,
95, Blakelaw Road,
Macclesfield,
Tel: 0625-22030

KARADAWN LTD.,
2, Forrest Way,
Great Sankey,
Warrington.
Tel: 0925-572668

PHOTO-ELECTRICS,
459, London Road,
Sheffield,
Tel: 0742-53865

**BRIARWOOD
COMPUTER SERVICES**
Briarwood House,
Preston Street,
Bradford.
Tel: 0274-306018

GNOMIC LTD.,
46, Middle Street,
Blackhall,
Hartlepool
Tel: 0783-863871

**BRIERS COMPUTER
SERVICES**, 1, King
Edward Square,
Middlesborough,
Cleveland
Tel: 0642-242017

3 LINE COMPUTING,
36, Clough Road, Hull.
Tel: 0482-445496

**H.C. COMPUTER
SALES LTD.**, 182
Earlsway, Team Valley
Trading Estate,
Gateshead
Tel: 0632-874811

EWL COMPUTERS LTD.,
8, Royal Crescent,
Glasgow
Tel: 041-332-7642

CUMANA LTD 35 Walnut Tree Close, Guildford, Surrey, GU1 4UN.
Telephone: (0483) 503121.

*Please add VAT to all prices.
Delivery at cost will be advised
at time of order.*

• Circle No. 134

ANGLIA COMPUTER CENTRE

MICROCOMPUTERS FOR BUSINESS,
EDUCATION AND HOME

FOR ALL YOUR BUSINESS, EDUCATION
& LEISURE COMPUTER REQUIREMENTS!!!

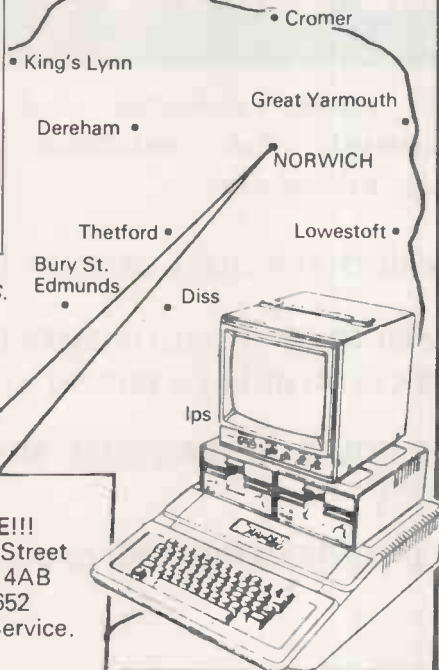
ACORN ATOM
APPLE II & III
TRS-80
SHARP
NORTH STAR
HORIZON
TANGERINE
U.K. 101
NASCOM
VIDEO GENIE

+ PRINTERS &
OTHER PERIPHERALS.

BOOKS**
SOFTWARE*
MAGAZINES**
STATIONERY***
BUSINESS &
INDUSTRIAL
CONTROL

WE ARE HERE!!!

88 St. Benedict's Street
NORWICH NR2 4AB
Tel. (0603) 29652
24hr. Answering Service.



• Circle No. 135

NEWDOS80 — APPARAT'S DOS FOR THE 80's

- * Up to 4095 bytes per record on disc files
- * Variable — length records
- * 5 or 8 inch disc drives of 35, 40, 80 tracks may be mixed
- * DOS and BASIC command changing
- * Print Spooler provided for concurrent printing and other processing
- * NEWDOS and TRSDOS compatible
- * PLUS MUCH MORE !!!

£65 including detailed manual
BUSINESS SOFTWARE

Contact us to discuss your application

UDMS INFORMATION MANAGEMENT FOR THE NON-PROGRAMMER

- * Powerful, easy-to-use facilities for data storage, update, and reporting
- * Ideal for business applications
- * Extremely flexible
- * Save £££'s on software costs!
- * Versions for TRS80 I and II
- * Comprehensive users manual

Basic Version £75 Full Version £150 Manual

MICROLINE-80 PRINTER

only £6.00

Phone for lowest price

Prices exclude V.A.T. and Postage.

CLEARTONE COMPUTER CONSULTANTS LTD.
PRINCE OF WALES INDUSTRIAL ESTATE
ABERCARN, GWENT NP1 5RJ Tel: (0495) 244555

CLEARTONE

• Circle No. 136

COUNT ON KEATING FOR THE SYSTEMATIC WAY TO SAVE

at SUPER LOW direct mail prices:

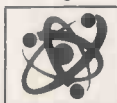
apple compatible boards

Model	Description	Price (£)	Model	Description	Price (£)
7500A	Wire Wrap Board, up to 25 sixteen-pin or 6 forty-pin sockets.	12.00	7710A	Asynchronous Serial Board, for Paper-Tape Reader, Keyboard, VDU, Printer etc. Baud rates selectable from 50 to 19.2K baud.	95.00
7520A	Extender Board, with top connector.	15.00	7712A	Synchronous Serial Board, for high-speed interface communications.	105.00
7114A	12K ROM/PROM Board, 6 sockets for combination of 2316 ROMs, 2716 EPROMs.	65.00	7720A	Parallel Board, for Paper-Tape, Printer etc. control on/off devices such as low current relays, sprinklers etc.	95.00
7424A	Calendar/Clock Board, 12 or 24 hour formats, adjusts Feb. to 29 days for leap years.	149.00	7728A	Centronics Printer Interface Board, for Centronics-type parallel printers.	119.00
7440A	Programmable Timer Board, 3 independent software-controllable 16-bit timers.	75.00	7379A	Cable for all Centronics, Okidata Mikroline 80 or Microtek MT-88T printers — specify which desired.	17.00
7470A	Analog-to-Digital Converter Board, converts analog voltages to BCD numbers then to ASCII characters for VDU. Use for monitoring thermostats, fluid level in tank, Apple power supply etc.	75.00	7388A	Cable for MPI 88T printer.	17.00
7490A	IEEE488 Interfact Board, up to 15 interconnected controllers, talkers and/or listeners for Counters, Signal Generators, Digital Multimeters, Colour Graphics Output Devices etc.	195.00	7811B	Arithmetic Processor Board, floating-point hardware to increase execution speeds and math functions by order of magnitude. Includes interpreter software on diskette for disk drive users.	249.00
			7811C	Arithmetic Processor Board, same as item 7811B except interpreter software on ROM.	249.00

BIG SAVINGS

On other new products including battery operated hand-held PROM programmer for only £895 complete — ideal for field applications pocket-size DVM's, Calculators, Interface Cables, Barrier Boxes, VDU's and more — send £1 for our catalogue and we'll credit you £5 on your first order. Don't delay — Send Today.

Prices INCLUDE VAT, Post and Package charges. You pay only actual net prices as quoted. Enclose your cheque/postal order, made payable to: Keating Computer, with quantity model and delivery address. Allow 30 days for delivery. Documentation includes installation guide, operating instructions, schematics and logic diagrams. All products warranted for 90 days, and backed by full money back guarantee if not satisfied. Big discounts for dealers and bulk orders.



KEATING COMPUTER WATCH US GROW 42 KNOLL BECK AVE., BRAMPTON, NR. BARNSELY, SOUTH YORKSHIRE

• Circle No. 137

Buying a printer is a serious business. We're adding a little fun...

The Great Centronics Tenth Anniversary Printer Offer

The first ever Centronics printer was shipped just ten years ago. Since then we have become the world's leading independent printer manufacturer, first choice for the professional user everywhere.

With everything set for an even more successful second decade, we would like our customers to join in a celebration of our 10th Anniversary, so we're making a very special offer on our highly praised Model 737 printer - at a new low Anniversary price.

The Fun



In conjunction with Hogg Robinson Travel we're offering to everyone who buys a 737 from a Centronics Qualified Retailer, before July 12th, a chance to win a luxury holiday for two in the Bahamas at a time of your own choosing. And there are lots of other exciting prizes to be won!



So get along to your nearest retailer displaying the 10th Anniversary sign for all the details. But hurry! The offer must close on July 11th.

The Serious Business

Centronics 737 Correspondence Quality Matrix Printer.

The ideal general purpose printer for the serious microcomputer user.

- Compact and attractive design
- Proportional and monospaced printing
- 40, 80, & 132 characters per line
- 80 characters per second print speed
- Roll, cut sheet and fanfold paper
- Bi-directional paper movement for super and sub-scripts



Your Centronics Qualified Retailer

Euro-Calc Ltd 128/132 Curtain Rd
London EC2 Tel: 01-729 4555
Henry's Radio 404 Edgware Rd
London W2 Tel: 01-402 6822
Informex 8-12 Lee High Rd
London SE13 Tel: 01-318 4213
Lion Micro Computers Lion House
227 Tottenham Court Rd
London W1 Tel: 01-580 7383
Newtronic 255 Archway Rd
London N6 Tel: 01-348 3325
The Xerox Store
84 Piccadilly 01-629 0694
77 High Holborn 01-405 5659
110 Moorgate 01-588 1531
Transam Components Ltd
59/61 Theobald's Rd London WC1
Tel: 01-405 5240
C & G Computer Group Ltd
36/38 Meadway St Weston S Mare
Avon Tel: 0924 417 724
C & G Computer Group Ltd
Tower House Fairfax St
Bristol Tel: 0272 28424
Decimal Business Machines
Decimal House Thomas Lane
Bristol Tel: 0272 294591

Comserve Computer Services
98 Tavistock St Bedford
Tel: 0234 216749
Jaxrest Linton House
Catherine St Aston Birmingham
Tel: 021 328 4908
Micro Associates
471 Lichfield Road Aston
Birmingham Tel: 021 328 4574
Westwood Computers Ltd
117-118 Tennant St Fiveways
Birmingham B15 Tel: 021 632 5824
Robert Harding Ltd
63 London Rd Brighton
Tel: 0273 608444
Interface Components
Oakfield Corner Sycamore Rd
Amersham Bucks Tel: 02403 22307
Cambridge Computer Store
1 Emmanuel St Cambridge
Tel: 0223 65334/5

C & G Computer Group Ltd
South Devon Hse Newton Abbot
Devon Tel: 0626 62101
Avrohurst 57 High St
Ingatstone Essex
Tel: 077 75 4022
The Computerist 642 London Rd
Westcliffe On Sea Essex
Tel: 0702 335 298
Screen Scene
144 St Georges Rd Cheltenham
Glos Tel: 0242 28979
Alpha Business Systems
89 Railway St Hertford
Tel: 0992 57425
Bromwall Data Services Ltd
25 Park St Old Hatfield
Herts Tel: 07072 60980
Compshop Ltd 14 Station Rd
New Barnet Herts
Tel: 01 441 2922

Local Business Technology Ltd
Wormley Hse 82 High Rd Wormley
Bromsbourne Herts Tel: 09924 66157
Digital Devices Ltd
134 London Rd Southborough
Tunbridge Wells Kent
Tel: 0892 37977/9
D J Herriot 42 Camden Road
Tunbridge Wells Kent Tel: 0892 22443/4
Byte Shop Manchester
11 Gateway House Piccadilly
Manchester Tel: 061 236 4737
Independent Computer Engineering
16/18 Littleton Rd Ashford
Middx Tel: 07842 47171
Byte Shop Computerland
92A Upper Parliament St
Nottingham Tel: 0602 40576
Micro Age Ltd 53 Acton Rd
Long Eaton Nottingham
Tel 06076 64264

Micro General 6 The Birchwoods
Little Heath Rd Tilehurst
Reading Tel: 0734 25226
Grist Business Services Ltd
West Quay Rd Southampton
Tel: 0703 39061
Aerco-Gemsoft
171 Church St Woking Surrey
Tel: 04862 22881
North Amber Ltd Great Oak Hse
Albany Close Esher Surrey
Tel: 0372 62071
Petelect Micro Computers
32 Chertsey Rd Woking Surrey
Tel: 048 62 63901/68497
Business & Leisure Microcomputers
16 The Square Kenilworth
Warwickshire Tel: 0926 512127
Catel 30 Kings Road
Harrogate N.Yorks
Tel: 0423 65165
Huddersfield Computer Centre
4 Cross Church St Huddersfield
Yorks Tel: 0484 20774
Scotbyte Computers Ltd
Thain Hse 226 Queensferry Rd
Edinburgh Tel: 031 343 1005

CENTRONICS®

Centronics Data Computer (UK) Ltd., Victoria Way, Burgess Hill, Sussex RH15 9NU Telephone 04446-45011 Telex: 877801

• Circle No. 138



THE LONDON SUPERBRAIN CENTRE

47, Lower Belgravia St., Belgravia, London, SW1.

Visit the Superbrain centre to see wordprocessing systems and business systems with your own tailored software.

Software includes customer and invoice system, leads and sales system. VAT output and debtors, insurance agents system, car sales program, order processing program.

SPECIAL OFFER! SUPERBRAIN FOR ONLY £1,550

We provide any printer to fit the Superbrain e.g. Qume, Starwriter, Spinwriter, Centronics 737 etc.

- ★ Special Educational Discounts
- ★ Demonstrations and Quotes given
- ★ Free catalogues on request

TEL:
01-730-8791
TODAY



47, Lower Belgrave Street, London, SW1.
Tel: 01-730-8791

AN EMG COMPANY

• Circle No. 139

NASHUA QUALITY DISKETTES



What more is there to say?

Nashua Computer Products Division, Cory House, The Ring, Bracknell, Berks. Tel: 0344 52711. Telex: 848821.

NASHUA DISKETTES ARE NOW AVAILABLE FROM THE FOLLOWING DISTRIBUTORS

MIDLANDS & SOUTH ENGLAND
Cavendish King & Computer Supplies
Bristol 849730 Hitchin 813511
London 940 4862

NORTH EAST ENGLAND
North East Computer Supplies
Washington 475442
Conrac (UK) - Hull 571741

NORTH WEST ENGLAND
RegalData - Buxton 5901
Claremont - Warrington 822925

WEST COUNTRY
Systematic - Plymouth 669934

SCOTLAND
Penforma - Glasgow 4295046

• Circle No. 140

The Jarogate Tape Backup System Discs are vulnerable . . . GET 'EM TAPED - FAST



This new system provides a reliable and flexible backup facility, but with a breakthrough in data transfer speed. Yet it costs no more than other systems offering only half the performance.

It transfers data at 24k/bytes per second - backing up a 10M/byte hard disk in less than 20 minutes, including checking and verification. It has twice the capacity of most other units, too . . . up to 24M/bytes of data on one standard cartridge.

Standard S100 bus controller card gives full interface with your computer, plus the additional facilities of two RS232C serial channels and 10 programmable timers.

A full Jarogate software package is included, on 5" or 8" diskette. It allows data backup and recovery on a file-by-file basis, under the Digital Research MP/M or CP/M systems or Cromemco's CDOS system.

The cartridge unit is based on the well-established Kennedy 6450 system.

The complete system costs £1,850 plus VAT and delivery is free in the UK mainland.

JAROGATE

JAROGATE LIMITED
MICROPROCESSOR CONSULTANTS
67 Tulse Mere Road, West Norwood, London SE27 9EH
Telephone: 01-670 3674

• Circle No. 141

Multi
Variable

Task ... System Software for Micros

Multi-user Micro Power through
FAMOS™
from MVT Microcomputer Systems, Inc.

THE ONLY 8080/Z80 MULTI-USER SYSTEM FOR HIGH END-USER PRODUCTIVITY

RELIABILITY - Owing to efficient design and long (3 year) period of stabilization.

DATA BASE INTEGRITY - FAMOS file system is only micro program supporting automatic file system integrity maintenance. File record lockouts are automatically provided by the file system.

DEVICE INDEPENDENCE - Table controlled random and serial file I/O. One microcomputer can simultaneously support several hard disks, floppy disks, drum storage and even core memory, all operating synchronously.

FLEXIBLE MEMORY MANAGEMENT - Bank select on fixed boundaries (16 and 32 KBytes) and extended address mapped memory. Up to 3 MBytes of memory can be used with each user having his own 32 KByte bank.

THROUGHPUT - Optimizing BASIC compiler and fast run-time provide unmatched throughput in a multi-user environment. . . . 6-30 times faster than competing systems.

EFFICIENT LARGE DATA BASE SUPPORT - Multiple key ISAM provides rapid access to records in files to 16 MBytes. Random files can be any size.

ENVIRONMENTAL FLEXIBILITY - FAMOS is the only software system supporting a true batch monitor. Any combination of foreground, background and interactive operations are simultaneously supported. This includes concurrent data and word processing, program development and communications.

USER ACCOUNTING WITH MULTI-USER FILE SECURITY - File protection is provided through: passwords, filename prefixing and code protected flag protects.

FAMOS, the logical system of choice:

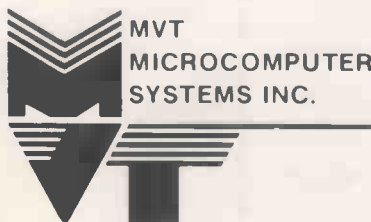
By the Manufacturer . . . prolongs sales life for Z80 based systems. FAMOS 6MHZ system will outperform 16 bit systems.

By the System House . . . lower maintenance, vertical customer base, migration path (16 bit run-time system will be available when timely).

By the End-User . . . high productivity, lower cost per work station, no obsolescence, minimal down time.

SINGLE SOURCE SYSTEM SOFTWARE . . . Multi-tasking DOS, Optimizing BASIC Compiler, 8080/Z80 macro assembler, Relocating Linkage Editor, Multi-user word processing system, List processing system, Disk SORTs, Core SORT, User Accounting, Multi-key ISAM, BASIC DEBUG facility, Diagnostic routines, Spooler, Forms facility, BATCH processor, Command line Interpreter, BDE utility, Communication software, BASIC SYSGN utility, Over 225 system routines, variables and utilities . . . and more.

HARDWARE SUPPORTED . . . CROMEMCO, IBC, IMS 5000, IMS 8000, NCR 8130, NCR 8140, PCC 2000, MICROBYTE, ARTEC, SSM, SYSTEMS GROUP and others. Hard disk subsystems include KONAN SMC-100, XCOMP and Century Data.



SALES AND SUPPORT IN UK:

Microtek Computer Services (Agents)

50 Chislehurst Road
Orpington, Kent BR5 0DJ
Tel. Orpington 26803

IMS Dealers



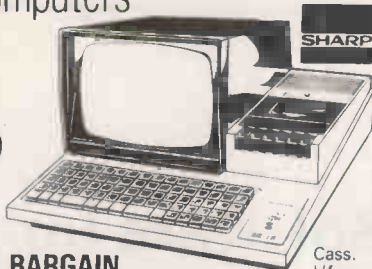
Microcomputers

moran

MZ80 48K

OUR PRICE **£460.00**

No gimmicks, No giveaways. Just good value for money



THIS MONTH'S STAR BARGAIN
Sharp PC-1211 Pocket Computer
£82.00

Cass.
1/face
£15.95

TRS-80

0 Expansion Interface Units **£173.87**

16K Ram Upgrades (same day service) **£30.00**

Disk, Drives, Singles, Twins 40-80 track from **£236.00**

For TRS-80 and Video Genie

Stringy Floppies TRS-80 **£169.** V/Genie **£179**

Video Genie 16K Level II **£299.00**

CREDIT FACILITIES AVAILABLE ON ALL PURCHASES OVER £150.00 (written quotations on request)

We fully support the products we sell.

TOP QUALITY 5¼" Floppy Disks £1.56 each.

Cassettes, Drivers, Tapes, Books, Paper, Cables, Software for Entertainment, Business and Educational purposes.

C. W. O. Please add VAT and carriage. Personal callers welcome



MICRO-CHIP SHOPS

91 FRIARGATE, PRESTON, LANC.
197 WATERLOO ST., BLACKPOOL
190 LORD ST., FLEETWOOD

L. D. MORAN & CO. LTD

Computer Systems Design

Head Office:

Tel. Fleetwood 79511/79480

• Circle No. 143

Are your computer supplies costing you more than your Micro cost?

TRY

A. W. Hawkins & Co. Ltd.

For computer supplies off the shelf at sensible prices from people who understand computer supplies.



A. W. Hawkins & Co. Ltd.

1-5 Clerkenwell Road
London EC1

Tel: 01-253 0768

• Circle No. 144

Does your microcomputer suffer from hiccups?

If so, quite often the cause of irregular performance or breakdown is very simple.

It's probably a high voltage spike in the electricity supply, called a transient, affecting the performance. Heavy electrical loads in the vicinity of your microcomputer (from domestic electrical appliances to office photo-copiers) can often cause voltage transients, which in turn, play havoc with both hardware and software.

The Reguvolt 'P' Model Constant Voltage Transformer provides the answer to a very simple yet aggravating problem, offering the following benefits to safeguard your supply sensitive computer and equipment.

- Transient suppression — gives software and hardware protection.
- Brownout protection — prevents micro interruptions and system crashes.
- Isolated secondary circuitry — gives complete electrical isolation between mains and computer.
- Fast voltage stabilisation — prevents VDU screen drift and complete system failure.



- Automatic overload current limited — protects equipment against damage during a fault condition.
- Low frequency mains harmonics removed, preventing VDU flicker and circuit overload.

The complete range of Reguvolt 'P' models, from 1/2 to 2 amp ratings (ie. 120VA to 500VA) are available from stock.

Should you require further details, please fill in the coupon, or, if you prefer, give us a call.



Cetronic Limited

Hoddesdon Road, Stanstead Abbots,
Ware, Herts SG12 8EJ, England.

Tel: Ware (0920) 871077 Telex 817293

Please send me further information on your range of Reguvolt 'P' Model Constant Voltage Transformers.

Name

Company

Address

Telephone

PC7/81

• Circle No. 145

COMPUCOLOR II

REVIEWED IN THIS ISSUE

THE SYSTEM

- *16K User RAM
- *Disk Drive
- *Colour VDU 64x32 CHRS
- *Excellent Colour Graphics Routines using 16384
- Dot Resolution
- *Upper & Lower Case + Graphics in Two Sizes
- *£50 Value Free Software



THE SOFTWARE

- *Word Processor £145
- *Trend Spotter £245
- *VAT Package £50
- * + Lots of system software and games from 12.50
- *Complete word processor system only £1695
- See write up

Compucolor and Intecolor systems are ideally suited to process control and data capture & display applications

INTECOLOR 3600 Series

3600 series	
3621	£1795
3651	£1595
3652	£1959
3653	£2595
3654	£2999

PRINTERS

Ok! Microline 80.....	£329
Epson Mx80.....	£399
Ok! Microline 83.....	£749
Anacom 150.....	£699

INTECOLOR 3621
Standalone desktop computer with color graphics, 13" CRT; Deluxe 117 Key Keyboard including color and numeric clusters plus 16 special function keys; File Handling DISK BASIC and FORTRAN Languages 32 lines, 64 characters per line. Built in 50K byte Micro-Disk drive. 32K of User RAM and User Manual.

INTECOLOR 3651
Complete desktop



computer with color graphics, 12" CRT; 101 Key Keyboard, including color and numeric clusters; File Handling DISK BASIC; 32 lines 64 characters per line. Mini Disk drive with

80K bytes storage including bus expanded interface and 16K.

INTECOLOR 3652
Same as 3651 except has 160K byte Dual Mini-Disk drive

INTECOLOR 3653
Same as 3651 except has 591K byte Dual 8" Floppy Disk drive.

INTECOLOR 3654
Same as 3651 except has 1182K byte Dual 8" Double Headed Floppy Disk drive.

INTECOLOR 8000 Series

Dyad Developments are now able to supply the full range of INTECOLOR 8000 series desktop computers and terminals

SPECIFICATIONS

13" or 19" colour display with 80x48 or 80x24 characters and 180x192 point resolution graphics in 8+8 colours. Disk storage from 80k to 1.9M Bytes, or 13,26MByte hard disk. Powerful disk operating system in ROM or CP/M on 8060 series computers. Also available is a Very High Resolution Graphics option with 384x480 individually colourable points of 8 possible colours. Includes software for point plotting, vector drawing in a variety of line styles, automatic labelling and scaling of grids and axis, bar charts & pie charts, multiple curve plotting, circles and markers, automatic polygon fill, text justification, both 2D & 3D modes, rotations, clipping and lots more.

PRICES

800IG 19" colour terminal	£1579
800II terminal with high resolution option	£2699
8051 colour computer with 90k disk storage	£2621
8052 colour computer with 180k disk storage	£2939
8053 colour computer with 590k disk storage	£3645
8054 colour computer with 1180k disk storage	£4275
8063 cp/m based computer with 980k disk storage	£4229
8054 cp/m based computer with 1960k disk storage	£4849

contemporary cabinate (as in picture) for 8000 series systems add £120.00



ALL PRICES EXCLUDE VAT AND CARR/ P&P

Please phone or write for further information to:-

Dyad Developments

The Priory - Great Milton - Oxon - OX9 7PB - Tel (08446) 729

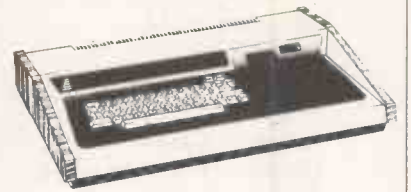
• Circle No. 146

★ FREE SOUND WITH VIDEO GENIE! ★

CASE FOR OHIO SUPERBOARD OR UK101 ONLY

IN PLASTIC OR **£24**
IN STEEL! **£37**
NUMERIC PAD FOR ABOVE
ONLY **£12**

WE CAN NOW OFFER THE
INCREDIBLE VIDEO GENIE
FOR ONLY **£279** INCLUDING
SOUND! 32K EXPANSION
INTERFACE FOR ONLY **£279**
AND 40 TRACK DISKS FOR
ONLY **£195** SINGLE AND
£380 DUAL!



**CENTRONICS
737**
LETTER QUALITY
PRINTER
ONLY **£345**



PET-CENTRONICS
FULLY DECODED
INTERFACE
NOW ONLY
£49

OHIO SUPERBOARD
COMPLETE WITH SOUND,
POWER SUPPLY, MODULATOR
FULLY BUILT & TESTED FOR
BRITISH TV STANDARDS
ONLY
£159

APPLE — CENTRONICS INTERFACE
ONLY **£79!**



ALL PRICES INCLUDE POSTAGE & PACKING BUT EXCLUDE VAT



KRAM ELECTRONICS
VICTORIA HOUSE, 17 HIGHCROSS STREET, LEICESTER

• Circle No. 147

STCS
ST Commercial Systems Ltd
26 New Broadway, Ealing,
London W5 2XA, England

CASH AND CARRY SUPERDEALS

SUPERBRAIN 64K **£1650**

**QUAD DENSITY
SUPERBRAIN** **£2250**

NEC SPINWRITER **£1600**

DIABLO 630 **£1600**

CROMENCO — (All hardware and
software in stock for immediate delivery)

MATRIX PRINTERS

**ANADIX
OKIDATA
EPSON**

The quietest, most
reliable printers
available — 40, 80 or
132 characters per
line with graphics

Telephone: 01-840-1926

STCS
ST Commercial Systems Ltd
26 New Broadway, Ealing,
London W5 2XA, England

MICROPRO

WORDSTAR

The Ultimate Word Processing
Package **£250**

DATASTAR

Forms Generation, Data Capture,
Validation and Retrieval **£180**

MAILMERGE

Mailing List, Standard Letters, etc. **£80**

SUPERSORT

Search, Sort and Select **£125**

PASCAL, BASIC FORTRAN,
PL/I and other CP/M software

Dealers: Best Discounts

Call for Details

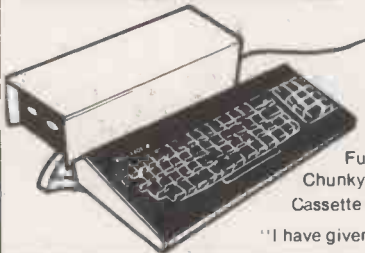
Telephone: 01-840-1926

• Circle No. 148

CASTLE ELECTRONICS MICRO COMPUTER CENTRE

Telephone Hastings (0424) 437875

TANGERINE



microtan 65 **£69**

Microtan 65 is the most advanced, most powerful, most expandable microcomputer available — it also happens to be the most cost effective.

6502 Microprocessor 1K Tanbug 1K User RAM Full TV Display **£79** (ready-built). 20-way KEYPAD—**£10**. TANEX—**£43**
1K 16 parallel 1/0 lines. Cassette Interface—1 serial 1/0 line. 2 x 16 BIT counter timers OPTIONS TK RAM total—32 parallel 1/0 lines. 4 x 16 BIT counter timers—RS232. 20MA current loop.
10K MICROSOFT BASIC—£49
System Rack—**£49** in black/tangerine In brushed aluminium.
Full Ascii Keyboard with numeric pad—**£60.85**. Cabinet available—**£20**. Lower Case option—**£9.48**.
Chunky Graphics Pack—**£6.52**, Tanram Full Memory Expansion to 40K—**£119.00**. Mini Motherboard—**£10.00**.
Cassette with counter—**£21.70**.

"I have given TANGERINE five bonus points for getting just about everything right"—E.T.I. Mag., May 1980.

COMMODORE PET

Everything has been said about PET—Britain's number one selling microcomputer. A full range of accessories and software, (both games and business), is held in stock.

8K Inbuilt Cassette—**£399**,
8K Large Keyboard—**£425**
16K Large Keyboard—**£499**
External Cassette—**£55**
Dual Disc Drive—**£695**
Tractor Printer—**£395**

CASSETTE SOFTWARE: Strathclyde Basic Course, Basic Basic Course, Invaders, Treasure Trove of Games 1 to 10 (10 selections of games), Basic Maths, Algebra, Statistical Packs and lots more!



£399



The Apple II+ is more powerful than its predecessors with built-in sound and high resolution graphics, which make it ideal for scientific and games applications.

APPLE 16K—**£599**
APPLE 32K—**£649**
APPLE 48K—**£659**
Epson Printer—**£349**

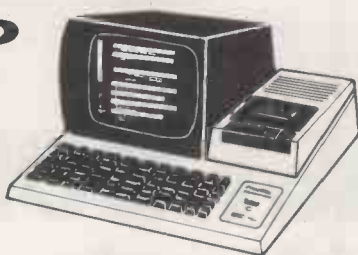
Cassette with counter—**£21.70**
Disc drive without controller—**£299**
Disc drive with controller—**£349**

16K add-on—**£89**

CARDS: Prototype/hobby card—**£15**, parallel printer interface card—**£104**, communications card—**£130**, high speed serial interface card—**£113**, Pascal language system—**£299**.

SHARP

MZ80 20K **£449**
36K **£475**
48K **£495**
Printer **£475**
Dual disc drive **£715**



video genie system



The Video Genie system has many uses in all spheres of life, the easy to use BASIC language means that programmes are easily written for specific applications, and pre-recorded programme tapes are available in great variety. TRS/80 software can be used with this system. The system has great scope in the home, sophisticated games programmes can introduce the computer age to all the family, who can then progress to writing their own programmes in BASIC or even machine code. Software is continuously being developed to aid home budgeting and education.

£299

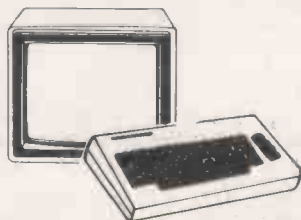


Acorn Atom

The ATOM is a British-designed personal computer—simple to operate, and in kit form, simple to build. It has all the features found in machines twice the price or more, and yet it has one outstanding advantage. It is designed on an expandable basis.

Atom kit 8K ROM 2K RAM	£ 120
assembled	£ 150
kit 12K ROM 12K RAM	£ 220
assembled 12K ROM 12K RAM	£ 250
1K RAM set	£ 9.50
4K Floating Point ROM (included in 12K version)	£20.00
Printer drive	£ 9.00
LS244 buffer	£ 2.50
Colour encoder	£19.00
Mains PSU	£ 8.00

COMMODORE VIC



Commodore International Ltd. (AMEX-CBU) has officially introduced the world's first full-featured colour computer priced at under **£200**.

The new VIC 20, which retails at **£199.00** was unveiled on January 8th at the Consumer Electronics Show in Las Vegas.

The new computer puts Commodore squarely in the low priced personal computer market with a fully expandable microcomputer which connects to any television set and rivals the features of existing microcomputers selling at four or five times the price. The features speak for themselves:

- colour
- sound
- programmable function keys
- 5K memory expandable to 32K
- standard PETBASIC
- full-size typewriter keyboard
- graphics character set
- plug-in programme/memory cartridges
- low-priced peripherals
- joystick/paddles/light pen
- self-teaching materials

ALL PRICES—ADD 15% VAT DELIVERY: POSTAGE/PACKING WILL BE NOTIFIED. BARCLAYCARD AND ACCESS ORDERS TAKEN BY PHONE

CASTLE ELECTRONICS 7 CASTLE ST., HASTINGS, E.SUSSEX
Telephone Hastings (0424) 437875

Shop hours 09.00 to 1730 Mondays to Saturdays

• Circle No. 149

BASIC COMPILER and PROTECTION FEATURE for COMMODORE machines

THE COMPILER

DTL-BASIC is the product that every Commodore user has been waiting for (but probably thought was impossible). Just look at these features:

- programs run up to 20 times faster (depending upon the nature of the program and its size)
- almost totally compatible with the Commodore Basic Interpreter
- no arbitrary constraints; if the program runs on the Interpreter then it can be compiled
- large programs when compiled can occupy significantly less store
- provides true integer arithmetic (as well as real arithmetic)
- compatible with almost all assembler routines
- the compiler accepts extensions to Basic
- compilation speed is 1.2 lines/second
- encourages well documented programs that are easier to understand, debug and modify

DTL-BASIC gives you the best of both worlds; you can develop programs on the Interpreter and then compile them to get an amazing performance improvement. Compiled programs can only be retailed with a Software Vendor license.

THE PROTECTION FEATURE

DTL-P-BASIC is the same compiler as DTL-BASIC with the addition of an outstandingly secure protection feature incorporating multiple levels of protection to deter the most determined 'Pirates'. Protected programs will only run on specially protected disks supplied by Drive Technology Ltd.

Available now on 3000 range, July for 4000/8000 series

DTL-BASIC Compiler Software vendor license

£300 (manual £15, Update service £100) price on application

DTL-P-BASIC Compiler

(including a copy of DTL-BASIC and a Software vendor license)

£900 (manual £15, Update service £200)

Protected disks

£100 for a box of 10 (quantity discounts available)

PRICES INCLUDE VAT

Please state machine configuration when ordering.

DRIVE TECHNOLOGY LTD

318 RINGWOOD ROAD, FERNDOWN, DORSET; BH22 9AT.
TEL. 0202 64 5819

• Circle No. 150

NICE AND EASY DOES IT Panasonic Hardware + CPS Software

The quality and reliability of Panasonic microcomputers is complimented by two new CPS programs specially developed to work with Panasonic hardware—OASIS and COMTEXT



Dealers!

CPS are Panasonic Distributors
Would you like to sell Panasonic
micros, OASIS and COMTEXT

CPS (DATA SYSTEMS) LTD



Third Floor, Arden House,
1102 Warwick Road, Acocks Green,
Birmingham B27 6BH
Tel: 021-707 3866

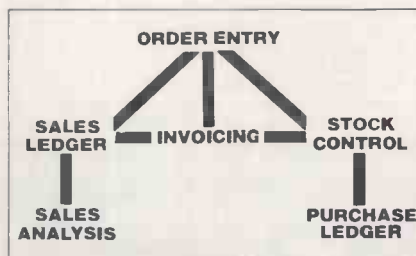
A member of the CPS Group

= OASIS PLUS COMtext

Wordprocessing and
Communications System

Business system
Fully integrated
Easy to use

Linked Functions



An interlinked suite of programs forming an advanced wordprocessing and communications system which facilitates the creation, manipulation and distribution of text simultaneously around an organisation with offices in different locations

If you want to know more about OASIS, COMTEXT and Panasonic microcomputers, talk to CPS on 021-707 3866 or complete the coupon

CPS (Data Systems) Limited,
FREEPOST, Birmingham B27 6BR
Please send me details of Panasonic micros,
OASIS and COMTEXT

Name _____
Position _____
Company Name and Address _____

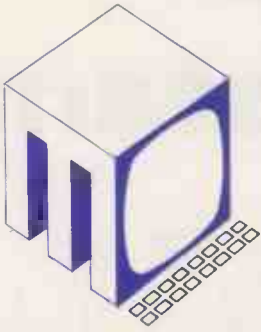
Telephone _____

CPS where performance and good value matter

• Circle No. 151

CP/M SOFTWARE

from



METROTECH

WORD PROCESSING

WORD-STAR^{tm1} is the most complete integrated word processing software system ever seen on a microcomputer.

WORD-STAR 2 £255/£30
WORD-STAR 2 with MAILMERGE £315/£40

NEW * Commercial Operating System * NEW

At last a secure commercial environment can be created under CP/M. COSY offers a true **COBOL compiler**, ISAM files, enhanced disk I/O, screen formatting and printer spooling. Requires Z80 or Z80A processor.

COSY — including COBOL compiler £450
COSY — run time system £200
PSORT — utility sort £50
FDUMP — utility file dump £30
 One manual for all the above £15.

INTEGRATED BUSINESS SYSTEMS

Written specially for the U.K. market, Version 2.0 of GRAFFCOM'S Integrated Small Business Software is now available for both floppy (ISBS-F) and hard (ISBS-W) disk systems. Modules available are: Payroll, Company Sales, Company Purchases, General Accounting, Stock Control, Order Entry and Invoicing, Name and Address, Time Recording, Lease, Rental/HP. Prices are available on request, discounts quoted for bundles of the above systems. Manuals £35 each.

LANGUAGES/UTILITIES

CBASIC II £75/ £20
COMMERCIAL DISK EXTENDED BASIC
SBASIC
COMPILER STRUCTURED BASIC £175/ £30
SUPERSORT I £125/ £20
WORD-MASTER SUPERIOR TEXT EDITOR £75/ £20
MET/ TWAM INDEX SEQUENTIAL FILE ACCESS IN CBASIC II £55/ £15
MICROSOFT BASIC 80 INTERPRETER £155/ £25
MICROSOFT BASIC COMPILER £195/ £25
MICROSOFT FORTRAN 80 £215/ £25
MICROSOFT COBOL 80 £315/ £25

MICRO DATA BASE SYSTEMS

MDBS is a database system offering full network **CODASYL**-oriented data structures, variable length records, read/write protection, one-to-one, one-to-many and many-to-many set relationships. Add on features are: an interactive report-writer and query system, a dynamic restructuring system and a recovery transaction logging system.

MDBS prices start from £600/ £350
Primer manual £5

COMMUNICATIONS

BISYNC-80/3780 and **BISYNC-80/3270** are full function IBM 2780/3780 and 3270 emulators for microcomputers.

BISYNC-80/3780 gives you a Remote Job Entry terminal for the price of a micro!

BISYNC-80/3270 combines the local processing power of a micro with a sophisticated screen capability. Make your dumb terminal smart!

I/O Master is a superb S100 buffered I/O board which supports 3780 and teletype communications, plus serial and parallel peripherals.

MET/TTY will connect your micro to a timesharing service in simple teletype emulation.

BISYNC-80/3780 £275/£15
BISYNC-80/3270 £275/£15
MET/TTY £95/£15
I/O Master Board £225/£20

DATA MANAGEMENT

SELECTOR III-C2

An easy to use Information Management System; requires CBASIC II £185/£30

SELECTOR IV

An advanced Information Management System; requires CBASIC II £275/£35

DATASTAR

Powerful data entry, retrieval and update system £195/£30

FINANCIAL REPORTING

REPORT WRITER

* **SPECIAL OFFER ***

You input the values — Report Writer will perform your calculations and produce a report with your headings, totals and summaries £95/ £15

GLECTOR

General ledger option to Selector III; Requires Selector III and CBASIC II £185/ £30

All software is **Ex-stock** and available on standard 8" disks or 5" disks for North Star Horizon, Vector MZ, Superbrain and Dynabyte.

- * Postage and Packing £2 per order.
- * Add 15% VAT.
- * State which disk type and size.
- * All orders prepaid.

Telephone orders welcome for Access, Barclaycard, American Express or Diners Club.

CALL 0895 58111 Ext. 247 or 269

or write to:

METROTECH MAIL ORDER

WATERLOO ROAD

UXBRIDGE

MIDDLESEX UB8 2YW

enclosing cheque, PO's payable to METROTECH

tm1 WORD-STAR is a trademark of Micropro. Prices are shown as Software with manual/Manual only. Prices correct at time of going to press.

METROTECH are sole U.K. distributors of DYNABYTE microcomputer systems.

• Circle No. 152

Is it time you had an Electronic Assistant in the office?

The micro chip has brought affordable computing to the small business and professional practice, as well as to individuals and departments in large organisations. Desktop computing is now a practical reality for a host of tasks that were too expensive or impractical on big computers. The microcomputer has become an Electronic Assistant in the office.

Number Cruncher

An Electronic Assistant can help collect, store, calculate and analyse numerical data. Microcomputers are aiding accountants, actuaries, administrators, analysts and architects. Budgeting, pricing, costing and estimating are just a few practical applications.

Word Processor

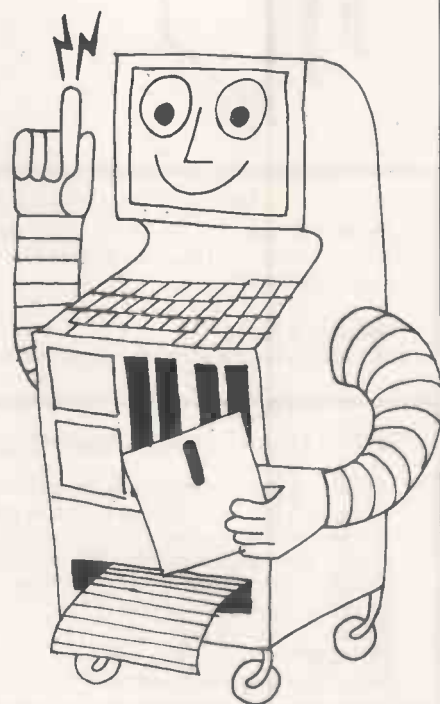
Change the disc and your Electronic Assistant becomes a word processor. It will help with proposals, contracts, reports, documents, price-lists, mailing and all those other wordy office tasks.

Information Retriever

Your Electronic Assistant will keep a file of personnel, pupils, properties, patients. Find what you want, when you want it. Match people to jobs, children to schools, buyers to houses, patients to treatments. Retrieve files and print information at the touch of a button.

Business Minder

And of course your Electronic Assistant will help mind your business. Send bills, keep



accounts, process orders, take stock. Give you time to look at the business information you've never had time to analyse properly.

Micros Can Grow on You

Microcomputers are cheap enough to add a second machine as jobs grow. Replicate them to perform similar tasks in different locations. Link them together in a local network. Program them to talk to big computers.

Ask Digitus to advise you and supply an Electronic Assistant to suit your present and future needs.

Call: 01-405-6761 or write for information to: Digitus Limited, 9 Macklin Street, Covent Garden, London WC2.

DIGITUS — ELECTRONIC ASSISTANTS IN THE OFFICE

Digitus

Digitus specialises in microcomputing, communications and the electronic office. The Company provides complete systems for the small business, professional practice and large organisation. Costs vary between £3,000 and £30,000 per system depending on facilities. We acquire software packages and equipment from all over the world to satisfy requirements and have the capability to put machines and software together, adding the special features you need.

• Circle No. 153

What price software?

PART OF OUR editorial stock-in-trade is an ingenious comparison between the impact on the software business of the micro and the impact on the book business of the first printing presses. To recap, for the benefit of those readers who have not followed the story so far: before Caxton, books were made very slowly, by hand, in monasteries for very rich men who could not read. That is very like the way software used to be written: very slowly, by hand in applications houses for rich men who knew nothing about computing. The printing press arrives and in the time it takes a scribe to do an illuminated "A", Caxton can run off three or even four whole pages.

Before very long, Caxton has a heap of finished books in the corner of the workroom and is wondering how much to sell them for. Over the centuries, a solution has evolved and now we know how to price a book. Of course, the problem is made easier because a book is a substantial object: the paper, the printing, its storage and transport to the reader all cost large and determinable amounts. What is in question is the return the author and the publisher should receive for their intellectual investment in the book.

With software, the position is rather different: the whole thing is apt to be intellectual investment — the cost of the disc, manual and postage can hardly amount to £10 while the whole package is apt to be offered for £20 — £100 — £1,000. Well, which? That is the problem.

One way to calculate the price is to take the cost of writing the package, add 100 percent for profit and divide the total by the number of copies you expect to sell. This, however, just puts the problem further back. How many do you expect to sell? It is a bold man who will put a figure to that, especially if he is trying to sell a piece of software of general — or so he hopes — appeal. By guessing too low, he might make his price so high it will never sell; by guessing too high he makes his price so low that the few he actually sells do not pay his costs.

Yet, that is probably the wrong approach altogether. The important man here — where is he not? — is the customer. He cares not one fig, jot, iota, or button what it cost the package's perpetrators to write it. He judges it only by its usefulness to him. He might argue: I pay my secretary £2 an hour and this word-processing package will let her type 10 hours less a week so my annual saving is £1,000 so I should expect to pay the capital sum on which £1,000 pa is the interest, viz: £5,000.

Is that how he argues? Of course he does not. Let us return to buying a book. Our customer — or "you" for short — walks into a bookshop and fingers the goods. You look at the cover, the publisher, the lies that he has printed on the back jacket, you flip through the pages, sample a few of the author's well-chosen words and then you part with the trivial amount of money demanded.

The buyer of software is in a rather different position. He can not really obtain any idea of what he is buying by looking at the disc. The manual may be totally misleading. It might be beautifully written, immaculately printed and totally wrong. It may be smudgy, badly laid-out, unindexed but the software it describes is so good you do not need a manual anyway. Yet even if you have the opportunity to run the software in the privacy of your home, you often cannot really tell whether it is going to be worth the month's work growing accustomed to it will entail. If you decide it is — well, here is a blank disc — why not just copy it and save everyone good deal of trouble?

To cope with these uncertainties, the customer tends to apply some very crude rules of thumb. He seems to say things like: "£90? Far too cheap. Not worth bothering about". "£150 — £300 — why not"? "£500 — I'll think about that".

Now, one can sympathise with anyone who does not want to

spend £1,000 on anything, but why reel back in horror from cheap software? Marketing folk-lore tells us that if you halve the price, you sell five times as much. However, the tribulations of low-cost software in our business tell us that this is not necessarily the case.

Even so simple-minded a fellow as our mythical buyer has discovered that an essential, invisible part of any software package is a soothing voice on the end of a telephone which explains why Minnie, your office mouse, made the whole thing crash just by looking at it.

That soothing voice is apt to cost the software perpetrator about £10,000 a year and for some reason emerging folk wisdom has decided packages that cost less than £90 will not make it. Yet VisiCalc originally cost \$70.


The whole problem is confused by the Americans who will insist doing things first, cheapest and loudest. Other things being equal, what relationship should we look for between British prices and U.S. ones? They have about four times the population and that would suggest that their prices ought to be one-quarter of ours to carry the same overheads. Yet if one is to believe the evidence available, people in Britain are twice as likely to be interested in microcomputing as they are in America, so that our real population is only half theirs, and their prices ought to be about half our prices.

Whether by design or accident, that is what we see: with the dollar about half the value of the pound, products often have the same numerical costs in Britain and the U.S. While this is satisfying to the theorist, it makes the entrepreneur's job rather difficult. He cannot confine himself solely to the U.K. market. With America's huge installed base of micros and lavish spending power, he must try to enter that market. It is however, all uphill. Not only does he have to sell 3,000 miles away, he must do it on returns which are only half as great per unit as he would receive in the U.K.

Of course, the volume of the U.S. market ought to work for him just as it does for native producers, but the cost of entering it is that much greater. To make matters still worse, he probably has to contend with the chauvinism of most of Middle America.

To work the American market properly, one almost certainly needs an American base. Keeping and supervising a body several thousand miles from home is an expensive and uncertain business: operating through loose links with American firms is equally risky.

What we need is a concerted national push. Products like Rolls Royces, whisky and tweed get the benefit of national prestige advertising to persuade Americans that of such stuff is heaven made. Something similar ought to be done with British software. Americans ought to have it firmly impressed on them that though they have many fine qualities, they ought to leave the delicate business of programming to their older and subtler cousins. The new computing age is one where the literature, laws, customs, habits of our time have to be transcribed on to silicon. While the thrusting dynamic of the new land may be very good at making hardware, it needs a more civilised spirit to breathe life into it.

The object of the exercise is to flatten out the marketing hill: to persuade the Americans that British software is worth paying a premium for. If we do not somehow manage this — perhaps in the last resort by actually writing better software than they do — our micro industry is going to be swamped in just the same way that our film, aerospace, book publishing, electronics industries have been. It is a great shame in a way that the Americans did not — as they so nearly did in the 1870s — choose German as their national language. If they had, Germany would have all the aggravation of the "special relationship", while we could get on quietly with our own lives. 

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback—it is your chance to keep in touch.

Censure for Sinclair

I WAS intrigued to read in Feedback, April 1981, that Commodore U.K. is "selling Pet updating ROM sets below cost price" as a gesture to good customer relations. It is good to know that someone in the industry is interested in good customer relations: there must be many customers like me who absolutely loathe Sinclair.

Following strong advertising in the Sunday press, I ordered a Sinclair ZX-80 earlier this year for £100. "We want you to be satisfied beyond doubt", said the advertisement "and there is a 14-day money-back option, of course".

The machine arrived in the second part of February and although it was fun, I had in the meantime discovered your excellent magazine and it did not take long even for a novice like me to realise what the ZX-80 lacked. Imagine my disbelief, however, in reading an advertisement in your April edition for the Sinclair ZX-81, a much-improved machine, at £70.

I immediately asked for my £100 back — so that I could purchase a ZX-81 — but the 14-day period had just expired. "We have every sympathy", said Sinclair and: "We regret we are unable to offer a discounted 8K ROM to existing ZX-80 owners, nor can we offer a part-exchange facility since, as you will appreciate, this would create a precedent".

What kind of business morality is this, to push outdated stock on to unsuspecting customers at nearly 50 percent more than the new model which is about to become available? You can imagine the enthusiasm with which I now view my Sinclair.

If there were more of us, we could have a riot, but as it is, I can only vow never to touch a Sinclair product again and suggest to as many acquaintances as I can that they might be wise to do the same.

**P D Austwick,
Bath.**

In praise of the ZX-81

HAVING drawn attention to the limitations of the Sinclair ZX-80 — Feedback, June 1980 — I feel I must now give due credit for Sinclair's most recent achievement in the computer market.

I refer, of course, to the ZX-81. I have recently bought one of these remarkable units for my own personal use, and also to assess its suitability for schools use. I can state without reservation that the ZX-81 is everything the advertisements claim — and more.

Certain specific points which may be of interest to readers:

- The construction of the casing is considerably more sturdy than the ZX-80, i.e., it does not fold if you squeeze it.
- The touch-sensitive keyboard has a finish far superior to the plastic-sheet finish of the ZX-80 keyboard.
- The manual is exceptionally well written, and very informative.
- I have experienced no problems at all in recording and playing back programs using a moderately-good cassette recorder.
- The moving graphics are very good, and give far more scope for games.
- The screen display is very good and totally flicker-free in slow mode.
- Using a function key, all keywords and functions are input by single-key inputs, plus Shift or Function for some — a great saving of time and storage.

I would have no hesitation in recommending the ZX-81 to any of my pupils, or their parents who are interested in a low-priced computer for personal use. Any comment on suitability for general school use would be a little premature at this stage, beyond saying that without the 16K expansion module, scope for school use would be limited.

Having visited the Acorn laboratories and seen something of developments on the BBC computer, it is clear that — for three times the price — the BBC Proton offers considerably more than the ZX-81 in terms of storage, facilities and expansion potential. It seems to be an excellent unit. For home computing power per pound sterling, though, the Sinclair ZX-81 is going to be hard to beat.

**Graham Blackwell,
South Brent,
Devon.**

Logical languages

I WOULD first like to say that I found Raymond Anderson's article on Pascal, May, 1981, most interesting. On the whole, I believe that it contained some very useful constructive criticism, which could be borne in mind by the software houses. However, I feel that Anderson has put little thought into some of his criticisms.

For example, concerning the case-statement default which he thinks is non-existent. True — there is no simple way out, but then, is it not one of the main intentions of structured languages — especially Wirth's brainchild, Pascal — to promote the logical approach?

The logical answer obviously involves

set instructions: declare all the case alternatives as members of a scalar type, i.e., declare a universal set at the beginning of the program, then just before the case statement, discover if the case operand is not in the universal set, i.e., using IF/NOT(IN/) THEN/ ELSE (Case)). It is longer, but default is not lacking, and in most situations the set version makes more sense.

May I take the opportunity to thank you for a great computing magazine, but please, can we have more articles on languages, like Micro-Pascal and Algol 68? While I am about it, I would dearly like to learn more about Lisp — books are so expensive.

**James Morgan,
Skewen,
West Glamorgan.**

Raising finance

YOUR interesting editorial, *Financing the Future*, May 1981, creates a sour taste in the mouth. The inability to see beyond the end of one's nose is not, I regret, confined to the Government. I am running a virtually-unfunded charity which deals with many hundreds of Vietnam refugees. One of our aims is to establish an efficient charity and thence to create jobs. Our initial dialogue with the Manpower Services Commission suggested that we might be able to obtain money to research unemployment but none to create any solution.

More to the point, in this case micro-computers, I believe that the comparatively small investment of a few £1,000 would provide us with the basis of efficient economic management and the opportunity to find employment for people whose English may not be up to normal employment standards. If and when I can raise some money, I will need to find a secretary; I would prefer a person from Vietnam both because one language barrier would cease to exist and to lower the horrible 90 percent unemployment which exists within this group.

A good word-processing program, for example, would enable our secretary to produce standard letters in reasonable English. The ability to produce and save letters without having to correct reams of paper could provide real help in English improvement.

Financial programs could help to solve the perennial problem of finding capable bookkeepers — a problem so noticeable in small and large charities alike. My experiences in working for commerce and

(continued on page 44)



Vision Business Systems

FOR YOUR

SUPERBRAIN™

WITH DEPENDABLE SERVICE AT A SENSIBLE PRICE!



(+ K Dual Density Model
(320K Disk) Only **£15.95** (Or
Lease for only **£12** per week)

64K Quad Density Model
(700K Disk) Only **£1995** (Or
Lease for only **£14** per week)

SUPERB BUDGET-PRICED WORD PROCESSING SYSTEM

Dual Density Model SUPERBRAIN Together with the
Dual Purpose Olympia SCRIPTA KSR Daisywheel Typewriter
and the Powerful WRDSTAR Word Processing Package
For only **£2,850** (Or Lease for only **£20** per week)

Full Range of Business Packages available including:

- Integral Account
- Production/Stock Control
- Service Contracts Scheduling & Control
- Data Base Management
- Financial Modelling

**Tailored Software designed
by our professional
consultants to meet your
specific needs**

To Order or for further Information Contact:
**VISION BUSINESS SYSTEMS LTD.,
58 ST. PETER'S STREET,
ST. ALBANS, HERTS.
TEL. ST ALBANS (0727) 33744**

• Circle No. 154

(continued from page 42)

in three charities have taught me that even the sometimes inadequate standards of financial management found in commerce are often lacking completely in charities. Already a number of local charitable organisations have expressed interest in the possible use of a microcomputer with multi-user facilities.

Sufficient dynamic and static RAM would provide us with the opportunity to compile the extensive medical statistics which could help solve the many stress-related illnesses that constitute the "Refugee Syndrome". The interest shown by the MSC in research-orientated projects could then produce the cash to staff a medical research and help program.

Finally, we wish to set up a co-operative to provide employment for the many skilled people whom we are trying to assist. The range and number of possible uses is extremely large. The problem arises when one tries to raise the cash to buy such equipment; those with the money to give to such causes tend to regard the micro as a kind of games machine. I can see the means of providing employment, creating wealth for the country, building a self-supporting charity which serves a community of many thousands and rebuilding the self-confidence and esteem of a homeless and lost people.

Roy Tindle,
The Community of Vietnam,
Erith, Kent.

Alternative history

I AM compiling an alternative history of computing. The history will focus on the lighter side of the development of the subject, highlighting the failures, the accidental discoveries, the legend both famous and infamous that have helped to share the present-day state of the art. My address is 996 Warwick Road, Acocks Green, Birmingham.

I would be grateful for any help in the compilation of this work and any contributions in the form of, say, press cuttings, references and personal recollections would be most welcome.

Martin Wakeman,
Acocks Green,
Birmingham.

Protecting software

WITH REFERENCE to the late Lawrence Perry's interesting discussion on the use of patents and copyright in the protection of computer software, April 1981, I would like to add a further possibility.

While it might be harder to implement the following approach in connection with disc-stored programs. I can see no reason why it might not offer immediate protection to program authors in connection with cassette-based material.

The idea is to resort to the protection offered under copyright law to pieces of music. Since a cassette tape — whether containing a program or a piece of Bach

— can be played audibly on a simple machine found in almost every home, and since the definition of music is largely culture-dependent — but still protected, even when the culture is far from the local norm — why not declare each cassette-recorded program to be a piece of music?

Any attempt to copy it, for whatever purpose, would be an infringement of copyright invoking a well-established legal procedure for recovery of compensation.

I would be interested to hear from anyone who has started to take this approach.

Nick Laurie,
Langport,
Somerset.

CP/M documentation

I AM glad to hear that Rose Deakin — *Practical Computing*, April 1981 — is managing to overcome the documentation problems of CP/M. I can, however, assure her that when she progresses to MP/M her earlier problems will seem like the joys of spring.

Having recently taken delivery of an MP/M package, I was surprised to find that documentation on CP/M 2.2 was supplied with it. Then I found that the manual MP/M mainly describes the differences between CP/M and MP/M; in other words, MP/M is just the same as CP/M — except, of course, where it is different.

My favourite quotation is found on page 11, where it says: "See the Digital Research document entitled, CP/M 2.0 Users' Guide for CP/M 1.4 Owners, for a detailed description (of MP/M)", Referring to the CP/M documentation supplied is not all that helpful either. For instance, page 2 of the CP/M 2.2 Users' Guide refers to the reader already being familiar with CP/M 1.4.

I have just one message for Rose Deakin and others who find themselves bewildered or confused — ask. Do not be afraid of appearing foolish, it happens to all of us sometimes. I am not referring to any particular supplier, but to any supplier whose documentation is inadequate.

We are the customers for whom the manuals were written and they should intelligible to us.

Roland Couvela,
Farnham,
Surrey.

Revolutionary storage

BRING personal computing out of the dark age. I have discovered the ultimate storage medium — a medium which can boast unsurpassed reliability, while being highly cost-effective, totally portable, requiring no special handling or storage precautions and easily and compactly stored. This medium can be read and written at different speeds without fear of reliability loss by virtue of a synchronisation signal.

Comparing paper tape to cassettes and floppy discs, you can see that, in price at least, paper tape is the clear winner:

Medium	Storage Capacity	Cost	Cost/Kbyte
Paper-tape	120,000 characters/roll	£1.50	1.28p
Cassette at 300 baud	21,600 characters/tape	£0.55	2.61p
Floppy disc density - single formatted	82,944 characters/disc	£2.90	3.58p

Clearly, from the table, paper tape beats all its competitors in price per memory unit.

I hear the sceptics saying that paper tape is slow, but slow compared to what? A popular machine like the Pet has a tape-transfer rate of 500 baud which is, effectively 250 baud since all data is recorded twice. The Teletype 43 runs at 300 baud.

Yet cost is not paper tape's outstanding asset. Paper tape has almost 100 percent reliability. My last four reels of paper tape have had only three parity errors — an error rate of 0.00625 percent or one part in 160,000.

TTY Knox,
Hull,
Humberside.

Micros in medicine

I WOULD be very pleased to hear from anyone who has any ideas or information about using microcomputers on general hospital wards for teaching or management.

I own a Sinclair ZX-80 with a 16K RAM pack and would like to be able to put it to use when I teach in the ward.

I realise that the Fluid Monitor as packaged by Medicom may soon be leading the field in intensive-care units and I feel that any means of improving nursing care and teaching with the use of microcomputers would be a welcome step forward.

Valerie Garland,
Plymouth.

Course control

I AM interested in locating packages, suitable for running on a microcomputer system, which are designed to control the bookings of places on courses and conferences.

The system would effect control from the first point of contact — an unconfirmed booking — through to the preparation of invoice data following a candidate's attendance on a specific course. Ideally, such software should interface directly with a compatible invoicing/ledger administration package.

If there are no proprietary packages available, perhaps someone could offer me their opinion of the suitability of a tailored hotel reservation, front and back office, system/billing system — such as is offered by Landsler, for example. I can be contacted at 20a Worley Road, St Albans, Hertfordshire AL3 5NS.

N J Williams,
St Albans, Hertfordshire. ☐

INNOVATIVE

TRS-80 SOFTWARE

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	ATRIB	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 5¼" 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.

TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [refundable] plus 50p postage.



MOLIMERX LTD.

A. J. HARDING (MOLIMERX)

1 BUCKHURST ROAD, TOWN HALL SQUARE,
BEXHILL-ON-SEA, EAST SUSSEX.

TEL: [0424] 220391/223636

TELEX 86736 SOTEX G



• Circle No. 155

LSI's M-Three aims at professional market

A NEW British microcomputer has been launched, aimed at the top end of the personal-computer market. The M-Three is the latest offering from LSI Computers of Woking in Surrey. The microcomputer cost around £1 million to develop, with one quarter of the money funded by a Government grant.

LSI already manufactures two computers, the M-One and the M-Two at its two factories in Woking. A third factory is under construction and when it is completed, the M-Three will be leaving the production line at the rate of 150 computers a month.

The manufacturer claims that the new machine offers more ability, storage and user-satisfaction per pound cost than any comparable machine available. The machine is Z-80 based, has 64K RAM, two double-density mini-floppy drives, a VDU with 1,920-character green phosphor display and a full-function keyboard. The keyboard has 14 programmable function keys, and a numeric pad making a total of 109 keys.

M-Three is equipped with a



CP/M operating system and is programmable in Basic and Cobol. There is also a range of applications software available from LSI computers. The complete package costs less than £3,000 without software, or £3,500 with one LSI software application included for small-business users.

There is a standard option of two 8in. double-density floppy-disc drives replacing the mini-floppies. With this configuration, the system will cost £4,000 with and £3,500 without software. Printer interfacing is simple and there are two RS232 interfaces available for extra printers or VDUs.

The machine specification and price have been carefully geared to market needs and the manufacturer is confident that

the machine will be a success.

LSI managing director Tom Fitzpatrick has this to say about the company marketing operation: "Our plan is to become one of the major suppliers of high-ability personal computers by 1982. We see the greatest market as the grey area at the top end of the personal market and the very small end of the business market.

"For example, typical customers would be professional people requiring computer power for their own work, small business proprietors, scientists, engineers, schools and colleges".

LSI Computers, Copse Road, St Johns, Woking, Surrey, GU21 1SX. Telephone 04862-23411. □

Second-hand equipment

A BECKENHAM-based concern has launched a microcomputer system to buy and sell new and second-hand micro equipment. Kelly's Computer Market uses two Apples to store details of equipment for sale and wanted.

Buyers and sellers are matched by price, area, machine type or whatever category the subscriber wishes, on a program written by the firm's managing director, Gordon Kelly. Weekly cost of the service is £2.50 plus VAT.

Used equipment attracts a special discount — one month's subscription covers inclusion until the equipment is sold. The service is free to buyers. Contact Kelly's Computer Market, Paragon House, Beckenham, Kent. Tel: 01-659 7997. □

Government outlines strategy for national teletext campaign

MICHAEL Marshall MP, the Parliamentary Under Secretary of State for Industry, has announced that October is to be National Teletext Month. The aim of this will be to promote the sales of TV-based entertainment and the teletext information service. There will be prizes for consumers and the retail trade.

In a speech given to the Scottish Congress of the Radio Industries Club at Gleneagles, Marshall said: "Government is supporting industry to establish rapid consumer acceptance of teletext within the home market, with consequential benefits to prospective imports of software, hardware and know-how.

"While there should be no

Government-led market creation, we can assist by serving as a focal point for industry to initiate increased marketing activity, as well as helping to develop a Teletext promotional campaign, aimed directly at the consumer".

He went on to outline this strategy which would include:

- Provision of consumer material to aid understanding and encourage trials of teletext.
- Public-relations activity.
- Sales-training schemes for shop-floor staff.
- Trade incentives for shop-floor staff.
- Seeking further support from other areas of the teletext industry.

"As a culmination of these

Stars of the Pet Show

THE Commodore Pet Show, West Centre Hotel, Lillie Road, London, June 18-20 features a number of innovative products for the Commodore range of systems. The Commodore Vic-20 has finally made its U.K. public debut.

The Vic-20 is a full-colour computer costing less than £200 and its launch has been eagerly awaited. Commodore, has, however, had problems in producing enough to meet the expected demands from the U.K. market and in adapting the computers for use with British television. Commodore officials are still confident that they will be able to sell 100,000 Vics by the end of the year.

CP/M enthusiasts, or Pet owners who have long been frustrated by their inability to use the vast range of software written under the CP/M operating system, will be heartened to learn that a CP/M adaptor for the Pet, launched at the Pet Show, is now on sale. The CP/M "stunt box" costs £550 and plugs into the IEEE interface on the Pet. An optional RS232 port costs an extra £20.

The software for the device was written by Keith Frewin of Unicorn who then had the "box" developed by Derek Rowe of Small Systems. □

Plessey makes micros

PLESSEY, the U.K. electronics and telecommunications giant, is to manufacture microprocessors. By choosing a licence deal with Mitel, Plessey has made a significant break with its previous policy of in-house process development.

Mitel is a Canadian company which already has similar deals with British Telecom and GEC and was chosen because of its Iso-CMOS process which is among the most advanced available today. □

Programming as a cottage industry

IN HIS book, *The Wired Society*, James Martin predicted the revival of cottage industries. Rather than the traditional weaving, or lace-making activities, however, the cottage industrialist of the future would be a computer programmer. Jeremy Hope, the managing director of Ram Computer Services, hopes to prove James Martin right.

Ram Computer Services' project will, if successful, begin the process of emptying the dp departments of Britain, reversing the trends of the past 200 years. Ram is not looking for just anybody, though — they want experienced, professional programmers to provide business users with first-class custom-designed packages.

The programmers will work in teams, supervised by Ram to ensure that the work meets the high standards required and in part to save programmers from wasting time exploring blind alleys. They will work on machines leased or purchased from Ram, and the scheme will be of special interest to redundant programmers who want to invest their redundancy monies in something which could provide them with a future.

Jeremy Hope, the instigator of the scheme says of the scheme: "We expect the opportunity to have widespread appeal as work can be undertaken at any time of the day or night they choose. Moreover, after a year of working for us, programmers

Four software additions to VisiCalc family

PERSONAL Software, the company responsible for the best-selling VisiCalc program has developed four more packages in the same vein. Like VisiCalc, probably the most-used microcomputer program in the world today, the four new products will be available for most of the popular brands of microcomputer.

The new programs include VisiPlot, a high-resolution

plotting and graphics package; VisiDex, a flexible personal information system; Visi-Trend/VisiPlot, a combination of the VisiPlot program together with a program for time-series manipulation, trend forecasting, and descriptive statistics.

The VisiTerm program allows a personal computer to communicate with a wide variety of other machines ranging from large mainframes down to other personal computers.

There is also a new version of the original VisiCalc program available for the Apple II and the Apple II Plus computers. The enhanced VisiCalc is compatible with Apple's 16-sector disc storage format and includes 17 new commands and operations to make numerical model-building on a personal computer easier still and even more powerful.

The four programs as well as

the new VisiCalc program have the ability to pass data between programs. For example, files created using VisiCalc can be transmitted to another computer via VisiTerm. Files generated by data input using VisiCalc can be used to provide graphical output when transferred to VisiPlot.

There are now a total of seven programs in the Personal Software VisiCalc family, all providing functions vital to the successful management of a business. The software can be used as a suite or the programs used individually by people without any specialised knowledge of computer programming.

The new software is not yet available in the U.K. but for those wishing to buy direct from the U.S., prices are as follows; VisiDex \$199.95; VisiPlot \$179.95; VisiTrend/VisiPlot \$259.95; VisiTerm \$149.95. Personal Software Inc. 1330 Bordeaux Drive, Sunnyvale, California 94086. □

will be in a position to purchase their own computer, which, who knows, could form the base of an autonomous business operation".

If you are interested in the scheme, contact Jeremy Hope at Ram, 15-17 North Parade, Bradford 1, West Yorkshire. Telephone 0247-391166. □

This neat hand-held terminal from MSI Data International is called a data capturer. Developed by Mektronic Consultants of Manchester, the device known as the TermiPet can be used for the remote entry of data using the keyboard or wand scanning of bar codes. When the Pet is not busy, the data stored in the TermiPet memory is transferred direct to the Pet via a cable connection. From the Pet, the data is transferred to either disc or cassette for immediate or future use. The particular configuration is a MSI-77 with 4K memory, the interface and software either on disc or cassette. The terminal has a double back-up system of batteries to ensure no loss of data. The TermiPet system is available for the 8000, 4000 and 3000 series of Commodore equipment. Prices of the TermiPet system start at £795 plus VAT. For further information contact Catlands Information Systems Ltd, Harrison Building, Green Lane, Wilmslow, Cheshire. Telephone 0625-527166. □



More powerful Aim 65/40

THE enhanced version of the Rockwell Aim 65 single-board microcomputer has been unveiled in London. The Aim 65/40 still uses the evergreen favourite 6502 eight-bit microprocessor from MOS Technology, which means that there will be a degree of compatibility between the two systems.

The Aim 65/40 at about £900 has an on-board thermal printer just like its predecessor, and a full 65-character keyboard. There is a strong resemblance between the two machines but the new model has more integrated circuits as well as a larger display and printer — 40 characters instead of the previous 20.

There is an ample 65K of on-board storage and the configuration of PROM, ROM, and RAM is user-selectable. Portable Microsystems Ltd, Forby House, 18 Market Place, Brackley, Northamptonshire NN13 5SF. Tel: 0280-702017. □

Last year we tested or reviewed 141 PET programs, evaluated 54 peripherals ranging from light pens to printers, and ran 27 major articles on PET programming. Our gossip columnist blew the gaffe on dozens of inside stories, receiving two death threats, five poison pen letters and a dead rat for his pains. We also published 53 letters from PET users, 88

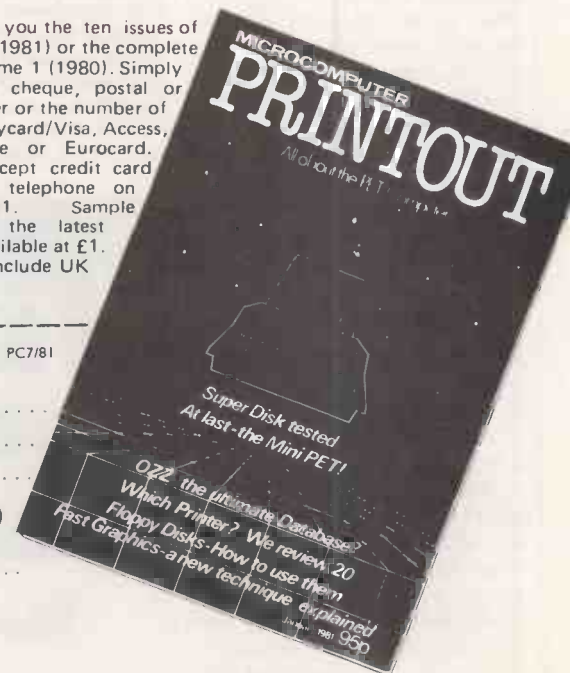
THE TRUTH ABOUT THE PET

listings, 105 programming hints, and 116 news stories about the CBM/PET.

All this added up to more than 150,000 words of essential PET information. We are PRINTOUT, the independent

magazine about the CBM/PET. Shouldn't you subscribe?

£9.50 buys you the ten issues of Volume 2 (1981) or the complete set of Volume 1 (1980). Simply send us a cheque, postal or money order or the number of your Barclaycard/Visa, Access, Mastercharge or Eurocard. We also accept credit card orders by telephone on 0635-201131. Sample copies of the latest issue are available at £1. All prices include UK postage.



To PRINTOUT PO Box 48, Newbury, Berkshire RG16 0UJ, England. PC7/81

My Name is
 Address
Postcode

Please Enter my Subscription to : Volume 2 (1981) Send me the set of Vol 1 (1980)
 I enclose my cheque or Postal Order OR
 Debit my Access/Mastercharge/Eurocard/Barclaycard/Visa account No.
 UK £9.50 Eire £12.50 Punts Europe (surface) £14.50
 Europe Airmail £18 USA Airmail \$45 USA (surface) \$36
 Rest of World Air £25 Rest of World (surface) £14.50
 Send me a sample copy UK £1 Europe Air £1.50 USA Air \$5
 Send me binders @ UK £3.50 Eire £4.50 Punts Europe £5 Rest of World £7.50 USA \$19

• Circle No. 156

MicroCobol adherents to form user group

MICROCOBOL does not seem to have dominated the pages of *Practical Computing* in the past, but apparently the language seems to set some people's pulses racing. In fact, so keen are some that they have banded together to form a distributors' and users' group.

At the inaugural meeting of the new group, certain resolutions were passed. The first stressed the support and enthusiasm of the group for the Business Operating System and the MicroCobol Development System and all the associated products produced by CAP Microproducts Ltd.

The meeting decided to "encourage further exposure which will result in substantially-increased use of the products". Finally the group proposed to work closely with the CAP organisation "to ensure that this British

software product is grown throughout the world".

Meanwhile CAP has let the MicroCobol division split from the main company. The new company will be known as Microproducts Software Ltd and will be essentially the same company as before but with a different name.

Anyone wishing to apply for membership of the MicroCobol users' group should contact the chairman Bob Muston on 0533 28256. □

The future of Nascom at Lucas Logic

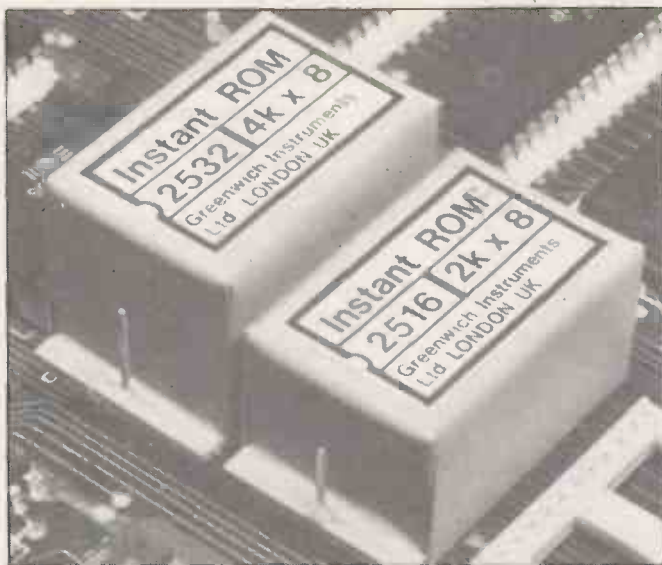
THE PURCHASE of Nascom by a subsidiary of the Midlands engineering giant Lucas Industries ends months of uncertainty regarding the British microcomputer manufacturer's future. The buying company, Lucas Logic, has promised to retain the Nascom name and product range.

Dealers and users of Nascom equipment will no doubt be happy about the deal as it ends for them a period of rumours and false starts. For Lucas, the deal brings them into the small-microcomputer market for the first time.

The new owner of Nascom is a newcomer to the personal-computer scene, but Lucas has been involved in computing since 1977. The management of Lucas Logic see the purchase of Nascom has a natural extension of the company's activities in computer applications for industry.

In addition, it will give the firm a comprehensive and proven range of products, varying from the "starter kits" suitable for educational and hobby users to the high-performance micro and mini-computers for small business and industrial use.

The new address of Nascom is care of the headquarters of Lucas Logic at Welton Road, Wedgnoek Industrial Estate, Warwick. Sales will continue through the existing dealer network. □



Instant ROM is two or four kilobytes of CMOS memory with battery back-up which can be plugged into any standard ROM/EPROM socket, or in the ROM-expansion sockets of the Pet or similar microcomputers. Once inserted it may be used like RAM. The difference is that when the system is turned off, the program stays. Programs can be edited or altered immediately, without erasure problems, yet once entered, the program will remain as if it was stored in ROM. The real advantages of the device are apparent when it is used to write security and utility programs. Since typical battery life is six years, the programs are not likely to disappear very fast. Instant ROM costs £39 for 2K and £56 for 4K inclusive. Contact Greenwich Instruments Ltd, 22 Bardsley Lane, Greenwich, London SE10 9RF. Telephone 01-853 0868. □

Software range will draw HP-1000s into world of graphics

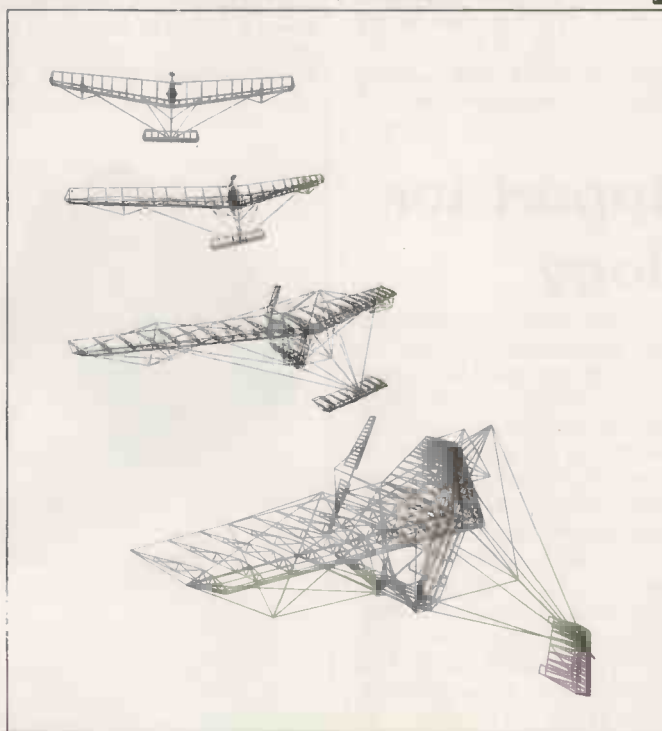
HEWLETT-Packard's new Graphics/1000 II software for use on the HP-1000 range of computers will provide the support required for a wide range of graphics peripherals. Additionally, the resources are now available for more advanced uses such as three-dimensional and interactive graphics which lead to sophisticated computer-aided design applications.

The available software will initially comprise two packages: the device independent graphics library, DGL, and the advanced graphics package — 3D, AGP-3. The DGL package is a collection of programs which will enable the users of different graphics peripherals to use a common set of commands. Alone, the package will support only two-dimensional graphics.

However, the second package will expand the capabilities to support three-dimensional, interactive graphics applications. The software is styled to complement the Hewlett-Packard range of graphics peripherals.

The graphics library weighs in at £1,082, and the three-dimensional package represents a considerable investment at

£2,164. Hewlett-Packard is at King Street Lane, Winnersh, Wokingham, Berkshire. Tel: Reading 61022. □



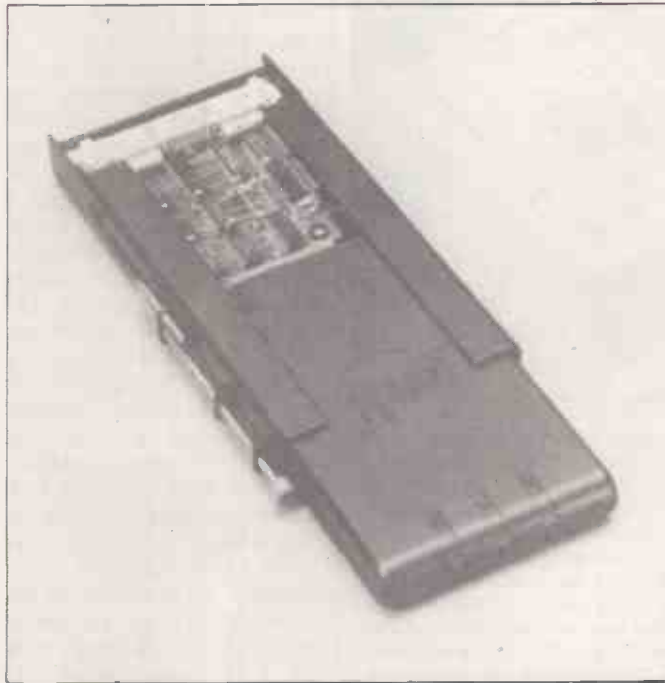
Intel develops removable bubble-memory cassettes

A COMPACT storage medium which can operate in a harsh environment is likely to be of real benefit to microcomputer users who do not have, say, the advantages of air conditioning. Intel has developed a system of removable bubble-memory cassettes which is designed to be a flexible building-block. The Plug-A-Bubble system allows users to configure systems in a variety of ways.

The basic iPAB system consists of a 128Kbyte capacity bubble-memory cassette and holder. There are two optional building-blocks available, a 5¼in. chassis, housing two cassette holders and an iSBX bus interface card with cabling. Individual cassettes are also available.

If 5¼in. sounds familiar, it is because the Plug-A-Bubble system is designed to fit in the same space as a mini-floppy unit. The iPAB cassette is housed in a rugged cast-aluminium cartridge and it contains the Intel 7110 one-megabit bubble-memory, together with the 7220 controller and other support chips. Up to two cassettes can be incorporated in each chassis and can interface with the standard Intel iSBX Multi-module bus.

Each cassette has an average access time of 48 milliseconds and a data transfer rate of 12.5Kbytes per second. The tough case can withstand a shock of 40g. in three axis. The



cassette will operate in the temperature range of 0 to 55° centigrade. The power requirement is a standard +5 and +12 Volts, power consumption eight Watts per cassette.

Typical applications of Plug-A-Bubble include those involving the capture of data such as test instrumentation, telecommunications and data-acquisition terminals and in industrial machine or process control. The system is of particular use in applications where the device needs handling or constant transportation.

To obtain the current

product price reflecting local billing factors and availability, contact Jacques Brunet at Intel Corporation, Rue du Moulin à Papier, 51, Boite 1, B-1160 Brussels, Belgium. Telephone: (322) 660 30 10.

Extra products to suit Apple

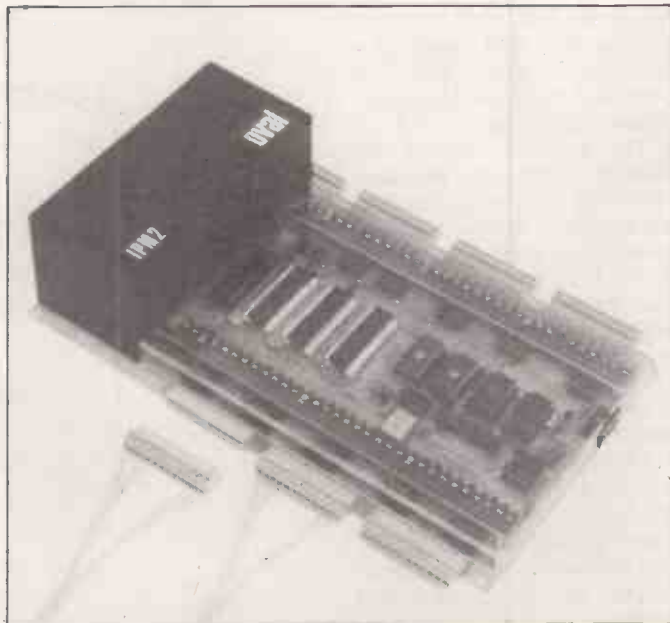
U-MICROCOMPUTERS is a British-based manufacturer of microcomputer accessories based in Warrington, Cheshire. Competing with imported products, mainly from the U.S., the first item in the U-Microcomputer catalogue is a 16K memory card. The U-Ram-16 is compatible with the Apple Language card, but costs less than half the list price of the imported article.

The U-Ram-16 allows Pascal programs to be run, makes 56K — as opposed to 48K — available to CP/M programs, gives VisiCalc 35K rather than 25K to play with, makes the integer Basic ROM card obsolete and can be used with the new Hayden Applesoft Compiler.

The card retails at £130 assembled or £99 as a kit, plus VAT. Discounts are available for volume purchasers. The card is available direct or through the nationwide Apple dealer network and has a one-year warranty against defects.

U-Microcomputers can be found at Winstanley Industrial Estate, Long Lane, Warrington, Cheshire, WA2 8PR. Tel: 0925-54117/8.

This, the new 32-channel Industrial Plant Interface from Oval Automation, is a self-contained, single-board unit and can be connected to the host computer via a serial RS232 link. Although primarily designed for the Apple microcomputer, the IPM-2 can be used with any computer which has a serial port. Alternatively, the unit can be used as a stand-alone device with the instructions contained in EPROMs. The cost of this device is £295 and further details can be obtained from Oval Automation Elm Park, Ferring, Worthing, Sussex, BN12 5RN. Telephone 0903-44831.



Financial support for high technology

A RECENTLY-established company has been formed to provide industries in the high-technology sector with the specialised financial support they need. New Technology Finance is highly selective in choosing the companies it will support, tending towards those concerns which have been established for some time and show considerable promise, yet need additional finance to cope with expansion.

New Technology Finance has a board whose expertise

combines technical, financial and commercial skills and the directors use their knowledge to link clients with potential sources of finance. Another service of the company is to monitor the progress of the client company to the benefit of both client and investor.

Interested companies are invited to contact the managing director of New Technology Finance Ltd, Mervyn E Smith at 27 Old Bond Street, London W1X 3AA. Tel: 01-643 9234.



The Onyx C8000 Series

The C8000 Series is a compatible family of microprocessor-based systems, designed for business and scientific applications.

These powerful general-purpose systems combine processor, memory, fixed 10 Mbyte or 18 Mbyte 8 in. disk (expandable to 76 Mbytes) and cartridge tape driver - all within one low profile enclosure.

The C8001 is an 8 bit Z80A* system with up to 256 Kbytes of memory for 1-5 users. And is easily expandable to the more powerful 16 bit C8002 configuration, with 256 Kbytes to 1 Mbyte of memory handling up to 8 users.

Based on the Z8000* processor, the C8002 may be connected to a high speed local network for further expansion.

Industry compatible versions of COBOL, PASCAL, BASIC, CBASIC2*, FORTRAN and C are available on OASIS*, CP/M*, MP/M* and UNIX* operating systems. Also available are packages for communications, data base management, word processing and business applications.

ONYX

Onyx Distribution Ltd
Unit 58, Suttons Park Avenue, Earley, Reading
Berkshire RG6 1AZ. Tel: (0734) 664343/6

DEALER ENQUIRIES WELCOME

*Z80A and Z8000 are trade marks of Zilog Inc. CP/M and MP/M are trade marks of Digital Research Inc. OASIS is a trade mark of Phase One Systems Inc. UNIX is a trade mark of Bell Telephone Laboratories. CBASIC2 is a trade mark of Compiler Systems Inc.

New! Sinclair ZX81 Personal Computer.

Kit: £49.⁹⁵ complete

Reach advanced computer comprehension in a few absorbing hours

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. At £99.95, the ZX80 offered a specification unchallenged at the price.

Over 50,000 were sold, and the ZX80 won virtually universal praise from computer professionals.

Now the Sinclair lead is increased: for just £69.95, the new Sinclair ZX81 offers even more advanced computer facilities at an even lower price. And the ZX81 kit means an even bigger saving. At £49.95 it costs almost 40% less than the ZX80 kit!

Lower price: higher capability

With the ZX81, it's just as simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, or to select a program off a cassette through the keyboard.

Higher specification, lower price – how's it done?

Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

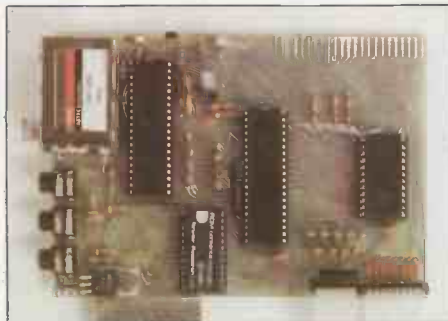
The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

**Built:
£69.⁹⁵
complete**

Kit or built – it's up to you!

The picture shows dramatically how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

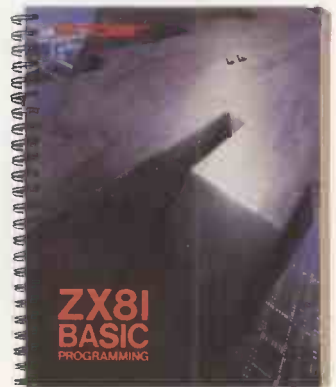
Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



Proven micro-processor, new 8K BASIC ROM, RAM – and unique new master chip.



New BASIC manual



Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.



If you own a Sinclair ZX80...

The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 – including the ability to drive the Sinclair ZX Printer.

Coming soon – the ZX Printer.

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alphanumeric across 32 columns, and highly sophisticated graphics. Special features include COPY, which prints out exactly what is on the whole TV screen without the need for further instructions. The ZX Printer will be available in Summer 1981, at around £50 – watch this space!



16K-BYTE RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.



How to order your ZX81

BY PHONE – Access or Barclaycard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access or Barclaycard. EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

New, improved specification

- Z80 A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer (not available yet – but coming soon!)
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

sinclair ZX81

Sinclair Research Ltd,
6 Kings Parade, Cambridge, Cambs.,
CB2 1SN. Tel: 0276 66104.
Reg. no: 214 4630 00.

To: Sinclair Research Ltd, FREEPOST 7, Cambridge, CB2 1YY.				Order
Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack(s).	18	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95
				TOTAL £

Please tick if you require a VAT receipt

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £ _____

*Please charge to my Access/Barclaycard/Trustcard account no. _____

 *Please delete/complete as applicable. Please print.

Name: Mr/Mrs/Miss _____

Address _____

FREEPOST – no stamp needed. PRC07

The Consummate Compact Computer.



You'll love the Black Box 3/30. It's everything you've ever wanted in a desktop computer. Including a very attractive price tag.

Take a look inside its modest enclosure. And you'll find an advanced 5-Mbyte micro-Winchester for fast-access, high-capacity storage. Plus a dual-sided, double-density floppy for backup.

The Black Box 3/30 gives you the ultimate in memory management and I/O flexibility. You can expand from 64k right up to 1/2-Mbyte of addressable RAM. And there are 16 programmable I/O ports along with an IEEE 488 bus that support VDUs, printers, other peripherals — and datacomm.



When it comes to software support, there's simply none better. Our single-user, multi-user and network operating systems let you configure the Black Box 3/30 to meet the widest range of tasks. For applications and development, you have a choice of BASIC, PL/1, PASCAL, FORTRAN, and COBOL languages.

The Black Box 3/30. Field-proven microcomputer technology perfectly packaged. And backed by powerful software. For complete details on the Black Box 3/30, call or write the RAIR dealer nearest you. Be sure to ask about the RAIR Rental Plan with purchase option.

Healey Office Equipment Unit 7, Westfield Industrial Estate, Portsmouth Road, Homdean, **Hants** Tel: 0705 597555

Digitus Ltd 9 Macklin Street, Covent Garden, **London** WC2 Tel: 01-405 6761

Holdene Ltd Manchester Unity House, 11-12 Rampart Road, **Leeds** Tel: 0532 459459

Lion Micro Computers Ltd 227 Tottenham Court Road, **London** W1 Tel: 01-636 9613 and 21 Bond St, **Brighton** Tel: 0273 601838

Micromedia Systems, Seymour House, 14-16 Chepstow Road, Newport, **Gwent** Tel: 0633 59276

NSC Computer Shops 29 Hanging Ditch, **Manchester** Tel: 061-832 2269

T & V Johnson (Microcomputers) Johnson House, 75-79 Park St, **Camberley** Tel: 0276 20446 also

148 Cowley Road, **Oxford** Tel: 0865 721461 and 48 Gloucester Road, **Bristol** BS7 8BH Tel: 0272 422061

GMS Computing Ltd Smithfield House, Blonk St, **Sheffield** S1 2BU Tel: 0742 730191

Rair Limited, 6-9 Upper St. Martin's Lane, London WC2H 9EQ Tel: 01-836 6921

RAIR

Art for Prestel's sake

COMPUTING may be an art, but can Art be done on a computer? To be specific, on Prestel? It is by no means an obvious application. The Prestel screen is formatted in such a way as to maximise the transmission of "hard" information — and graphics are effectively in a supporting role. The 40-by-24 screen is limited and entering graphics codes to build "pictures" is fiddly.

There are also some restrictions on the use of colours for pictures — we are discussing pictorial art — caused by colour-control characters. Nevertheless, the strong colour saturation and hard

by Martin Hayman

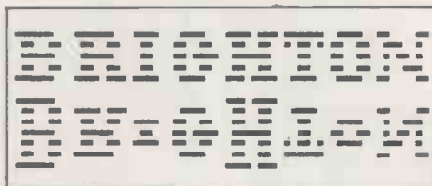
edges represent an obvious challenge to the artist who wishes to make a silk purse out of a sow's ear. Ralph Steadman's *Emotionally-drained squid on holiday* for example is recognisably Steadman but undoubtedly 40 by 28.

Brighton Polytechnic has risen to this challenge and last month presented, in association with Brighton-based Viewpress 444, "the world's first Viewdata art exhibition". Curiously, it was the department of graphic design, under Clive Chizlett, rather than the large and effective computing department, which took most interest in the topic.

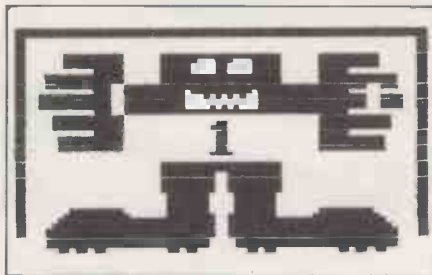
Though Brighton's computing department has taken a lead in videotex and education with its espousal of the schools telesoftware project — see *Practical Computing* Printout, June — this was intended as an exercise in exploring the visual possibilities of the medium.

In the first place, it was intended to run an international competition but this did not make the starting line for shortage of time. In the event, the students in the group had less than two weeks to learn the keyboard and the tricks of the trade, so it was not altogether surprising that several of them found the most interesting avenue

Alphabet by Adam Taylor.



Reflex Brighton by Clive Chizlett.



The goalie by Mark Johnson.

of approach was to design a satisfactory typeface, some of which I reproduce here. These are doubtless a useful contribution to the Prestel repertoire though one doubts their usefulness in a commercial Prestel operation.

Clive Chizlett argues that legibility is demonstrably an aid to comprehension and hence perhaps to saleability; to the idle flicker-through of the Prestel database, this may be so. At the moment, much of Prestel is used for sheer woggles of information but as it becomes more and more part of the well-equipped household, there will be a greater premium on attracting the browser rather than the seeker.

Chizlett also sees room for a Prestel study into the partially-sighted, for whom Prestel offers a means of communication, but he feels it would require resources — intellectual and financial — outside his range. He would not feel qualified, he indicated, to "measure" quality of sight, which would need researchers, qualified in psychology.

As for the exhibits, I must confess to a

Chinese Dragon by Clive Chizlett.



Planet in eclipse by Clive Chizlett.

abcdefghijklmnopqr
stuvwxyz
1234567890

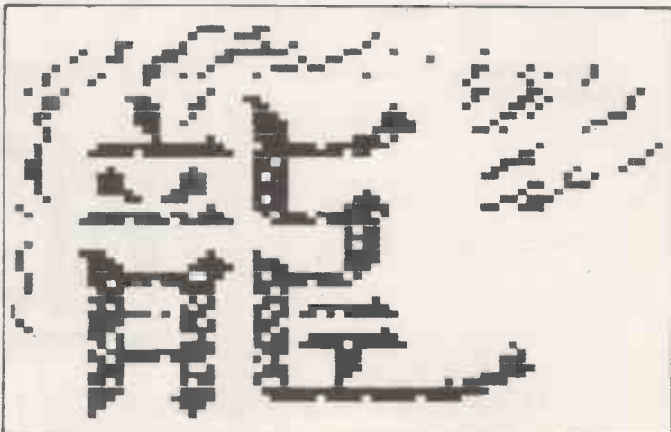
Alphabet by Mark Johnson.

slight disappointment. Much of the best work came from foreign exhibitors, notably the Germans, who have a school dedicated to the exploitation of the medium. I saw no further work from Steadman, who had certainly whetted my appetite for further pictures. One interesting feature of Steadman's *Squid* is the routine developed by IP Mills and Allen to get continuous vertical colours. Unless you can do that, pictures are practically impossible.

The constrictions of blank colour-control characters also make the design of serifed character faces fiddly, though the raster thrown up by the Techs machines which Viewpress 444 uses are an inestimable boon in any kind of Prestel screen design.

Will it catch on? It is certainly an intriguing exercise, but with picture Prestel just around the corner, which will cater for mail-order and other product-type displays, and with the current sophistication of inexpensive, dedicated graphics-orientated machines, I think it may prove something of a blind alley. □

ABCDEFGHIJ
KLMNOP
QRSTUVWXYZ





**TODAY'S BEST
PRICE/PERFORMANCE
RATIO FROM
A MICRO
COMPUTER**

£1695

Standard Model 64K RAM/320 DISK

ALTERNATIVE MODELS
'QD' 700K DISK £1995
'S' 800K DISK plus
Function Keys etc £2

SUPERBRAIN PACKAGES

The efficient business system consists of standard Superbrain Microline 80 Printer

£2045

Complete word processing system - including 'Word Star' and 'Mailmerge', standard Superbrain, Diablo 630 printer, and training.

£3495



Individual Price: £395 (inc. serial interface)



Microline 80



Individual Price: £1595

Diablo 630

Software Options: we market a full supporting range of standard languages, including, BASIC @ £175, FORTRAN @ £225, PASCAL @ £225, and CIS COBOL @ £425. We have a growing and comprehensive library of software programmes available:

Incomplete Records for Practising Accountants @ £750

Graphics - Hardware @ £435 with Software from £80

Integrated Accounting System - Stock Control @ £350, Order Entry and Invoicing @ £350, Sales Ledger @ £450, Purchase Ledger @ £450, General/Nominal @ £400, Name & Address @ £250, Complete Package so far @ £1650 plus Payroll @ £500.

Financial Modelling - T/Maker @ £155 and Micromodeller @ £645.

Data Base Management - DMS @ £400
Word Processing - Wordstar @ £250 and Mailmerge @ £75.

Also available - Form Creation, Debugging etc. Alternatively we will design and implement software packages to suit your specific needs.

KGB

MICROS LIMITED

KGB Micros Ltd., 88 High Street, Slough, Berks SL1 1EL Tel: Slough 38581/38319

Prices exclude V.A.T and are subject to fluctuation, please phone for an up-to-the-minute quote

• Circle No. 160

Twinning schools and business



DAVID FAIRBAIRN, the director of the National Computing Centre and I were discussing the ideal programmer who is — in my view — a 17-year-old who writes code like unrolling a carpet. Developing this theme, we were musing on the fact that most of the people in the U.K. who thoroughly understand micros but have little hardware on which to work are in their teens and in school, while the people who have micros, badly need to understand them but do not are middle-aged and in business.

“Why not”, we said as one, “bring the two together”?

That is what we propose. Schools with a stock of programmers but little hardware should be twinned with businesses which have a stock of hardware and a supply of problems. The twinning will, initially, be arranged through a register kept at the *Practical Computing* offices. As suitable schools and businesses apply, we shall introduce them to each other.

What might happen in practice? We imagine that it could be well worth a firm's while to set aside two afternoons a week when the computer would be used by people from the school. They would expect to help with the business problems that must arise, but at the same time, they would have their own programs to run. “Could you write a little package which re-formats the stock-control file so the word processor can use it”?

“What about a program to calculate whether it's better to buy widgets FOB Rotterdam at the warehouse door in Galashiels”?

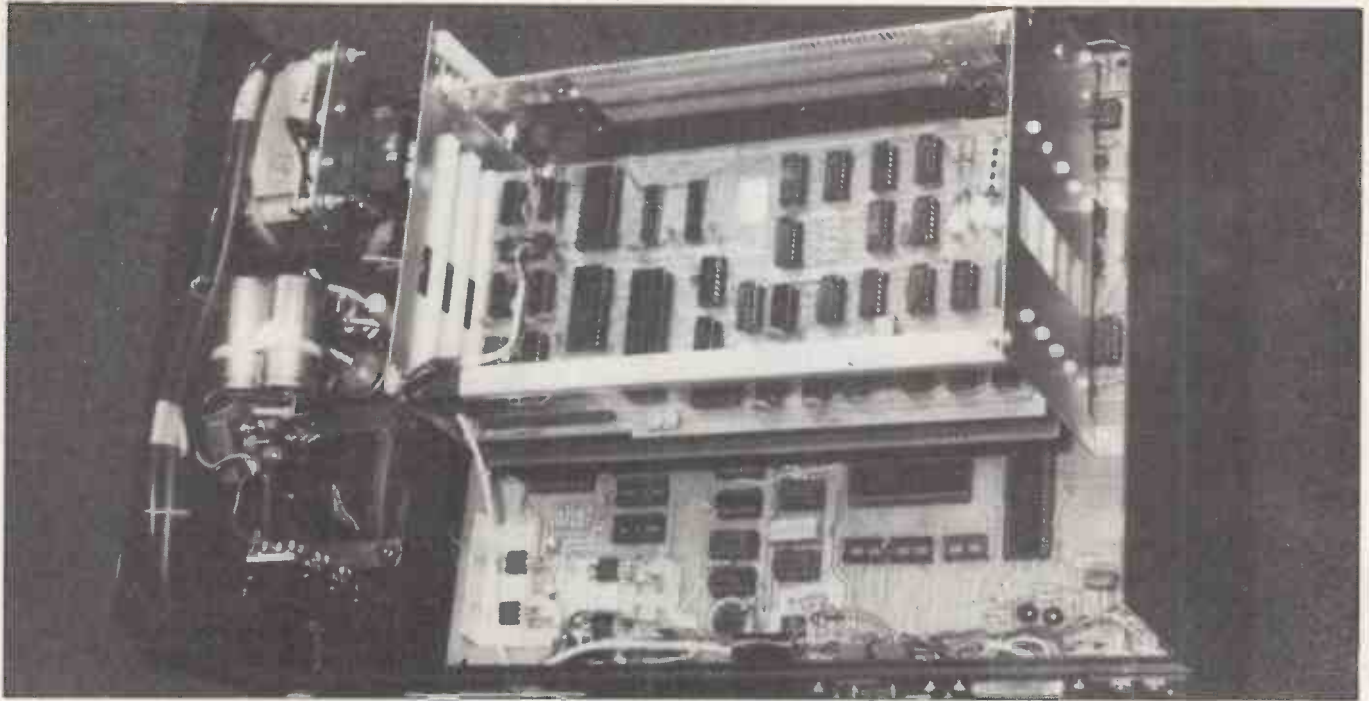
No doubt, as the young helpers make themselves useful around the place, the amiable proprietors will want to reward them suitably. Happily there is not yet an honourable Corporation of Master Programmers to shout “foul” so it is possible that everyone might be able to proceed in a mutually-convenient way. Possibly, the association will lead to the writing of major software packages in the school holidays: if that happens, it can only be to the good.

What, on the other hand might go wrong? Well, the young visitors could be a nuisance. For this reason, we think it is necessary that the link is made officially to the school so that discipline can be applied. A child who makes a pest of himself can be controlled through the school's computing organisation.

If everyone involved is to stay sane, access will have to be controlled. From the school's point of view, it would want to be sure that the youngsters are not being exploited. It would be no part of the project to provide labour for keying in the day's invoices.

The success of a twinning will depend a good deal on the give and take of both sides. If you are interested, let us know. Write to: Twinning, *Practical Computing* Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Peter Laurie



Through the expansion jungle with intrepid Explorer

THE EXPLORER 85 microcomputer system is a low-cost, 8085-based system manufactured in the States by Netronics Research and Development Ltd. The system is designed to be used at a series of levels which provide the user with a logical and well-mapped route through the jungle of system expansion. In its final, fully-developed form, the Explorer is a powerful little machine suitable for a wide range of serious programming tasks.

The powerful 8085 processor from Intel is fully software-compatible with the 8080 and is faster by about 50 percent. That means any program written in 8080 code can be implemented on the Explorer and will execute faster.

The review Explorer system consisted of a series of modules cased in an attractive blue cabinet which lends the system a no-nonsense, business-like air. These sturdy, steel cases are available as an optional extra to those who build the system from scratch and certainly do something to inspire user-confidence.

Compactness

A striking feature of the Explorer system is its compactness; the component parts of the system are a main system cabinet, a rather neat little video monitor, a disc unit, and a ASCII keyboard as well as the CP/M system disc.

The first task, having unpacked all the boxes, is to arrange the component parts on a desk or table and to assemble them. The main system box is the largest component and has three buttons on the front and some switches on the back. The back of the case also has a RS232 port and some jack sockets as well as a number of

terminals, one of which was intriguingly labelled "loudspeaker".

A logical method of constructing and proving the system seemed to involve testing the main part of the system before connecting the floppy disc unit. Verifying the main system soon proved to be simplicity itself — the system components just plugged into each other. All too often when reviewing microcomputers, they fit

by Bill Bennett

together well enough, but when the machine is switched on, nothing happens.

Happily, the fan inside the main cabinet began to hum. When the monitor is turned on, the usual patchwork of a memory dump is displayed on the screen. The next move is to press the re-set button on the front of the main cabinet. The computer will now boot — that is, the memory is cleared and the computer will go to the beginning of the monitor. The Explorer now sits in limbo until an input is received from the keyboard.

The input the Explorer is expecting is a signal to set the baud rate automatically; the machine will operate at any baud rate between 110 and 9,600. The monitor contains a routine which looks for the particular input — in this case, a constant depression of the space bar. The routine then calculates the baud rate accordingly.

Once the rate is set, the signing-on message is displayed on the screen and programming may begin. There was no Basic interpreter in the review Explorer,

so at this level, the programming is entirely in 8085 machine code but to make life easier for the user, some monitor commands are provided.

Connecting the floppy-disc unit did not present any major difficulties. Before connecting the disc unit to the main system, and before inserting a disc, it seemed a good idea to check the disc unit worked. The floppy disc manual recommends that the voltage readings on a certain chip are checked first, and having had bitter experience of wayward disc drives in the past, I followed that advice. The voltages appeared to be correct.

Deceptively simple

Next was the deceptively simple-sounding task of connecting the disc to the main system. To perform this task, you must remove the two screws on the rear of the cabinet, swing the top of the lid forward and lift it out. With the lid off, it is a comparatively easy task to plug in the disc-connector ribbon cable.

I should, however, point out at this stage that once the disc unit is set up it should not be moved too often — the disc controller board sits on a cradle inside the main system cabinet, and every time the disc cable is removed there is a disconcerting flex in the controller card. The manual suggests a blank disc is first loaded to test the head-load and release commands. Not having any blank discs handy at this stage could result in much grief later.



Now the big moment arrives — the loading of the system disc. The Explorer system utilises the 8in. floppy discs which, apart from inspiring confidence in the user with their more business-like appearance, hold far more information than the smaller, 5¼in. version.

Re-set button

The re-set button on the front of the main cabinet is pressed and the reassuring sound of a solenoid clicking informs the user that the disc is being read. After a short wait, which can be nerve-racking if the disc contains expensive software, the system replies by displaying the signing-on message on the video monitor. The machine worked, and gave a good account of itself.

Since the Explorer uses the CP/M disc operating system there is a wide range of applications software available and there is no reason why an Explorer, possibly using two or more disc drives, should not be used in a commercial application. Its compactness and smartness certainly make it a desk-top microcomputer which would not look out of place in the office of any businessman.

One of the best features of the system was the video output — there was very little of that annoying screen flicker which can strain the eyes. The picture always appeared to be sharp and bright. The video monitor supplied with the system can be bought as an optional extra, but considering one is required anyway, the Newtronics monitor at about £80 seems

to be a wise and inexpensive purchase.

If the user is considering using the system as a business or personal computer then the ASCII keyboard is also an essential purchase. A less-expensive alternative for those more interested in control applications is the Hex keypad/display unit.

Unfortunately the Explorer has a shortcoming: it is a little prone to dirty supply current. This is only a small problem and is very simple to remedy but it can be a serious problem because of the consequences of the power supply being interrupted.

When a spike appears on the line — possibly caused by a motor being turned on — it causes the system to crash, which in turn damages any disc which happens to be in the disc drive at the time. To criticise the Explorer on this point might be a little unfair, though, since most microcomputers have the same problem.

The documentation supplied with any computer system provides the potential user with a valuable litmus to hold against the system. Good documentation does not always mean that the hardware is good, however, but if a company goes to a good deal of trouble to make sure that the documentation makes the user's life easy, then this helpfulness may be reflected in the product, and the support the company provides.

The documentation supplied with the Explorer was somewhat unusual but this may be due to the fact that as each level of the Explorer system is bought, the

relevant manual is included with it. As stages are of differing degrees of complexity, the manuals are of vastly differing sizes. One possible solution to the problem would be to provide a ring binder so that each level can be added to the total, providing the user with one volume containing all the relevant information.

The level A manual is a little brief but it contains a parts' list and some reasonable assembly instructions. At first glance, this would appear to be adequate but many constructors would surely welcome a section devoted to trouble-shooting, especially considering the complexity of the project in question. The only help the bewildered constructor can seek is a price list which details factory trouble-shooting fees, and those are all given in dollars.

Machine code

Even so the level A manual contains a rather good section introducing the user to machine-code programming on the Explorer 85. This section is not aimed at the absolute beginner — anyone using it must understand Hexadecimal code, for instance.

I found it to be more than adequate and there is even a sample program fully-documented and talked through, providing anybody with an interest in 8080/8085 machine-code programming a useful introduction. The rest of the manuals, that is for levels B through to E,

(continued on next page)



(continued from previous page)

have a common thread in that they provided relevant parts' lists and good, clear assembly instructions.

There is the slight matter of the different sizes of the manuals, and their differing appearances, but this is a minor complaint. The manuals form a complete set and as such, would be more-conveniently presented in a ring binder. As supplements to these manuals, there are the Microsoft Basic-80 reference manual, assembly instruction sheets for the video board and the ASCII keyboard, cabinet assembly instructions and a Explorer-terminal ROM-user information sheet.

Overall, the documentation is adequate, in terms of information concerning the assembly of the system there are no complaints, but a trouble-shooting guide would be a great help. Some notes concerning the theory of operation of the system would also be desirable. Anyone seriously interested in system architecture would be strongly advised to buy a book on the 8085.

The promotional literature for the Explorer 85 makes great capital of fact that the system is expandable, and to quote the literature: "You're never forced to spend a penny for a component or a feature you don't require". This is the great advantage of the Explorer system.

The design philosophy behind the Explorer is based on the concept of levels. These levels are the backbone of the system and provide the user with a structured method of expanding the system. These units or levels are relatively inexpensive and the system can, therefore, be expanded as the user needs more computing power or as his budget allows.


The lowest level in the scheme is a single-board computer, the level A. The level A kit together with a video monitor,

an ASCII or Hexadecimal keyboard, an RF modulator, and a suitable power supply, would provide the beginner with a useful introduction to programming.

The level B kit provides a S-100 bus expansion; level C is a card cage to accommodate up to six S-100 cards; level D provides the user with 4K of static RAM and level E is an EPROM expansion kit and also available is 8K Microsoft Basic in ROM or on tape.

The Explorer system then is capable of assuming many forms, for instance, a beginners' system, an OEM controller or a fully-fledged microcomputer system with four discs and running under CP/M.

Conclusions

- The Explorer 85 is above all else a flexible little machine, available as a single-board kit or as a fully-fledged system, complete with discs, cases and CP/M.
- The CP/M operating system gives the user access to a very large range of software at reasonable prices.
- Construction of the system may prove to be far too difficult for the novice but should not prove too arduous a task for the more experienced and less faint-hearted constructors.
- The modular approach to expansion allows the user to let his system grow with his finances or requirements.
- The level A kit can be purchased for about £85, a 4K kit £327. Assembled this price would rise to £402 and the cases with cooling fans, etc., take the price up to £502.
- A RAM board is now available containing 16K of pageable memory.
- The Explorer 85 uses the 8085A CPU and is an S-100-based system.
- The Explorer 85 is marketed in kit and assembled forms by Newtronics Ltd, 255 Archway Road, London N6. Telephone 01-348 3325. 

NEW from Computer Centre

WINCHESTERS

Our Winchester fixed disc systems are now in production.

OEM 4

Stand alone S100 main frame with DMA controller to the hard disc.

20 MEGABYTES
(DRI 3100 WINCHESTER)
Z80 . 80K BYTES . FLOPPY
SERIAL & PARALLEL I/O

£4,950

SUB SYSTEM

This will interface to any single density floppy disc controller. Plug compatible to most existing 8 inch floppy systems.

20 MEGABYTES
(DRI 3100 WINCHESTER)
INTELLIGENT INTERFACE

FROM £2,500

NEXT...OEM 5

MULTI USER SYSTEM
16 BIT MICRO
128K BYTES RAM
20 MEGABYTE FIXED
1 MEG FLOPPY
FRONT END PROCESSOR
FOR UP TO EIGHT TERMINALS

ALL FOR UNDER

£6,500



Comcen are also Apple dealers
- Ring us for a quote - We have
the best prices nationwide.

ComCen

9 De La Beche Street, Swansea, SA1 3EX
Tel: (0792) 460023, Telex: 48638
45-46 Wychtree Street, Morriston, Swansea,
Tel: (0792) 796000

computer
centre

Everything you want and more from Computer Centre



OEM FROM £1,970

High speed Z80 microprocessor. Twin 8" floppy disc drives. 16K to 256K bytes RAM. Up to 2 Megabytes on floppy discs. Supports Cobol, Fortran, Basic, Pascal, and PL/1. Multi-user versions. 20 Megabyte Winchester sub-systems.

The range of ComCen OEM machines starts with a six slot stand alone, Z80 with serial and parallel I/O at £499 and at the top of the range there are multi-user systems with 60 Megabyte Winchester fixed discs.

The common disc operating system for the OEM range of machines is CP/M which supports an extensive range of high level software. COMCEN also offer a free library of more than 40 8" diskettes packed with utility software, programming languages, user programs and games.



MEGABOX £890

MEGABOX DRIVES Two 8 inch single or double sided drives in an attractive case with built in power supply. Front panel has illuminated mains switch. Units are supplied with appropriate cables for direct mains connection and plug compatibility to mainframes. Versions are available for Apple (SVC controller required), Tandy Model 2, as well as add-on drives to COMCEN kits or OEM systems, and other Shugart compatible disc systems.



525 SPECIAL £195

BOXED 5 INCH DRIVE SA400 (or equivalent) Minifloppy drive with power supply and attractive enclosure. Compatible add on to TRS80, COMCEN OEMO, Horizon, Nascom, and many other standard floppy controllers. Mains cable and plug supplied, 34 way cables and connectors available to order.

Educational + OEM Volume Discounts Available

FIRMWARE + MANUALS

Please write or call for details.

PRICE LIST

OEM ASSEMBLED MACHINES

1560.00	OEMO Z80, 1SER, 1PAR, 2" 120K Disks
1970.00	OEM1 Z80, 32K, 1SER, 1PAR, 2" 1/4 MEG Disks
2270.00	OEM2 Z80, 48KB, 1SER, 1PAR, 2" 1/2 MEG Disks
4950.00	OEM4 Z80, 1SER, 1PAR, 20 MEG Fixed, 1 Floppy

COMPUTER CENTRE KITS

800.00	K1 Computer Centre Mini System 5 inch Disk
911.60	K2 Computer Centre Maxi System 8 inch Disk
208.00	Z80 Starter Kit

TIME SHARING SYSTEMS

2350.00	MUO 2 User MP/M 2" 120K Floppy Drives
3290.00	MU1 2 User MP/M 2" 1 MEG Floppy Disc
6660.00	MT 2 VDU S + MP/M +20 MEG Fixed + Floppy
5150.00	SD - 200 Computer 64K

DISC DRIVES

890.00	Megabox-S Twin 8" Single Sided Drives Boxed
995.00	Megabox-D Twin 8" Double Sided Drives Boxed
2950.00	20 MEG Winchester Sub-System
275.00	8 In Single Sided Disc Drive
395.00	8 In Double Sided Disc Drive
199.00	Boxed 5 inch Drive with Power Supply
135.00	SA 400 Minifloppy Disc Drive
1350.00	DRE 3100 20 MEG Winchester Drive

VDU'S

695.00	Wordstar VDU
575.00	Pentland (Full Spec)

PRINTER'S

1790.00	QUME Sprint Daisywheel Printer
188.00	QUME Tractor
890.00	ANADEX 9500
449.00	ANADEX 8000
325.00	EPSON TX80
51.00	TX80 Graphics Option
345.00	EPSON MX 80

SOFTWARE

219.00	MP/M + Manuals
70.00	CP/M Operating System + 6 Manuals + Basic E
94.00	CP/M 2.2 + Manuals
209.00	COSMOS Multi-User OP System
4.50	Library Copies on 8 Inch Media
4.00	Library Copies on 8 Inch Media (10 or more)
85.00	Microsoft Macro 80
148.00	Microsoft Basic
202.00	Microsoft Basic Compiler
255.00	Microsoft FORTRAN
376.00	Microlocus Compact COBOL
590.00	Microlocus VERS 4 COBOL
60.00	C Basic 2
148.00	Dalastar
179.00	Wordstar 2.1
49.00	Mairmerge
63.00	Z80 SD Global PKG
113.00	SDOS
60.00	FORTRAN LIB for FPB
216.00	Configurable Business Package
60.00	Z-SID
255.00	Selector 4 C-2
127.00	Supersort 1

KITS	MPU	Assd
125.00	CB2 Z80A 1EEE S100	163.00
118.00	Godbout Z80	145.00
178.00	SBC100 Z80 + Serial + Parallel	197.00
194.00	SBC 200	224.00
163.00	Godbout 8085/8088 Tandem Board	219.00

KITS	DISC CONTROLLER	Assd
126.00	Tarbell Single Density	179.00
179.00	Tarbell Double Density	233.00
149.00	Versal floppy 1 - Single Density	181.00
214.00	Versal floppy 2 - Double Density	240.00
99.00	Tarbell Cassette Interface	

KIT	RAM	Assd
86.00	8K Bytes Ecoram 2 (4Mhz) Static Ram	94.00
—	16K Econoram XIV (4Mhz)	155.00
180.00	16K Static Bank Set/Ext Addr	185.00
231.00	24K Static Bank Set/Ext Addr	236.00
298.00	32K Static Bank Set/Ext Addr	333.00
245.00	Expandoram 2 (Dynamic) 16K Population	251.00
285.00	Expandoram 2 (Dynamic) 32K Population	290.00
322.00	Expandoram 2 (Dynamic) 48K Population	367.00
362.00	Expandoram 2 (Dynamic) 64K Population	

KIT	INPUT/OUTPUT	Assd
105.00	2SIO (2 Serial Full Handshaking Units)	130.00
82.00	IO4 2 Serial Parallel	138.00
332.00	MPC-4 Serial I/O Controller	358.00

KITS	SPECIAL BOARDS	Assd
226.00	VDB-8024 (80 Chns 24 Lines) Video	263.00
88.00	PB1 2716-2708 Eprom Programmer	127.00
125.00	SD Prom 100 Programmer	150.00
49.60	2708 Prom Board (Ex Proms)	65.00
24.20	Active Terminator Kit	33.00
36.20	Memory Manager	46.00
98.00	VB2 64" 32 Video + Keyboard Input Port	129.00
266.00	VB3 80" (Up to 51 Lines) + Graphics	303.00
175.00	Spectrum Colour 8K + Parallel	184.00
29.60	S100 Extender + Logic Probe	—
21.00	MI3 11 Slot Motherboard	—
—	Floating Point	268.00
—	A-D 16 Channel 12 bit	450.00

POWER SUPPLIES

195.00	S100 Laboratory Cardcage and Powersupply
77.00	Power Supply for Mini-Maxi Kit (1 Drive)
81.00	Power Supply for Mini-Maxi Kit (2 Drives)
16.00	Transformer (Bus + Drives)

CONNECTORS

2.80	PIS 100 Edge Connectors
0.20	Card Guides
2.20	AC + DC Connectors for Dri Disc
1.80	DC Connectors for SA400
7.80	50 Pin Edge Connector for Dri Disc
9.80	50 Way Speed Block Connector
1.60	50 Way Ribbon Cable (Per Foot)
7.00	34 Pin Edge Connector for SA400
8.00	34 Way Speedblock Connector
1.00	34 Way Ribbon Cable (Per Foot)
5.00	26 Pin Edge Connector for SBC100
6.00	26 Way Speedblock Connector
0.80	24 Way Ribbon Cable (Per Foot)
11.60	D25 Special Ribbon Cable Edge Connector
1.60	16 Pin IC Sockets (Pack of 10)
1.60	14 Pin IC Sockets (Pack of 10)

IC'S

14.80	WD 1771 SD Disk Cont
5.00	2114
3.00	4116 (Or Equivalent) 250 NS
1.00	2102
15.00	Z80A
5.00	5257 4K 1 Static
8.20	8251
77.00	16K Expansion (1RS 80/Apple)
7.40	2708 Eprom
7.40	2716 Eprom 350 NS
6.00	2716 Eprom 450 NS

MEDIA

23.40	8 Single Sided Floppy Media (Box of 10)
35.80	8 Double Sided Floppy Media (Box of 10)
26.20	5 Single Sided Floppy Media (Box of 10)

CONSUMABLES

14.00	11" 14.5 Continuous Lined Paper (2000 Box)
12.40	12" 9.5 Continuous Plain Paper (2000 Box)
8.60	11" 9.5 Continuous Plain 60g. (2000 Box)
37.40	Multistrike Ribbon (Qume Type) 12-Box
53.00	Singletrike Ribbon (Qume Type) 12-Box
40.20	Fabric Ribbon (Qume Type) 12-Box
18.80	TX80 Ribbon 12-Box
6.60	Daisywheel Qume Type

Terms are Cash with Order
Please add 2% for Post and Packing and 15% VAT
(N.B. £2 Post & Packing on boxes of Stationary and Transformers)

ComCen

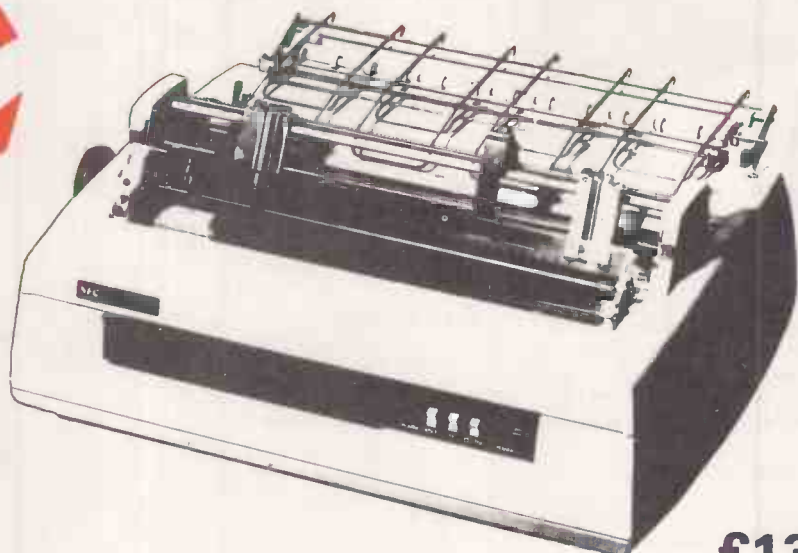
9 De La Beche Street, Swansea, SA1 3EX
Tel: (0792) 460023, Telex: 48638
45-46 Wychtree Street, Morriston, Swansea,
Tel: (0792) 796000

computer
centre

• Circle No. 161

The Printer People

NEC



The word-processing printer

- * Letter quality for word-processing
- * 128-character standard 'thimble'
- * 55 chars/sec — friction/tractor feed
- * Up to 5 copies; single-sheet option
- * Five models available, including RS232 or Centronics parallel interface versions

from
£1350

Anacom 150

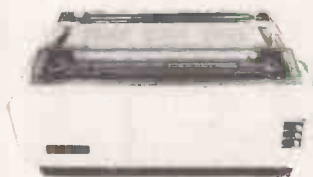


The reliable commercial printer

- * 150 chars/sec, 136 columns/line
- * 9x9 matrix, upper and lower case
- * Up to 15" paper width
- * Full forms control
- * Centronics parallel or RS232 serial

£799

TEC Starwriter



The low-cost daisywheel printer

- * 25 cps letter-quality output
- * Standard 96-character daisywheels
- * 136-column/15" print width
- * Programmable forms handling
- * Centronics parallel interface standard
- * RS-232 option

£999

OKI Lineprinters



High reliability Slimline lineprinters

- * Print speeds from 125 to 300 lines/min
- * Full 132 columns
- * 12 program-selectable fonts
- * Built-in diagnostics, self-test features

SL125/160, SL250/300 from **£1799**

TVI terminals



Full range of intelligent units

- * 24x80-character display
- * Full upper/lower case ASCII
- * Separate numeric keypad
- * Smooth scrolling on 950 version
- * Wide range of editing functions

Models 910, 912C, 920C, 950
from **£425**

Pentland VI



A British smart terminal

- * Full ASCII character set
- * Numeric keypad
- * Green anti-glare screen
- * Reverse video, full cursor controls

Model VI **£449**

Automatic sheet feeders



from **£450**

For complete word-processing

- * Feeds letterheads, multipart sets
- * Up to 250 sheets
- * No software required
- * Optional twin-tray envelope feed
- * Versions for NEC, TEC, Qume, Ricoh, Diablo and others

Phone 0372 62071

Qantex



6000 / 6010 series

- * 150 characters per second
- * Up to 136 columns per line
- * Bidirectional printing, logic-seeking
- * 9x9-dot matrix
- * Standard ribbon cartridge
- * Centronics parallel or RS232/20mA serial interfaces
- * X-ON / X-OFF control
- * 2K or 4K buffer available

from
£775

Centronics 737

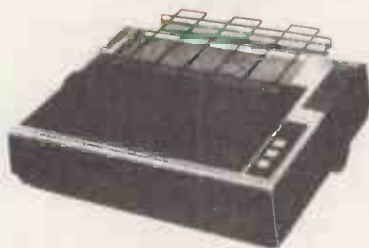


Letter quality printer

- * 7x9 and nx9 dot matrix
- * 3-way paper handling, up to 8 1/2"
- * Up to 80 characters/second
- * Centronics parallel standard; RS232/20mA serial option

£349

Epson



Complete range of interfaces

- * ASCII and graphics characters sets
- * Bold, expanded, condensed print
- * Centronics parallel interface standard

MX70T
MX80T MX80FT
MX100FT **from £259**

OKI Microlines



The quiet workhorses

- * ASCII and graphics characters
- * Condensed, double width print
- * Friction, tractor or pin feed
- * Rugged, quiet and reliable
- * Centronics parallel/RS232 interfaces

Microline 80 **£295**
Microline 82 **£399**
Microline 83 **£699**

Tymac products for Apple

Parallel printer board **£69**

Universal Centronics-compatible printer board, suitable for Epson, OKI, Starwriter, NEC Spinwriter and many other printers. **Complete with cable and connector for Apple computers.**

Super Pix screen dumper for MX-80 **£25**
Use with Parallel Printer board to print out full Apple HiRes graphics on an Epson MX-80 series printer.

Double DOS plus **£25**
Allows free intermixing of DOS 3.2 and DOS 3.3 programs. Piggyback board plugs into disk controller card.

Convert your Epson MX-series tractor printer to friction/pin feed

A neweasily fitted conversion kit for your MX70-T or MX80-T tractor-feed printer, to allow you to print on single sheets and letterheads as well as standard-width tractor-feed paper.

Our price £49

Realistic DEALER,
OEM and EDUCATIONAL
DISCOUNTS OFFERED —
please phone 0372 62072
for details.

NORTHAMBER

*Importers, Distributors
and Wholesalers*

Great Oak House,
Esher, Surrey, KT10 9BR
Phone: ESHER (0372) 62071

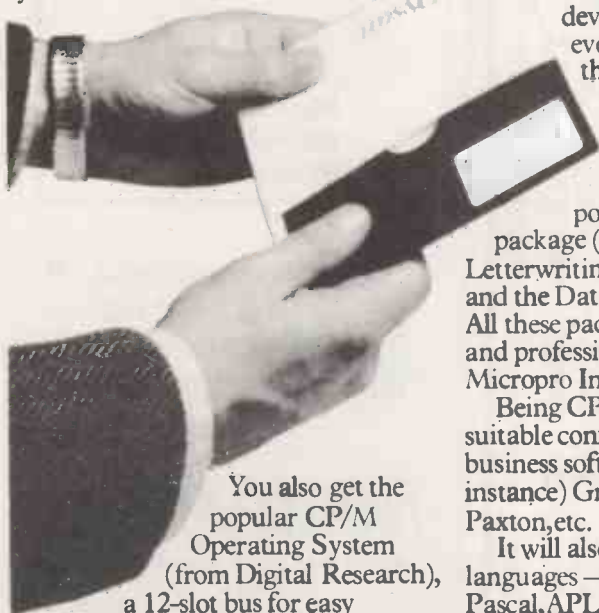
*Full details on request
All prices quoted exclude VAT*

A Word Processor, Report Writer, Mailing System, Data Base Manager, and a Computer all for £1995*



Yes, we are offering all this with our SERIES 5000 5" floppy-disc system for the incredibly low price of £1995.*

Not only do you get a powerful Z-80A system on the S-100 bus built to high quality standards by Industrial Microsystems, one of the longest and best-established companies in the microcomputer industry, and supported by Equinox, specialists in microcomputers and multi-user systems.



You also get the popular CP/M Operating System (from Digital Research), a 12-slot bus for easy expansion, a Z-80A CPU for powerful performance, 2 serial and one parallel interfaces, 64KB of dynamic RAM with in-built error detection capability,

and dual 5" double-density drives with the option of a third drive (or quad capacity drives in place of double-density) in the same cabinet. Additionally, there is the Turbocharger option providing both enhanced disc capacity, disc performance and diagnostics. And if even greater storage is required we can supply 8" floppy drives and cartridge disc drives.

A powerful system for the computer-user and system developer – and one with eventual access to OS/2000, the Industrial Microsystems networking system.

And for the office or business user we are including as standard a powerful Word-Processing package (Wordstar), a Mailing and Letterwriting package (Mail-Merge) and the Datastar Data Base Manager. All these packages are widely accepted and professionally written by Micropro International.

Being CP/M based, the system with suitable configuration will also run the business software developed by (for instance) Graffcom, Peachtree, Paxton, etc.

It will also run a wide range of languages – Basic, Cobol, Fortran, Pascal, APL, Algol, C. Lisp, and Forth and will support a wide range of add-on S-100 devices, such as floating point processors, Prestel interfaces, speech synthesisers, digitisers and plotters, etc.

And just to make certain that you get full use out of your system, nationwide field service support is available at a modest extra cost.

*add VAT and the terminal and printer of your choice at the costs shown.

Series 5000 with 64KB Dynamic RAM, dual 5" double density drives, CP/M Operating System, Wordstar, Mail-Merge and Datastar £1995

The same system with quad drives in place of the double density drives £2230

Add-on double density drive £290

Add-on quad drive £405

Peripherals:

Teletype 912C VDU £595

Elbit 1920X VDU with Wordstar keyboard £895

OKI Microline 80 printer £595

Texas 810 150cps printer £1450

NEC Spinwriter RO Word processing printer £1850

All prices exclude VAT, carriage, training and installation and are subject to our standard terms and conditions.

OEM dealer and educational enquiries welcome.

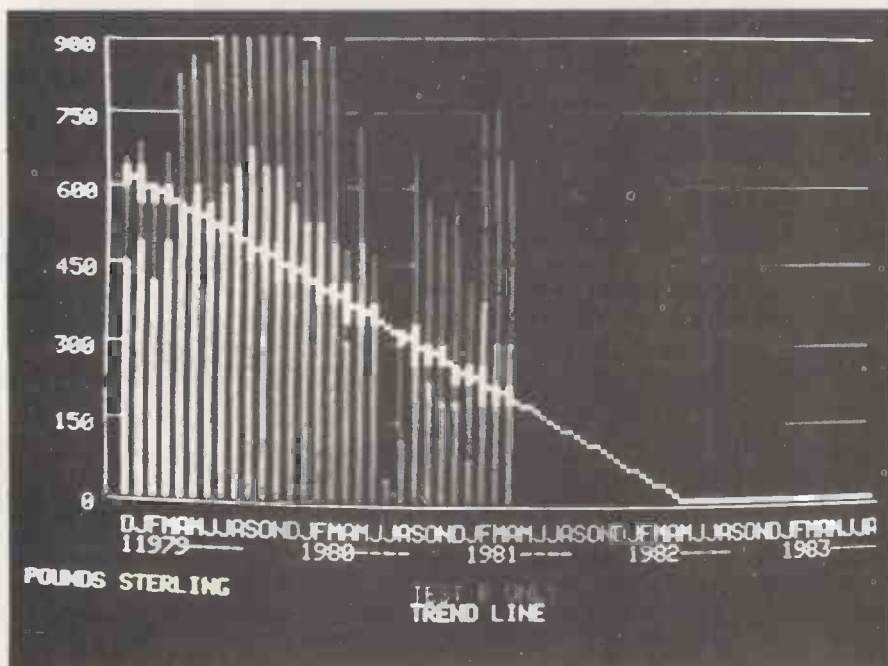
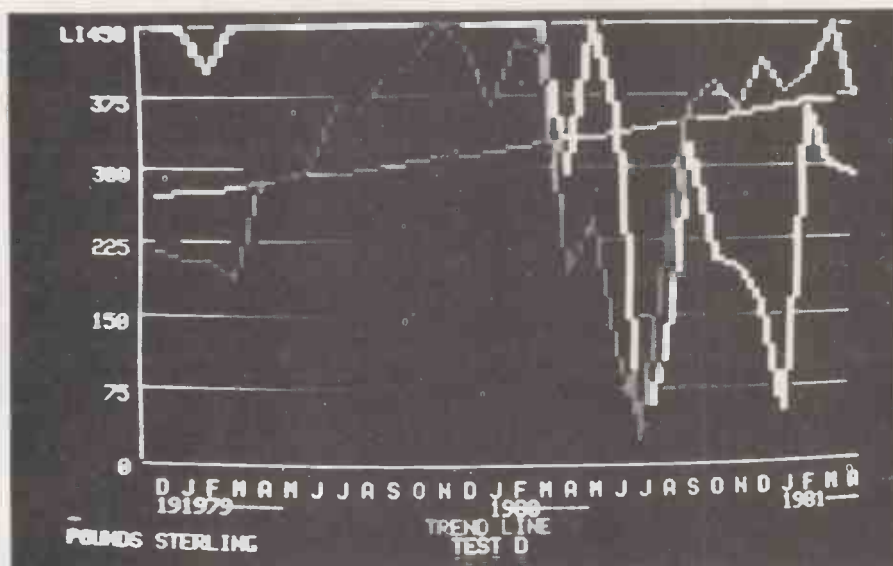
EQUINOX

COMPUTER SYSTEMS LIMITED

Kleeman House, 16 Anning Street,
New Inn Yard, London EC2A 3HB
Tel: 01-739 2387/9 & 01-729 4460

• Circle No. 163

Putting a new complexion on micro graphics: Compucolor II



THE COMPUCOLOR machine was first launched in the U.S. in 1978 by Intelligent Systems Corporation and has been available in the U.K. since early 1979 from Abacus and now Dyad Developments Ltd of Great Milton, Oxfordshire. Dyad has been handling the Compucolor II in the U.K. for about a year.

The Compucolor II is in its second and third generation of development. The review system supplied to us by Dyad Developments was the Compucolor II with a 'deluxe keyboard and single floppy disc drive and Microline 80 matrix printer.

The Compucolor II is manufactured in the U.S. by Compucolor Corporation which is also linked with Intelligent Systems Corporation. Intelligent Systems Corporation also manufactures a similar machine called the Intecolor 3000 and

by Mike McDonald

8000 and has a long history of manufacturing colour micro-based systems. The Compucolor II population in the U.K. is currently in the low hundreds.

The system is supplied as a set of stand-alone units comprising:

- A 12in. colour monitor which also contains the peripheral controllers, central processor and power supplies.
- A single-density, single-headed floppy disc drive made by Siemens.
- A "floating" keyboard available in three models — standard, extended, and deluxe. The last two are optional and our version had the 117-key deluxe model.
- A Microline 80 serial dot-matrix printer. This was the printer supplied although the RS232 interface would be capable of driving any variety of Teletype printer.

Each unit is connected via ribbon cable to the printed-circuit-board edge connectors on the back of the colour monitor. The monitor and printer are each powered separately from the mains. There are three edge connector outputs on the back of the monitor: a 50-pin bus of no particular standard; an RS232C bi-directional serial output; and a keyboard/peripheral connector.

We found the connection of the disc drive unusual in as much as it had to be piggy-backed via a small printed-circuit card on to the keyboard connection.

The disc drives for the Compucolor machine are all externally connected. The 3000 series has an integral, single floppy disc drive mounted in the colour monitor casing.

Our system was the model 5 with 32Kbytes of RAM, 16K of ROM and the disc drive provides 50Kbytes of on-line user storage. The Compucolor II had been modified with a microswitch to select

(continued on next page)

develop a better understanding of the information content.

The package is supplied in the form of a comprehensive manual and two floppy discs — one program disc and one data disc. The software is a single program. Once it has been loaded, the program disc is dismantled and the data disc brought into use. The main menu offers:

1. Update file
2. Create a new file
3. Edit old file
4. Delete a file
5. Hard-copy printout
6. Directory of files
7. Change file name
8. Go to display program

Initially, data must be entered into a file for retrieval by the display program. Data may be periodical or independent — although the package is geared to analysis of data against a time base of months, quarters, or years. The create function prompts the user for a title of the data to be entered, the file name under which it will be stored, whether the data is monthly/quarterly/yearly, the starting date, and a units title.

Having completed this, the system produces a formatted screen and proceeds to prompt the operator for the data values against incrementing dates beginning with the start date. Each value is keyed until a null entry terminates the data input routine and the operator is then prompted for confirmation to write the file away.

Having created a file, it can then be displayed, edited and updated. The edit function displays the data dates and values on the screen and prompts for the entry of the date of the value to be altered and then its new value.

The update function permits additional values to be concatenated on to the end of the file at a later stage. The routines are easy to understand and use. Having entered a few files, the other main function is the display program, option 8.

The display program creates a blank graph format on the screen and awaits input from the operator at a prompt point on the bottom of the screen. Data files may be loaded into one of four work files in memory or into a common work area. Alternatively, files may be called for direct plotting on the screen.

Any file loaded from the disc is placed automatically into work area 0. From there, it may be saved into the other work areas numbered 1 to 4. If we had a file of values called EXPA, it could be plotted as a bar graph by simply entering BAR EXPA or the same result could be achieved by entered Load EXPA followed by BAR 0. In both cases, a copy of file EXPA is left in work area 0. The display is filled in with x and y axis values and descriptions and a bar plot is built across the screen in a suitably different colour from the background.

Trendspotter calculates the axis to fill the graph format and labels the display with the title of the file in the same colour as the plotted information. Further files

may be plotted on to the same chart in different colours providing there is not too significant a change in the scaling factor.

The types of plot are: bar graph, line graph, scatter graph — point plot — area graph line graph with solid colouring of area under the plot, and nBar or multiple bar graph — several bar plots combined. Various types of the same data may be executed on the same display to find the most appropriate display method. The data may be further manipulated in the

Model 4 16K RAM 50K disc 72-key keyboard	£1,175
Model 5 32K RAM 50K disc 72-key keyboard	£1,295
Optional extras	
101-key keyboard	£80
117-key keyboard	£120
Add-on 50K disc drive	£310
Add-on 80K disc drive	£525
Add-on 184K double-headed disc drive	£725
Keyboard upgrade 72 to 101	£95
Keyboard upgrade 72 to 117	£135
Keyboard upgrade 101 to 117	£55
16K RAM add-on memory	£120
Maintenance manual	£25
Programming manual	£14
Sound output	£30
Light pen	£49
Oki Microline 80 Matrix Printer	£329
Software	
Compuwriter word-processing package	£146
Trendspotter data-display package	£245
Basic editor	£20
Fortran	£40
Pilot	£30
Statistics pack in three volumes	£55
Other programs are available such as games and utilities and other business applications are due for release soon.	

Table 2.

work files to provide some simple trend analysis. The options include:

Smooth: Calculates an exponential smoothing of the data in the 0 file and plots a line graph with the result. A factor of between .01 and 1 must be entered as the argument.

2Smooth: same as smooth except that it computes and plots a second-order exponential smoothing of the data in work file 0.

3Smooth: third-order smoothing.

Moving: calculates a moving average and plots a line graph. User must enter a value to indicate the number of periods for the calculation.

Trend: computes a linear-least-squares trend line and plots a line graph. An optional date may be entered to indicate the start point for the evaluation.

Etrend: computes an exponential-fit trend line and plots the result.

Ltrend: computes a logarithm-curve fit trend line and plots the output.

There are a further 33 commands for handling data, data files or making cosmetic changes to the display parameters. They can be entered as the first three characters of the command followed by any argument necessary. Many of the commands are useful but we found little occasion to use many of them.

The package does an excellent job of handling and displaying the data in a reasonable format. The user may plot as much information on any one display as can be digested and would appear to be a

welcome aid for anyone whose job requires a considerable amount of forecasting with figures. The package is simple to use and although it lacks a number of other analytical routines such as multiple regression, the methods available should be sufficient for most data analysis.

Trendspotter is well-named. We found that the programs are robust and the displays excellent. Certainly a program like this is a great aid in the pictorial representation of time-based data. From the two example files used, some interesting trend information was gleaned which was far from apparent or even obvious from a close examination of the numerical data. It was unfortunate that the printer would not interact with this program to allow us to obtain a hard-copy listing of the data files. The manual refers to the use of plotters. In general, the documentation was very good and not difficult to read or use. Trendspotter is exceptionally good value for money at the quoted price.

The second application package supplied with the Compucolor II was a program called Comp-U-Writer. It is a word-processing package for the machine written by an U.S. company. To run the package, users are required to have the full 117-key keyboard. Supplied with Comp-U-Writer are about 20 key-tops, which replace most of those on the top row of the keyboard and provide dedicated functions within the package. Comp-U-Writer is supplied in the form of an A4 manual and two program diskettes — one of which is for security only.

When you load the program, the system requests a date entry and the screen is set into a 24-line blank page and a ruled heading for showing tabulator settings and messages. Comp-U-Writer can accept and hold up to 500 lines of typed text based on the Compucolor II 63-character-line format. This storage capacity is divided up into a number of 24-line pages.

The status line at the top of the screen shows the user on which line and which page the cursor is to be found. Comp-U-Writer accepts text entry directly from the keyboard and pre-formats the input on to the screen preventing truncation of words on wrap-around of the text from one line to the next.

Text is displayed as green characters on a black background in both upper- and lower-case. Once some text is entered, the user may move the cursor around the screen and any further text entered at the cursor position is automatically inserted into the line.

The cursor is a solid colour square and does not act as a background character. As it is moved along a line, the characters and line move one space to the right of the cursor which visually produces a most unusual effect. Each page automatically scrolls upwards, line by line, as more text is added and the page indicator is incremented. Four of the function keys

(continued on next page)

(continued from previous page)

allow the operator to jump around a document as follows:

- Beg — Place the cursor at the beginning of the document. (page 14).
- End — place the cursor at the end of the document.
- Next — move the cursor on to the next page of text.
- Prev — move the cursor on to the previous page of text.

A tabulator key is provided and there are two fixed — function keys offering set-tabulator and clear-tabulator options. Tabulators are indicated by markers on the status line at the top of the screen. Editing keys are provided to give the following functions: delete character, delete word, delete line and undelete.

The undelete key will restore text which has just been deleted inadvertently. Insertion occurs automatically if text precedes the current cursor position on a line or extra lines can be inserted with carriage returns.

There is the facility to mark blocks of text with a mark-beginning and mark-end function. The cursor is positioned at the start of the text to be marked and "mark beg" is selected which places a special red character at that point on the screen.

Cursor movement to the end of the text to be marked is followed by the "mark-end" key and the interposing information is displayed in red. Once a block of text has been highlighted in this way a number of facilities are available to manipulate the block using more fixed function keys. These are:

- Move block — if the cursor is moved to another part of the screen and move block actioned, the block is inserted at this position and the remaining space closed up.
- Copy block — produces a copy of the marked text at the current cursor position.
- Delete block — removes the marked text from the screen and closes up the display.
- Marked text may be unmarked by deleting the marking characters displayed at the beginning and end of the block. Screen editing is carried out as quickly as we have seen in other microcomputer-based word-processing systems.

Words or phrases may be sought and replaced through three function keys offering define, search and replace. The define key prompts the operator to enter the required word or phrase. Once completed, this is stored for future reference until changed by the entry of something else.

Depression of the search key causes Comp-U-Writer to search through the text held in memory and to place the cursor on any first match it can find. For several occurrences of the same word or phrase, the search may be re-enacted from the new start point. If replace is selected, the operator is prompted for input of text which is to replace any occurrence of the search option.

The replace option will alter every occurrence of the search string if desired.

Cursor movement may be either slow or high-speed. Text may be further formatted on input by selecting either the

indent or centre functions. Centre causes any text entered to be positioned in the middle of the page. As more words are entered, Comp-U-Writer re-justifies the line to re-position it around the centre of the screen line until a carriage return is entered, forcing the cursor down on to a new line. The indent causes the current line of text to be started at a left-margin position which corresponds to a default value set by the user as part of another Comp-U-Writer.

The balance of the dedicated function keys and their facilities within Comp-U-Writer are associated with the disc file handling routines and the setting of options for producing hard-copy print-outs of the text.

Text may be saved and re-loaded from floppy disc through the save and load function keys. When you select the save option, you are prompted for the file name under which the file is to be stored. Comp-U-Writer then concatenates the current system data which was entered on loading the software program — or to the end of the file name and proceeds to store the information on the diskette mounted.

To load a file into Comp-U-Writer, the load option is keyed and a display is produced of the first five directory entries on the disc. Each entry shows the file name, the date of creation and the number of pages contained. Placed beside each file name is an individually-coloured square.

To load the chosen file, the user hits the colour key corresponding to that file. If the required file is not shown in the current display, the next five may be brought on to the screen by hitting the list function key.

Disc functions comprising; initialisation formatting of a new disc — file deletion, and renaming of files are offered through a similar colour-coded menu option selected by depressing the out key.

Printer options are provided for through two functions. The print key will allow for the setting of the following defaults — again through a colour-coded menu: Lines per page — page length; characters per line — page width; left-margin position; M indentation start point; baud rate setting — for printer: and start-page number.

Printing is started by selecting the print function as a command key and the operator is led through two screen menus offering the following option before printing starts:

Double spacing	Continuous forms
Two columns per page	Justified right margin
Marked text only	Auto page numbering
ETX-ACK protocol	Commence printing

While printing is in progress, the user may abort the function by pressing the escape key. The ETX-ACK protocol is a handshake-procedure required by some printer devices. Marked-text-only is a very useful option which allows the operator to print blocks of text highlighted with the mark-beginning and mark-end key options.

The two-column selection forces Comp-U-Writer to print the text in two discrete columns on the page. This would presumably be used in a publishing-industry application.

We found Comp-U-Writer to be a very simple word-processing system but very easy to use by virtue of the colour-coded dedicated function keys. Dyad Developments offers the excellent NEC Spinwriter as the hard-copy printer for use with Compucolor II and Comp-U-Writer and many should find the package more than adequate for the preparation of non-standard letters and reports.

The only convenient way to erase the Comp-U-Writer memory of all text was to re-set the machine and re-enter the program at the opening sequence which meant having to re-key the system date. It was also a pity that the user is not given the opportunity to define which colour is to be used for the background screen or for the display the text characters on the screen.

We found that better character definition was obtained with white on black. Other than this, the package appeared to be robust and should prove to be useful for commercial users of the Compucolor II. Like Trendspotter, the program certainly offers very good value for money at £146.

Conclusions

- For those interested in colour-display microcomputers, the Compucolor II must be a serious contender against systems using a colour television set as their output display device.
- The colours provided are not extensive, but rich and easy to select directly from the keyboard: the display quality is superior to TV output although some lower-case characters become ill-defined when buried in a screen full of text.
- The price of this machine is certainly competitive in the present U.K. market and the Compucolor II represents a good buy for those who would like a colour-based Teletype VDU for on-line working to mainframes.
- A ROM-resident screen editor would be a distinct advantage for the Compucolor II.
- The keyboard is of a high quality and should meet most users' requirements in terms of facilities ad features.
- The Basic interpreter has all of the commands commonly available in other machines and FCS is adequate although error messages from both are not well-defined.
- Trendspotter and Comp-U-Writer are both useful packages which represent good value for money: some of the more traditional commercial functions — payroll, stock, ledgers, etc. — are now needed before this machine becomes generally accepted in the business environment. □

CHROMASONIC electronics

48 JUNCTION ROAD, ARCHWAY, LONDON N19 5RD 100 yds FROM ARCHWAY STATION & 9 BUS ROUTES
 TELEPHONE 01-263 9493 263 9495

YOUR SOUNDEST CONNECTION IN THE WORLD OF COMPONENTS AND COMPUTERS

Ideal For Your Business

- 4008 8K RAM
- 4016 16K RAM
- 4032 32K RAM
- C2N Cassette Unit
- 4040 Dual Drive 343K Floppy Disk

PETS & SYSTEMS



COMPLETE 32K SYSTEM
 APPROVED COMMODORE DEALER

Ideal For Word Processing

- 8032 NEW 32K with 80 col screen
- 8050 Twin Disk Drive 850K
- 3023 Friction Feed Printer
- 4022 Tractor Feed Printer

WRITE OR CALL JULIA ON 01-263 9495
 TO ARRANGE A DEMONSTRATION



APPLE II PLUS

COMPLETE SYSTEMS

- 16K MACHINES £549
- 32K MACHINES £579
- 48K MACHINES £595
- DISK DRIVE WITH CONTROLLER £375

MONITORS

DISK WITHOUT CONTROLLER £299

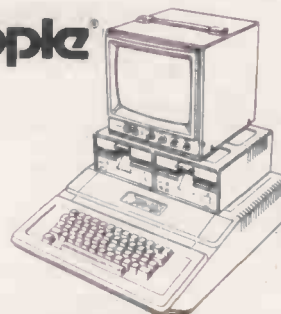
ACCESSORY CARDS & SOFTWARE

ALL AVAILABLE
 PHONE FOR FURTHER DETAILS

APPLE SYSTEMS

APPLE II PLUS features:

- * High Resolution Graphics
- * Sound capabilities
- * Internal memory expansion capacity of 48K
- * 8 accessory expansion sockets
- * APPLE II extended Basic
- * 9 digit arithmetic precision
- * Auto-Start automatically runs programs with computer turn-on
- * Hand Controls for games etc.
- * 15 colour standard graphics



PHONE FOR MOST COMPETITIVE PRICES

PRINTERS



EPSON MX80 £359

Dot-matrix printer with Pet graphics interface. Centronics parallel and serial. Pet and Apple compatible. True bidirectional, 80 cps.

EPSON MX80 FT/ 1 £399

Dual single sheet friction and tractor, 9 wire head, true descenders.

APPLE, PET, RS232 ETC. INTERFACES ALL AVAILABLE

EPSON MX80 FT/ 2 £449

An FT/1 with high resolution graphics

EPSON MX70 £259

Tractor feed, 7 wire head high resolution graphics.

SEIKOSHA GP80A £199

Dot matrix 5 x 7, 80 columns 30 cps. graphics, double width characters.

JUST PHONE FOR FURTHER DETAILS

VIDEO GENIE



£279 EG3003

Utilises Z80, 12K level II Basic, Integral Cassette Deck, UHF O/P, 16K RAM, all TRS80 features. Simply plugs into monitor or UHF TV. With V.U. Meter.

EXPANSION BOX	185.00
EXPANSION BOX (WITH RS232)	215.00
16K RAM CARD	94.00
32K RAM CARD	129.00
SINGLE DISK DRIVE (35 TRACK)	215.00
PARALLEL PRINTER CABLE	17.00
DISK DRIVE CABLE (4 DRIVES)	32.00
PARALLEL PRINTER CABLE FOR UNEXPANDED-VIDEO GENIE	33.00
SOUND KIT (FITTING EXTRA)	7.00
SOUND KIT USING AY/3/8910	24.95
LOWER CASE KIT (FITTING EXTRA)	27.50
VIDEO GENIE TECHNICAL MANUAL	5.00
COLOUR BOARD (FITTING EXTRA)	34.45



Please add VAT 15% to all prices. Postage on computers, printers and cassette decks charged at cost, all other items P&P 30p. Place your order using your Access or Barclaycard. (Min. tel order £5) Trade and export enquiries welcome, credit facilities arranged.



• Circle No. 164

For 80 Column Printers call **Micro Peripherals**

SEIKOSHA GP80

Probably the world's most compact 80 column Impact Printer

*5x7 dot matrix *128 chr set inc £ sign *High Res Graphics *30 CPS *80 chrs/line or extended chrs *12 chrs per inch *Tractor feed *Up to 8" plain paper with 3 copies *£17.25d x 32.8w x 13.2h cms *2.5Kg



Dealer Special

SEIKOSHA GP80 (inc.2000 sheets of paper) £199*

EPSON MX70

The lowest cost 80 CPS Printer with High Resolution Graphics

*5x7 dot matrix *80 CPS uni-directional *96 chr set inc £ sign *High Resolution Graphics (8x480 dots/line) *80 chrs/line or extended *Adjustable Tractor Feed *4" to 10" paper with up to 3 copies *Easy head replacement. Ideal for Acorn, Apple, Nascom etc.



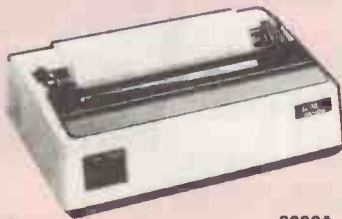
Dealer Special

EPSON MX70 £259*
Friction Modification Kit £call

OKI MICROLINE 80

TRS-80 Graphics compatibility

*9x7 dot matrix *80CPS uni-directional *80 col. or condensed *Expanded characters *Friction and pin feed *Up to 3 copies



OKIDATA MICROLINE 80 £299*

CENTRONICS 737P

High quality proportional text suitable for word processing type applications.

*80 CPS proportional mode *50 CPS mono spaced mode *Nx9 (proportional or 7x8 (monospaced) matrix *96 character set *9 1/2" pin feed or friction *Reverse platen

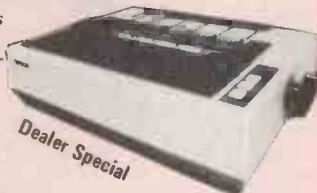


CENTRONICS 737 £349*

EPSON MX80

Correspondence quality hardcopy at a realistic price

*9x9 matrix with true descenders *80 CPS bi-directional with logic seeking *80 column with condensed and enlarged characters giving 40, 66, 80 and 132 chrs/line *Tractor feed *Optional interfaces for APPLE, PET, TRS80, VIDEO GENIE, SHARP RS232



Dealer Special

EPSON MX80T. £call
Friction Modification Kit £call
Interfaces £call

EPSON MX80 F/T-1 MX80 F/T-2

This must be the first choice for a truly professional 80 col. printer *9x9 matrix with true descenders *Friction and Tractor *12 different fonts *40, 66, 80 + *Single sheet feeding *96 chr set inc 4 Int chrs



Dealer Special

EPSON MX80 F/T TYPE 1 £call
EPSON MX80 F/T TYPE 2 £call
Interfaces £call
Ideal for Apple, PET, Acorn, TRS80, Sharp etc. Paper Roll Holder £call

OKI MICROLINE 80	£299*
EPSON MX80T	£call
EPSON MX82	£389*
EPSON MX85	£call
EPSON MX100	£575*
ANACOM 150	£699*
QANTEX 6000 P/S	£call
PAPER TIGER 560 G	£995*
ANADEX 9501	£call
VISTA-TEC (P)	£950*

EPSON MX82

High Resolution Graphics with 'high gearing'

*9x9 matrix with descenders *Details as MX80T/1 but with high geared high resolution graphics (1152 dots/line)



Dealer Special

EPSON MX82 £389*

FOR ALL YOUR PRINTER NEEDS CALL 0256 56468

or 132 Column Printers call **Micro Peripherals**

OKI MICROLINE 83

Complete with RS232 interface

*9x7 matrix *132 column
*Friction and Pin Feed
*4 chr sizes *120 CPS bi-directional *96 chr set plus 64 block graphics



OKIDATA MICROLINE 83 £799*

EPSON MX 100

The ultimate in Matrix Printers

Dealer Special

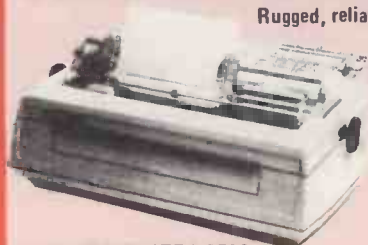


*Friction *Tractor *136 column *22 different chr sets *7 International chr sets *Up to 254 chrs per line *9x9 matrix *80CPS bi-directional *True descenders *High geared *High res graphics (1632 dots/line)

EPSON MX100 £575*

NEC SPINWRITER

Rugged, reliable correspondence quality printer



*55CPS bi-directional
*Interchangeable thimbles *Proportional spacing *Tractor option

NEC SPINWRITER 5510 £1350*
NEC SPINWRITER 5530 £1350*

QANTEX 6000P 6000S

Low cost, compact



*9x9 matrix with descenders
*150CPS bi-directional *Logic seeking *136 chrs/line *96 chr set *Exp chrs *Parallel or serial int.

QANTEX 6000P (Parallel) £call
QANTEX 6000S (Serial) £call

PAPER TIGER 560G

For high quality correspondence quality printing

*160 CPS bi-directional *132 column *High res graphics
*2K buffer *Double width chrs
*RS232 or Centronics interface
*Up to 14.75" paper *Tractor feed *Up to 6 part paper



PAPER TIGER 560G £995*

ANADEX DP9501

High resolution matrix printer



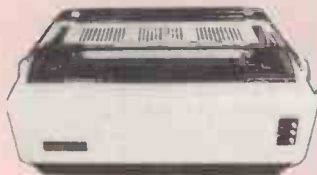
*11x9 matrix *High resolution graphics *200 CPS bi-directional *X-on/X-off
*RS232 interface *4 print densities 10, 12.5, 15 and 16.7 chr per inch

ANADEX DP9501 £call

VISTA-TEC

Daisy Wheel letter quality

*25CPS *Letter quality
*136 column *Proportional spacing *Bi-directional *Diablo compatible *Friction feed



VISTA-TEC £950*

MICRO PERIPHERALS are the UK's largest suppliers of Epson Printers and independent printer specialists.

*1 YEAR GUARANTEE on all printers (except NEC and TEC).
*FREE DELIVERY (UK mainland only) *SPECIAL DISCOUNTS for Educational Establishments *FREE PRINTOUT and data sheets on all printers (call today). *DEALER/TRADE/OEM prices are available (call 'Trade' Sales today). *FREE EXPERT ADVICE on all our printers *DEALER EXPRESS SERVICE if orders are placed before 11 am, delivery will be made by same day (50 mile radius of Basingstoke (inc.London) there is a small charge for this service. *BARCLAYCARD/VISA/ACCESS accepted for telephone orders. *CREDIT facilities can be arranged. *ENTER YOUR SCHOOL into the National Education Computing Competition (ask for details).

Micro Peripherals

61 NEW MARKET SQUARE, BASINGSTOKE, HAMPSHIRE. Telephone: 0256 56468

ALL PRICES QUOTED ARE EXCLUSIVE OF V.A.T. BUT INCLUDE DELIVERY !!!

The Printer Professionals



Prokit's machine-code routines ease data-entry problems

PROKIT 1 is a collection of machine-code subroutines intended to solve data-entry problems for programmers and operators alike. The program is available on tape, disc, and Computhink disc for 32K large-keyboard Pets with the new ROMs, and in identical format for the newer 8000 series SuperPets.

My version of Prokit was supplied by Intex Datalog of Eaglescliffe Industrial Estate, Stockton on Tees, Cleveland, a company which is a local Pet dealer and

by Joe Telford

which produces business software; Prokit is a spin-off from these packages and consists of a CBM disc and a manual.

The manual is of foolscap size, 20 pages in length and uses the front cover as an instant guide to the package. The manual is structured to take you through all the Prokit routines one by one and suggests ways to use Prokit in your programs. Prokit's use with tape, CBM disc and Computhink disc is covered in a section at the end.

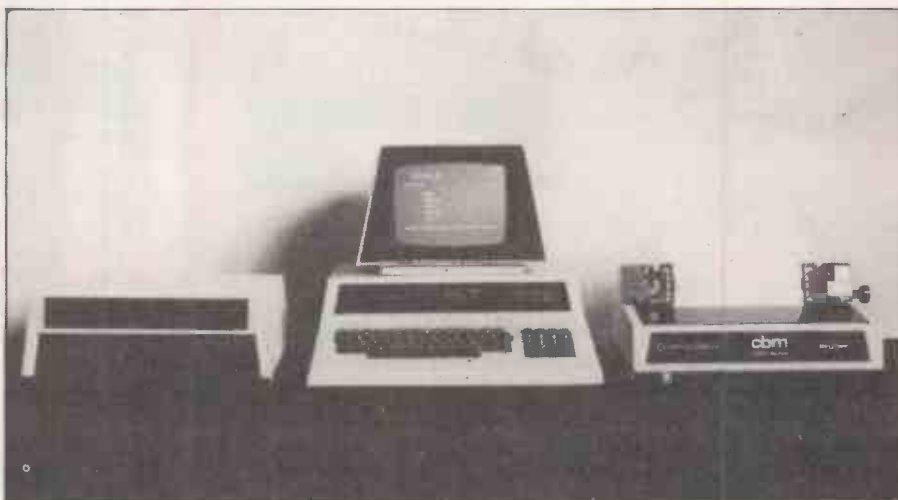
The manual is essentially easy reading. In addition to the manual, there are a number of demonstration programs you can load to help you during a section on a particular routine. These programs are full of REM statements and easily understood.

The first program to load is Prokit itself. Once run, it settles in the top 3K of user memory, just below the visible screen. The operator must now set the top-of-memory pointers — unless that is done by any program containing Prokit. Examination of the top 3K of memory showed that no space was left to hold DOS support for CBM discs.

This plus the fact that all routines are called by the Sys command, with parameters amended by Pokes, made me wonder why Prokit had been designed in this way while other programming-aid packages were patched into Basic.

Intex Datalog explains that the lack of DOS support was simply because during the run of the kind of large program you might design with Prokit, the operator would not need DOS support. Indeed, the Prokit package has to work for tape users and Computhink disc users, hence the version must be acceptable to all.

Intex Datalog's reason for not patching Prokit into Basic, via the Chargot memory area, is because there are a number of add-on programs and ROM chips using the patch, and even Computhink uses one. Prokit must be able to run with any of these loaded, in



any order — hence the apparently clumsy Sys/Poke technique.

The manual shows that there are six specific routines, each called by a Sys command, with parameters adjusted by one or more Poke commands.

They include:

1. Date input
2. General input of chosen valid characters.
3. Numeric inputs.
4. Screen-to-printer graphic conversion.
5. Search/match routine.
6. Screen-swap routines.

Once Prokit is settled into memory, the string QS is set to the null string and the

Size	3K memory not including extra screens
Type of program	Machine-code routines
Computer type	CBM 3000,4000,8000 series.
Market	Serious amateur/business programmer.
Cost	£35 plus VAT
Setting up	QS = " ": Poke 59468, 14 : Lower Memory
Routine calls	By Sys commands, adjusted by Poke commands
Special entries	Default entry allowed.
Facilities	1. Date entry. 2. General entry. 3. Numeric entry. 4. Graphic conversion 5. Search/match routine. 6. Screen exchanges.

Figure 2. Prokit package details.

Pet Poked into lower-case. Failure to set QS will cause syntax errors during use. Setting-up must be done in the Basic section of each program to use Prokit. The string QS temporarily holds the input after being formatted by Prokit. For this reason one normally copies the contents of QS into a more permanent variable, so

that data is not overwritten by future input-routine calls.

The date-input routine allows input into QS of a date in the format dd.mm.yy. On calling SYS 29699, a reverse field bar eight spaces long is produced after the last print position. Only valid dates may be entered, e.g., 29.02.80 is treated as valid, though 29.02.81 is not, nor is 31.09.81.

If the reverse-field area is filled by a print statement, the cursor is returned to the start of the field before calling the routine. The reverse field will display a default value which will be accepted by pressing return. The return key can be pressed at any time during date input, but only valid dates will be accepted. When a valid date has been entered, the reverse field clears leaving the entry still on the screen but also in QS for processing.

If, during input, the operator presses the Shift-Clr key combination, the format dd.mm.yy. is superimposed on the reverse field as a memory jogger. A demonstration program "PKD" is included to show the use of the date-routine in a program.

A certain maximum number of particularly-chosen valid characters may be entered into the general-input routine. This routine is set up by creating a string VCS containing all the valid characters allowed in entry and then by Poking the maximum number of characters into location 1. A call of SYS29696 produces a reverse-field bar, the length of which is governed by that Poke to location 1.

Only characters previously loaded into VCS will be accepted and the Return key can be pressed at any point in the line. If the entry is less than the full bar length, QS will be padded with spaces to help future print formatting.

As before, default values can be set for Return key entry. Because they are in the

entry field, the routine assumes they have all passed the entry-validation tests. All characters in the default entry are, therefore, accepted, valid or not. It is up to the programmer to ensure that the program default statements are valid.

This routine does not check for spelling mistakes — the size of a suitable dictionary makes it impossible. Again a program with many REMs is included for demonstration, and a more elaborate version is included as well as suggestions for applications such as telephone-number entry.

Numeric input

The numeric input routine allows the input and formatting of numbers, specifying the number of places before and after the decimal point as well as allowing positive-only numbers to be input or both + and - number entry. Before calling the routine, three locations must be Poked:

910: the number of points before the decimal point

911 : the number of points after the decimal point

912 : a 0 for only positive numbers or a 1 for both negatives and positives.

SYS 29702 calls the routine and the now-familiar reverse-field bar appears as in the other routines. Because numbers are entered from left to right, the number 12 in a four-digit entry field looks like 1200. When the decimal point is pressed, however, the routine re-formats the number to 12 automatically. An unwary operator can press Return at an inappropriate stage and obtain a garbage input a power of 10 higher than expected.

Two remedies are suggested in the documentation. The first alternative is to press the decimal point after your whole-number part has been entered, then the Return key. This is, in fact, what I suggest. The routine has a special extra key, J, which behaves like the return key except that only numbers to the left of the cursor are accepted into Q\$.

The normal Return key enters everything in the field into Q\$. The demonstration program "PKN" shows ways of using the routine, reminding the operator that in accepting both positive and negative numbers, the '-' key can be pressed at any stage to make the number negative, and the '+' key reverses the process.

The previous three routines have an extra key which behaves as a Return key. The RVS key performs the same function as Return, but after it has been pressed, the location 32767 contains a 1 to indicate trouble. The suggestion given with the documentation and demonstrated by the accompanying programs is that an operator may notice an input mistake, such as a spelling error, possibly three inputs after it has occurred.

The operator can press RVS and a Basic routine can step the input back sequentially to the faulty line. This can be corrected and the correct inputs Returned to the position where the error was noticed. The program can then continue as normal.

The Pet, in some printer combinations, prints garbage on a printer when the screen is in upper- and lower-case. The graphics-conversion routine adjusts for that problem. As before, input from the screen goes straight to Q\$. SYS 29711 adjusts Q\$ to print correctly on a printer.

Search match

With the search/match routine, characters in string S2\$ are searched for a substring S1\$. Both strings must be set by the program, then SYS 29708 does the hard work. Location 32767 contains the number of the character in S2\$ where a match starts. If the number 0 is found, no match occurs. The serious programmer will find that sequential searches using the routine are up to 200 times faster than using Basic.

An additional benefit is the reduction of garbage collections when using the routine.

Its suggested uses are given in the manual and a demonstration is included. One which particularly interests me is the implementation of a Match statement in Basic, so that a Pilot-like language can be approximated.

In a Basic program, a number of data-entry forms may be duplicated on the screen. The suggested method is to create them in their entirety and call them to screen when needed by machine-code screen exchange. The routines allow the exchanging to be done, though not the creation of screen forms. This is done by a program called Screens which has 10 suggested input forms, which you may change to suit yourself using the editing facilities provided by the program.

The final results can be protected, the Screens program erased, and the operator's own business/administration program added. The complete combination can then be saved for future use. Once the screens are created, the next step is the use of the routine which calls the screens into view.

The control over screen exchange is as follows:

1. Memory copied to screen.
2. Screen copied to memory
3. Screen and memory swapped.

The type of exchange 1,2,3 is governed by Pokes to locations 32503,32504,32506, 32507 and called by SYS 29705. If more than one hidden screen has been created, additional Pokes to locations 910 and 911 are needed to select the particular screen.

Each screen of information uses up an extra 1,000 bytes below the Prokit routines, so one is advised to use the minimum number of screens necessary for any particular business program. The complete routines are demonstrated in a program 'TDEM', which is very impressive.

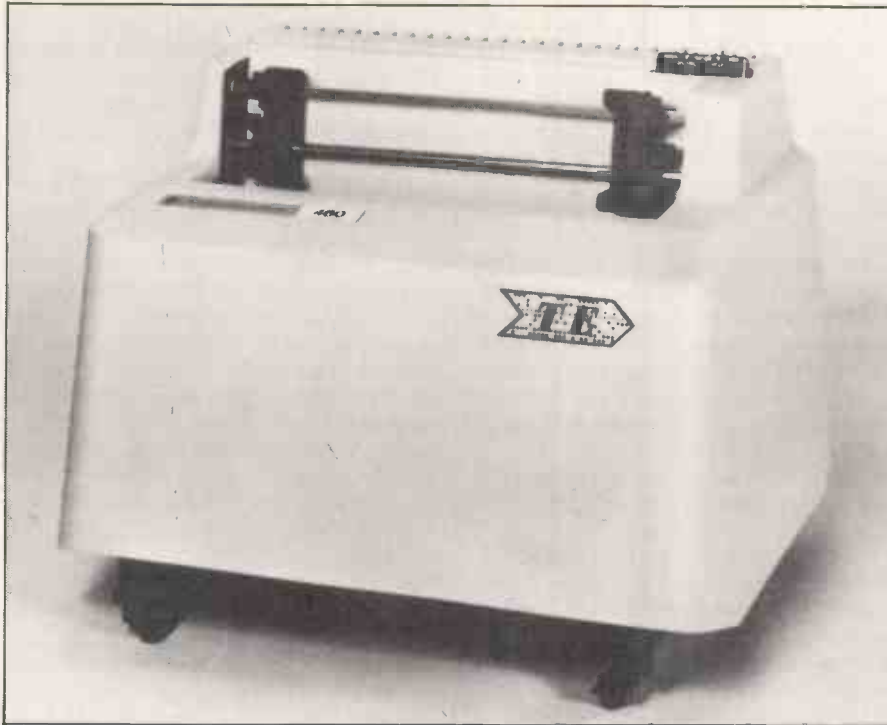
A section of the manual is devoted to an explanation of how to use Prokit in one's own programs, and deals with saving the entire memory on tape, CBM disc and CompuLink disc. Commercial software writers wishing to use Prokit may contact the distributor to reach an agreement over copyright.

Conclusions

- I tried especially hard to create a situation which affected any routine, and in all situations, as long as the correct Pokes, Sys and valid characters were set, Prokit behaved according to documentation.
- My biggest worry now is that any data errors in programs which I write will be caused by poor programming on my part, rather than their poor entry technique.
- It is worth looking after the manual as the Screens program and swapping routines are more difficult to remember than the other routines, most of which I have now committed to memory.
- All in all, a very useful package. □

Figure 1. The Prokit memory map.

Address	Contents	Address	Contents
1	Length of field for general input routine.	29439	Top of spare screens 1K for each screen.
910	Number of spaces before decimal point/low byte of current screen start.	29440	Start of Prokit
911	Number of spaces after decimal point/high byte of current screen start.	29696	Link to general input routine
912	Sign for numerical input.	29699	Link to date input routine.
1025	Start of Basic program area.	29702	Link to numeric inputs
		29705	Link to screen exchange
		29708	Link to search routines
		29711	Link to graphic conversions
		32503	} Directions for type of screen exchange.
		32504	
		32506	
		32507	
		32767	Flag for search/RVS ROUTINES
		32768	Start of visible screen.



The action of the Tiger

THE PAPER TIGER made its first appearance in the U.K. in September 1979 as an eye-catching design — one of the American contenders against the onslaught of the Japanese dot-matrix invasion. Like the majority of dot-matrix machines, that model, the 440, had a seven-wire head, producing a text crippled with truncated descenders which was legible, useful for listing and general computer donkey-work, but a poor second to the Qume/Diablo front when it came to word-processing.

Substantially the same machine is still available as the 445, but the manufacturer, Integral Data Systems, is closing on the heels of the expensive daisy-wheel designs with two new offerings, the 460 and the 560, each of which offers true descenders and a print appearance not far removed from that of a good typewriter.

The improvement is achieved by increasing the number of wires in the head to nine and by staggering them so that the individual dots to some extent blend into a smooth line. High print-speed is maintained at around 150 characters per second, and according to Integral Data Systems, the machine “also offers a bi-directional logic-seeking device to enhance its print optimisation characteristics”.

Teleprinter Equipment, the U.K. distributors, lent us the 460, the version designed for standard 8.5in. tractor-feed stationery, although the adjustable tractors will take all the smaller roll sizes. The 560 is a similar machine

mechanically, but with a maximum carriage width of 14.75in. and a newly-designed case. The 460 retains the upright moulded resin case of the earlier Paper Tiger model.

The industrial design of the machine was, frankly, a disappointment, as if the good ideas and the ingenuity had all been used up on the internal workings. The case in particular, a single resin moulding that slips over the chassis from above, is an ergonomic flop, and for most of our

by Chris Bidmead

trials, we dispensed with it altogether, wedging a piece of rubber into the micro-switch which cuts out the mains when the chassis is exposed.

In everyday use, this cover probably works well enough. The poor design becomes evident only when trying to remove or replace it — to change the ribbon, for example.

The 460 and 560 each use the same ingenious ribbon cartridge — a kind of oblong plastic box into which the mechanism stuffs the ribbon at one end while pulling it out at the other in a continuous Möbius loop. Ribbon life is now claimed to be increased from six million to nine million characters compared to the previous open-ribbon system, although the new cassettes now cost £13 each as opposed to £9. This represents a small saving, until you prematurely damage a ribbon and have to throw it away, because

there seems to be no easy way of repairing the loop.

The machine arrived with tell-tale inky finger marks on the cover, indicating that somebody had had trouble fitting the ribbon. We quickly discovered why — although the ribbon is neatly cartridge, its inked surface has to be handled to loop it round the four guide rollers. Replacing the case afterwards is not an enjoyable business. There are too many points at which the strangely-shaped case can foul the chassis.

The dedicated owner, who has bought the machine for its undoubted versatility — RS232 and parallel interfaces are options, and the electronics offers a choice of font sizes, as well as a proportional-spacing option — will no doubt become adept at handling the case, guiding it back so that its four slots engage simultaneously over the chassis bolts.

Even so, the day will arrive when he, or somebody, picks the machine up to carry it across the room. The case is held on to the chassis by four finger-tightened nuts — or, in transit across the room, *vice versa*. The ease with which the chassis could drop from the bottom of the case hardly bears thinking about.

On power-up, a toggle switch gives the option of self-test, continuously printing out the whole character set. The manual also recommends using this switch “momentarily” for emptying the buffer to abort printing. Your idea of “momentarily” had better correspond with the manufacturer’s, because if this moment is prolonged until the printer begins to self-test and the print-head is not in the home position, the self-test logic insists on printing out a full line, remorselessly jamming the print-head against the right-hand limit of travel with an awful graunching noise.

When this happened, we dived for the mains-off switch, but not before we had fouled the ribbon and blown the print-head motor fuse. To replace the fuse and the ribbon we had to remove the cover.

The 460 appears to offer a choice of four character fonts, though in reality they are all a re-dimensioning of the same basic set. Thus the smallest, 16.5 to the inch, resembles book type, particularly when printed out proportionally; and the largest is the familiar dot-matrix ‘Expanded’. The appearance on the page is close to a good cloth-ribbon typewriter, the slight unevenness giving the text a hand-wrought look.

Occasionally, particularly at the beginning of lines, a character appeared to be squashed sideways, and this might create problems of legibility, especially with figures printed in the smallest size. Apart from this, and a raggedness of the left-hand margin which we managed to cure by tightening the drive belt, the printed output is very elegant. The smallest type size enabled perfectly-legible full assembler listings to be made on 80-column paper.

The 460 on trial was supplied with the full graphics option, which includes a 2K buffer and the capability of addressing each needle individually, so that in theory, the printer will print any pattern for which you have the patience to write the software. If you do not have patience, but have an Apple, a commercial package called Apple Graphics Dump will send screen graphics directly to the Paper Tiger.

We tested the graphics to the extent of printing a series of chequers of various sizes, and everything worked very well and at high speed. Resolution is excellent, comparable with so-called infinite-matrix printers.

We drove the printer at its top speed of 9,600 baud and ran into buffer overflow problems, as our standard printer-driver software is based on ETX/ACK buffer control, and so failed to recognise the DC1/DC3 protocol observed by the Paper Tiger — see table 1. All the other printers we have tested offer both protocols, either simultaneously or as “strappable” options, and we had to spend some time with a hot soldering iron around the sensitive parts of our Bitstreamer II I/O board before solving the problem by implementing the Data Control Ready handshaking line of the RS232 interface.

Although we used the printer only in its RS232 mode, the machine can be re-configured as a parallel Centronics-type printer with some nimble-fingered re-strapping. This is not something one would want to do every day, but the inaccessibility of the relevant jumper board is one more manifestation of the inward-looking design, which seems to tolerate but not welcome human contact.

Another example, common among printer manufacturers, is the misuse of miniature DIL switches. These devices, though robust, are intended on the whole for once-and-for-all setting of options — so that defining the baud rate and parity is a legitimate application.

The Paper Tiger leans on them too heavily for setting and re-setting such variables as auto-line feed, proportional spacing, form length and character density. True, these options can also be adjusted through software, and in a properly-integrated system probably would be. However, by the time you have re-written your operating system, the domestic laser printer will have arrived.

Limited word-processing facilities are built into the machine, so that it is possible to write software to alter margins and execute absolute tabbing both vertically and horizontally. In particular, the right-justification mode offers very clever word-wrap facilities.

Table 1

Speed test comparisons with daisywheel printers are not really relevant because the applications are different, but we ran two of our standard speed tests on the Paper Tiger to see what kind of speed advantage a good dot-matrix machine could give.

Test	Time taken
Standard-text test	1'03"
Formatted-text test	0'26"

Comments

57 cps — half the claimed best speed. Yet the manufacturer does not define the conditions of its own test. The machine was in justify and proportional mode, so had a good deal of thinking to do. Under these conditions it was not much faster than a daisy-wheel printer.

Twice the speed of a good daisywheel printer. The print-head moves very fast, bi-directionally converting strings of spaces into absolute tabulations. Yet direct comparison with daisywheel speeds is unfair — the Paper Tiger did not provide underlining in this test.

Text is sent to the printer without carriage returns — except at the end of paragraphs — and is automatically broken at the correct spaces into lines that are then padded out to be of identical length. There is no easy way, though, of producing underlines and centring text.

Conclusions

- The Paper Tiger is a fast dot-matrix printer with correspondence-quality resolution.
- The machine should be trouble-free and inexpensive to run — but the ribbons are only available from the distributor.
- A good variety of setting-up options means the printer should be able to match virtually any system.
- Poor industrial design mars an otherwise well-conceived machine.
- At £795 for the 460, £995 for the 560, the new Paper Tiger is not exactly given away. With Japanese competition hard on its heels, these prices may well fall soon.

Spinwriter's quality is not just on paper



OUR FIRST impression on unpacking the NEC Spinwriter was one of superb production engineering. The case is the apparently now industry-standard cream colour well-cast in three metal parts which fit together perfectly. The front cover is articulated on long hinges which lift it clear of the tractor feed when fitted and it snaps shut again with reassuring firmness. Even the disposable security bolts which hold the machine during shipping are beautifully tooled.

Not one but two main power switches are provided at the front and rear, ingeniously linked so that the functioning switch is defined as whichever the user switches on first — you do not have to fumble for both of them.

The purpose of this is not entirely clear; perhaps the rear switch is intended for applications where an unqualified user might switch off the machine accidentally.

Optionally, the machine will self-test on power-up, though only in the most rudimentary way by reiterating the familiar holo-alphabetic sentence about the fox and the lazy dog. The built-in diagnostics also appear elementary at first sight. They are based on combinations of

(continued on next page)

(continued from previous page)

a single light and an alarm bell; so that, for example, the light and the bell with printing continuing indicates "Paper out", light and bell with printing arrested means "Cover open", while a repeating bell broadcasts the news that all is not well with the print-head. Until one masters these various cries for help, the teething period can be very noisy, but with practice, it becomes easy to identify the fault quickly.

An obtrusive feature at the back of the machine is a chrome-plated wire cage responsible for monitoring the even feed of continuous stationery to the platen. The equivalent on other machines is a simple grill which ensures that incoming paper does not choke the air intake. The Spinwriter device is hinged, and requires continuous paper to be threaded through it so that a microswitch can detect the paper-out condition.

It adds to the complication of loading continuous stationery and means that if using single sheets, something has to be done to override the switch. Though the arrangement works well, we were left with the feeling of a certain amount of "chrome-wire overkill" in this department.

Access to the internal workings is a simple matter of operating two levers inside the cover, which lifts off cleanly with no trailing wires. The interior is uncluttered and well laid out, with most of the components easily accessible. None of these, incidentally, seems to run at much more than blood heat, even after sustained operation.

The electronics occupies four large, well-mounted boards at the rear, three of which run almost the whole width of the machine. From the size on the boards and the mixture of components, it becomes clear that the very latest technology has not been used, but this seems to be a deliberate design choice — part of the overall conservative philosophy.

One element of the design is obviously innovative — the tulip-shaped print-element, or "thimble". Unlike the Diablo daisywheel, but like more recent wheels such as the Ricoh, each petal carries a pair of characters.

This introduces the need for a vertical shift, with corresponding complications to the print-head design, but the trade-off is a gain in print speed and the ability to offer a total character set of 128 characters compared to the more usual 98. Changing the thimble seemed to be marginally more difficult than the corresponding operation on the Diablo, though this may have been due to our lack of familiarity. On both machines, the ribbon has to be removed first.

Annoyingly, the left edge of single sheet paper sometimes caught the print-head, causing the ribbon to ride up out of position, and the lid had to be lifted to adjust it before printing. We have encountered a similar bug on other

Test	Time Taken	Comments
Standard-text test	1'31"	43 cps — rather less than claimed. The manufacturer does not, however, define the conditions of its own test.
Formatted-text test	0'57"	About the same as a medium-speed printer.
Graphics test	7'40"	Not impressive.
Tabbing test	0'43"	Very good. The Spinwriter seems to handle tabbing cleverly.

- **Formatted-text test.** The 8080 CPU loses a relatively large amount of time in calculating print-head movement, so that the speed of printing heavily formatted text is disproportionately slow.
- **Tabbing test.** The Spinwriter seems to translate a string of spaces into a single continuous carriage movement, resulting in print action which is smoother than the usual judder associated with the LPrint Tab instruction from Basic on ordinary daisy-type printers. The trick with the latter is to translate all Tab instructions into absolute tabulator instructions, using ESC LT «ascii character». This also works on the Spinwriter and results in an improvement in tabbing speed.
- **Graphics test.** The Spinwriter makes the necessary calculations so slowly that in this mode it runs some 50 percent slower than its nominal print speed would suggest. The machine also seemed to be somewhat careless about its print-impression control when running in graphics mode: its full stops almost drilled through the paper.

Table 2.

machines: there is often a position of the paper guides that causes the paper to foul against the print-head in its zero position.

Mechanical single-sheet feeders are sometimes programmed to move the print-head to the centre during paper-change, and it seems a pity that this cannot be arranged to occur during manual paper-change. The remedy is to be careful on setting the paper guides

On one occasion, the ribbon broke — our only carbon ribbon — which gave us the chance to discover that the ribbon cases are so well engineered that it is a simple matter to ease them open, effect the repair, and snap them shut again. In fact, they are so well made they are virtually refillable.

Which they might well need to be. None of the computer-consumable suppliers we talked to knew of any alternative manufacturer of Spinwriter-compatible ribbons and thimbles. There seems to be little difficulty in obtaining supplies from NEC — at least not in London. Yet the absence of "second-sourcing" is something would-be buyers certainly ought to take into account.

The model under test was the 1515, chosen as the version which understands the Diablo escape codes of our word-processing software. Physically-identical machines are available to match a variety of interfaces, notably Centronics, parallel Qume, and Current Loop. The Diablo version seems to correspond closely to the older Diablo escape codes, which are a sub-set of the current protocol used on the Diablo 630 but the Spinwriter does not understand any of the later updates like Remote Re-set and Top Margin. The 1515 is, in fact, described in the Spinwriter maintenance manual as a direct replacement for the Diablo 1610 a machine now two generations old.

Its chip technology seems to belong to much the same era, and it is clear that

assessed alongside newer machines like the Diablo 630, the NEC Spinwriter is a little long in the tooth. Apart from the novel tulip-shaped print-element which may well owe its existence as much to the laws of patent as to design progress, and a major re-think of the printer chassis "borrowed" back by Diablo in its new range, the Japanese device appears to be little more than a collation of beautifully-engineered refinements on the old Diablo 1610/20 range.

The result is a conservatively-styled, beautifully-built printing terminal with a reputation for sustained trouble-free performance. Its philosophy seems to be to accept a slight trade-off of print quality against increased print speed, although this gain is unfortunately lost whenever the somewhat senior 8080 CPU is called on to deliberate on print-head movement optimisation — see table 2.

Within these limitations, the Spinwriter is quiet, fast, and gives the impression of being very assured in operation. Memec, the U.K. distributor to which we are grateful for the loan of the review machine, recommends an end-user price of £1,950, which is not exactly a bargain. Shop around and be prepared to argue: these prices are not carved in stone. Be careful, though, to make sure that the dealer from which you buy can give you support at the price you choose.

Conclusions

- Mechanically fast, the spinwriter still "thinks" slowly.
- There is no second-source yet for Spinwriter ribbons and thimbles.
- The print quality, though very good, is not of the first order.
- Manufacturing quality is superb.
- The Spinwriter is a mature product in the very best sense: bug-free, increasingly well-supported, and as reliable as the best machines available.

Writing your own business software

PERHAPS the best piece of advice in this series will be given in the first sentence — don't. Producing good business software is a job for a software house. Its staff will, ideally, be able to take the time and trouble required, knowing that their investment can be recouped from volume sales of a successful package. Their experience will produce results of a standard you will find hard to match.

If you are still reading this, you probably fall into one of the following categories:

- You have a specialised problem, cannot find a package, and custom-written software would cost you the earth.
- You have plenty of time and are convinced that you can do the work yourself.
- The sales literature for your machine says that programming can be learnt by anyone with a few hours to spare.

The way to avoid the hours of work normally involved in designing, programming and testing your system is to have someone else do most of it for you. Since about 80 percent of all programming is not concerned with the application in question, but relates to input validation, data conversion and other standard routines already in existence, it follows that 80 percent of any typical program has already been written.

This series aims to provide you with the 80 percent and help you write the other 20 percent. I shall assume that you already

by Charles Somerville

have some programming experience, and, as Basic is probably the most commonly-used language, it will be used in all the examples.

All the routines are already incorporated in successful commercial packages, using Microsoft Basic and CP/M. Users of other Basics, and perhaps other languages, should be able to convert the routines easily for their own use.

Imagine that you are watching ITN's *News at Ten*. The newsreader's head appears at the top left-hand side of your television screen. As the program progresses, more of him appears, until you can see a head and shoulders lining the left-hand side of the screen.

At this point, the newsreader's toupe begins to disappear from the top of the screen, while his torso climbs on from the bottom. By 10.30pm you are left with a view of a pair of shoes, three inches of sock and some turn-up.

That would not be the standard of presentation you expect on your television, so why should the average computer user have to tolerate information appearing and disappearing on a VDU in the same manner?

Good screen presentation is an essential part of good software. Not only does it make a system easier to use, it can make it easier to sell, too.

One of the most important aspects of

any software you may write is a standard screen lay-out.

System Title
Menu Selection
Working Area
Error Messages
Help Information

Distinct areas of the screen are reserved for the following purposes:

- System title: Displaying the title of the system is use is especially helpful if several people will use the computer in the course of a day's work.
- Menu selection: The method of programming which this series describes as based on a menu system of selecting processing options. Showing the chosen option is a reminder to the user.
- Working area: This is where your 20 percent fits in. The working area will be used to display application-related data, and to accept information from the user.
- Error messages: All error messages will appear in this area. They will be highlighted in some way to catch the user's eye.
- Help area: This area will be used to display additional guidance to a user who cannot follow instructions given in the working area.

The number of lines allocated to each area depends on the display format of the machine you are using. For the 'standard' 24-by-80 screen used in examples, the screen is divided as follows:

Lines 1 and 2:	System title underlined.
Line 3:	Blank
Line 4:	Menu selection
Line 5:	Blank.
Lines 6 - 21:	Working area.
Line 22:	Error messages
Lines 23 and 24:	Help information

The idea that information should not be allowed to roll-off the screen does not mean that the screen should be cluttered with redundant information. Once a portion of the display is no longer helpful or relevant, it should be erased.

For instance, the user may be presented with a list of 10 choices, followed by the instruction to choose one of them. Once the choice has been made, only the chosen item should be kept on the screen. The rest of the list, and the installation, must be erased.

If we are to use the computer as outlined, the following facilities must be available:

- A method of clearing the whole screen.
- A method of clearing a portion of the screen.
- A method of highlighting certain areas of the screen, e.g., intensified or flashing characters or reverse video.
- A method of positioning the cursor at a certain point on the screen.

The Superbrain and others use Hexadecimal "DC" ASCII form feed to clear the screen, but Vector Graphic uses hexadecimal "04". The information for your machine is probably tucked away in an appendix to the user manual.

Clear screen

Having discovered, say, that the clear-screen character for your machine is Hexadecimal "0C", you could use the statement PRINT CHR\$(12) to clear the screen. To anyone else reading the program though, this could mean cursor left or clear to the end of line if they are used to a different machine. A better idea is to have an initialisation subroutine in your program:

```
30000 REM INITIALISATION SUBROUTINE
30010 CLS$ = CHR$(12) : REM CLEAR SCREEN CHARACTER
30999 RETURN
```

You can then use CLS\$ to clear the screen through the program. Perhaps the best idea of all is to keep the value on disc, and enter it as part of the initialisation subroutine. This means that your program can be transferred between different makes of machine by updating a "configuration" file. The subroutine might look like this:

```
30000 REM INITIALISATION
SUBROUTINE
30010 OPEN "I", 1, "CONFIG"
30020 INPUT #1, CLS$, CLES, CLL$,
HIONS$, HIOFF$, X, Y,
FIRST$, LEADING$
30030 CLOSE #1
30999 RETURN
```

Note that besides the value of CLS\$, we have read in several other variables. CLES and CLL\$ are the characters to clear to the end of the screen or to the end of the current line, respectively. HIONS\$ and HIOFF\$ are used to control the highlighting of error messages.

They switch on and off any flashing characters, highlighting characters or reverse video. Should your VDU have none of these features, set HIONS\$ and HIOFF\$ = "" when creating the configuration files, and they will have no effect when used. The other four variables are used in positioning the cursor. A typical computer will position the cursor

(continued on next page)

(continued from previous page)

by writing a string of characters to the screen in the form:

Cursor lead-in sequence + column number + row number.

The cursor lead-in sequence will be one or more characters which tell the video-driver software/firmware that a cursor positioning operation is required. Once again, lack of agreement between manufacturers means that a Superbrain uses Hexadecimal "1B59" ASCII Escape Y while a Vector Graphics uses Hexadecimal "1B". The same applied to the column and row numbers.

Many manufacturers add a fixed number to the row and column numbers to allow them to be represented by printed characters. Hence to position the cursor to column 30, row 12 on a Superbrain:

```
CURSORS$ = CHR$(27) + "Y" + CHR$(32 + 30) + CHR$(32 + 12)
```

```
PRINT CURSORS$;
```

You will see that this machine adds decimal 32 to both the row and column numbers, and requires the column number to be stated before the row number — unlike our general-purpose examples.

All these differences between machines can be overcome by defining a Basic function to generate cursor-positioning strings. This would be included in the initialisation routine as follows:

```
30040 IF FIRST$ = "X"
```

```
THEN DEF FNTAB$(C,R) = LEADIN$ + CHR$(X+C) + CHR$(Y+R)
```

```
ELSE DEF FNTAB$(C,R) = LEADIN$ + CHR$(Y+R) + CHR$(X+C)
```

FIRST\$ will have been set to "X" on the configuration files if the machine in question expects the column X co-ordinate to be given first. Otherwise FIRST\$ will have been set to "Y". X and Y are the decimal values which have to be added to the column and row numbers respectively. We now have a function which can be used on any machine in either of two ways.

Commonly-used cursor positions should justify creating some cursor positioning strings as part of the initialisation routine:

```
30050 CUR 3012$ = FNTAB$(30,12)
```

would initialise the variable CUR3012\$ so that:

```
PRINT CUR3012$;
```

will always position the cursor at column 30, row 12. At other times, the variable CURSORS\$ could be set to the required value by use of function FNTAB\$ just before it is needed.

You may be wondering why the cursor is positioned with:

```
PRINT CURSORS$;
```

and not just:

```
PRINT CURSORS$
```

This is because, unless you include the semicolon, Basic appends a CR/LF — carriage return and line-feed — sequence to your character string, causing the

cursor to jump to the start of the next, ruining your cursor positioning.

Microsoft Basic has a command, WIDTH 255, which suppresses the insertion of CR/LF, but as this is not found in most other Basics, it will not be used here.

Next month's article will deal with data input and validation and acting on the result. In the meantime, try the following:

- Find the screen-control characters for your machine.
- Create a configuration file. Set all the nine variables to the correct values, open a new sequential output file, and write a single record consisting of the variables. For example:
1000 CLS\$ = CHR\$(4) : CLE\$ = CHR\$(15) : CLL\$ = CHR\$(16)
1010 HION\$ = CHR\$(26) : HIOFF\$ = CHR\$(26)
1020 X = 127 : Y = 127 : LEADIN\$ = CHR\$(27) : FIRST\$ = "X"
1030 OPEN "0", 1, "CONFIG"
1040 WRITE #1, CLS\$, CLE\$, CLL\$, HION\$, HIOFF\$, X, Y, FIRST\$, LEADIN\$, 1050 CLOSE #1
1060 RESET
1070 END
- Write a program which uses an initialisation routine to read the configuration file. Clear the screen. Write a highlighted message to the error-message area. Write "TESTING" to column 36 onwards of the menu-selection area. Clear the error message line. Write information on the first four lines of the working area then erase from the second line of the working area to the end of the screen.

Automatic Sheet Feeders from



The Printer People

Feeds up to 250 single sheets or letterheads automatically — no more hand-feeding!
Universal unit with mountings for **NEC, Tec, Qume, Ricoh, Diablo** and others.
Easily attached or removed in seconds.
Adjustable forms length and/or sizes.
No modification to printer or software required.
Optional twin-feeder and envelope feeder available.

from **£450** excluding VAT

NORTHAMBER LIMITED, GREAT OAK HOUSE, ESHER, SURREY KT10 9JR Telephone: Esher (0372) 62071

Trade, OEM and educational discounts available — area dealerships invited

No holiday for seaside resort's hard-working Apple

ANYONE WHO ventures towards the East Coast from, say, the bustle of London's Old Street Station could be forgiven for thinking that time was playing tricks — that Freddie Laker had never put America within the range of most people's holiday budgets, that the glossy sunday supplements of most had never brought exotica, squalor and glamour from far-flung corners of the earth into your sitting room, and, in fact, that the late sixties, and early seventies, had never really happened at all.

The Essex coastal villages typically have the air of beleaguered settlements whose inhabitants chose to bypass the stark facts of London life by building a closed world of net curtains, chicken in the basket and holiday camps.

It also has a remarkably flat landscape, which some might find rather on the depressing side. The land beyond the pretty little village of St Osyth is flat. Towards the sea, it is punctuated by rows of small beach huts; at the beach itself there are more than 2,500 holiday letting units. At the height of the season, the place reverberates with the sound of bingo callers, fruit machines and kids.

We went there out of season though, when it is a ghost town of empty chalets and abandoned plastic buckets. Our destination was the Seawick Holiday Lido, largest holiday homes complex at St Osyth Beach and from Whitsun to late September the destination for thousands of visitors — mainly east Londoners bound for one of the 150 chalets or 600 holiday caravans.

Seawick provides more than just accommodation by the sea, though. In fact, the management is quietly proud of the fact that once a holidaymaker has arrived, there is no reason why the family should leave Seawick.

Star performers

For example, Seawick's tenants have the Club El Tora Leisure Complex, two bars, heated swimming pool, restaurant, dance floors and a medieval banqueting hall complete with hogs' heads and shields. There is bingo, a children's playground, an amusement arcade, a shopping centre, and the Seagull pub — where every night in the season you will find Jolly Roger, "the virtuoso of the organ". There is a big-name entertainment programme, too, offering among other attractions Acker Bilk, Marty Wilde, Gary Glitter and Joe Brown and the Bruvvers.

There are "space invaders" games in the amusement arcade, but you feel that not much else has changed at Seawick in the past 20 years — that is, until you visit the nerve centre of this substantial business operation. In the office of Seawick's accountant John Lambert, you will find his Apple II microcomputer.

The Seawick Holiday Lido was established just at the end of the Second World War and now covers some 50 acres of land. John Lambert explains that it presents immensely-varied administrative problems: "Here we sell everything from

by Cathy Lane

a tiny box of matches to a £5,000 caravan — a big range of items at widely-varying prices and in very different volumes. Our turnover is in excess of a million, but, of course, that money is earned in a very short space of the year.

"Every June and July we're suddenly and completely overwhelmed with money, mostly cash, and I'll be spending virtually every morning counting wads of grubby pound notes".

Seawick's staffing levels also vary enormously from about 120 people at the height of the season, including part-time bar staff and chalet cleaners, to a core of just 30 or so for the rest of the year.

What is more, all the money may be taken in the summer, but winter is the busiest time of the year for John Lambert. That is when the sums have to be done and all the prices set for the following season. The bills have to be paid for the 25 or so suppliers; contracts for the caravan owners are renewed; and the Lido must ensure that it remains ahead of its competitors, checking facilities and potential new offerings and the performance of others in the same business.

To help him monitor outgoings, Lambert had been using a bureau in Ipswich for the purchase ledger and some analysis. This certainly helped, but by 1978 it was becoming unsatisfactory: "The bureau's prices were constantly rising and by the end we were paying as much as £150 a month. Combined with the time it took to send data to the bureau and eventually receive the reports and the books back, that system was just not good enough".

Like any sensible accountant in the last two or three years, Lambert had been taking an interest in the development of the small-computer market. He gradually became convinced that Seawick both needed and could afford a system of its own.

His only previous computer experience was with a large IBM machine at his previous job but his young colleague, Steve Gay, had studied computing as a recreational subject at school for a year. So between them, they had some appreciation of the potential for computers.

They had scant knowledge of programming though. That did not stop them being convinced that they needed a system which they could program themselves. That was largely due to the special problems of running Seawick. Their encounters with computing had already led them to the conclusion that no off-the-shelf package would match their requirements well enough: "We're just not a standard kind of business". Also they felt that no brought-in programmer could do a better job of understanding the Seawick operation than they would.

Steve Gay and John Lambert attended a one-day conference-cum-demonstration held by Tandy and were duly impressed. The impact was dissipated, however, when a TRS-80 was demonstrated at Seawick: "For a start, the chap didn't seem to know as much as we did. It was a disaster". This was a disappointment for by this time they had bought the Tandy reference manuals and started to learn programming.

Help from dealer

They had some help from Lambert's brother-in-law, a lecturer in computing at Southampton Polytechnic, and between them they had already worked out how a purchase ledger could be devised for Seawick.

Then in September, a microcomputer dealer called Micro Management opened a shop in nearby Frinton. Lambert found he was talking to people who seemed friendly, helpful, and, above all, easy to talk to. After several visits to Frinton, they elected to buy from Micro Management an Apple II with two floppy disc drives and a matrix printer. On top of this they tested, liked, and bought Micro Management's own off-the-shelf purchase-ledger program on the understanding that they would receive assistance with writing subsequent programs. The total cost was in the order of £2,500.

From the outset, the computer was very much an accounting machine. Most of the other people at Seawick were dubious of its value, but Lambert and Gay had to be committed — for one thing they had no option but to start work on it immediately. They had already stopped dealing

(continued on next page)

(continued from previous page)

with the bureau and a large backlog of work had built up.

The main problems at the outset were due to their lack of understanding about how the computer worked. That was compounded by the seemingly-inevitable program faults. "The hardware has always been very reliable; it's us who have proved unreliable".

The purchase-ledger software had to be modified quite substantially; Seawick has nearly 25 suppliers, but needed 1,000 cost-analysis codes. The program allowed only for 100.

Batch processing

Even after Micro Management had adjusted the program, it continued to give problems — the kind of problems that Lambert and Gay could not solve without understanding the computer. Lambert now believes that "it is essential to be able to see what goes on in the computer — you need to see how data are being stored on the discs".

He also had to devise his own operating methods for the system, and one important result of the exercise is that he has effectively adopted those usually more characteristic of large companies: "For instance, when we first went to Micro Management, we were told that you just have to key in your invoices every day or each week or so and leave them. Yet it's

not that simple, because you do have to tally all your figures back. So now we always batch-list everything in a control book before feeding it into the computer".

Despite the hiccups, the purchase ledger was sorted out in two months and Lambert is grateful for the help they received from Micro Management. By then, they had already started on a sales-ledger program — helped interestingly enough by piles of brochures from all types of micro suppliers: "Between them they almost told us how to write the program."

The sales ledger has a file of 500 or so caravan owners who pay ground rent to Seawick, as well as electricity and repair bills. There is evident relief in Lambert's voice at the prospect of computerising this: "At last, we're getting rid of that laborious Kalamazoo system. It may have been all right in its way, and it would certainly be fine for most businesses — but we're unusual. The caravan rents account for about only one-fifth of our total revenue, but they were very complicated to calculate. We're sending out computer-generated statements now, which really do make people better payers, and soon we'll be sending out contract-renewal forms and the invoices automatically".

Once the sales and purchase ledger were completed, Lambert found himself with many other things he wanted to do at

once; a nominal ledger, a cigarette stock-control program, some method for handling bar inventory.

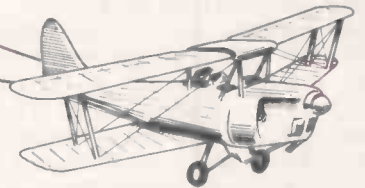
Lambert is pleased enough with the ways things have gone, though: "I was extremely happy that the purchase, sales and nominal ledger were all set up in time to cope with 1980 — good going I think. Whether we could have done it without Micro Management's help is debatable.

"We also have the cigarette program running very much as a test-bed for other stock control. Actually," he confides, "I hate cigarettes. I don't smoke, there's no profit in them and there's so much at risk. Yet we must stock them; and it's just because there isn't much profit that it is essential to keep a close eye on them". This program involves one file of brands and another for the outlets round the Lido, so that the incoming and outgoing stocks can be checked.

Payroll

John Lambert intends to consolidate the work already done on the machine: "We've had to adapt our working methods to suit the computer: I'll change that. We have thought about doing payroll on it — at the moment we still use the Kalamazoo system. I don't think it would be beyond us to write our own program, though whether we could do it for the same price as buying a commercial package is another question".

CAMBRIDGE COMPUTER SHOW



Micros have really taken off in Cambridge!

- TRS-80 Model I II & III
- Apple II & III
- North-Star Horizon
- Communicator
- Commodore Pet
- Daisy-wheel printers
- Computer books
- Acorn Atom
- Hewlett-Packard HP85
- UK101 kit computer
- Sharp pocket computer
- Wordstar/Datastar
- Plotters/digitisers
- Electronic components

First time buyer or experienced user? See what's best in microcomputers today, all generally on demonstration and available from stock at:

Cambridge Computer Store

1 Emmanuel Street Cambridge CB1 1NE
Telephone: (0223) 65335/4

Mon - Fri 9.00 to 12.30, 1.15 to 5.30.
Sat 9.00 to 5.30

• Circle No. 167

Qantex

**MATRIX PRINTERS
SERIES 6000/6010**

**150 CHARACTERS PER
SECOND**

136 COLUMNS PER LINE

**MICROPROCESSOR
CONTROLLED**

TRACTOR PAPER FEED

**MULTI-FORMS
IMPRESSION CONTROL**

TOP-OF-FORM OPERATION

OUT-OF-PAPER SENSOR

9 × 9 DOT MATRIX

96 ASCII CHARACTERS

CARTRIDGE RIBBON

**PARALLEL OR SERIAL
INTERFACES**

X-ON/X-OFF CONTROL

**2K OR 4K BUFFER
AVAILABLE**

**PLUS MANY MORE
FEATURES**

from £775

excl. VAT



Sole U.K. Distributors:

The Printer People

NORTHAMBER LIMITED, GREAT OAK HOUSE, ESHER, SURREY KT10 9BR. Phone Esher (0372) 62071

Dealer, OEM and educational enquiries welcome — some area dealerships available

AUSTRALIA

Sydney
Mitsui Computer Systems
02-9299921

BELGIUM

Brussels
Compudata Belgium
7205066

CANADA

Toronto
Computer Markets
416-445-1978

FAR EAST

Hong Kong Equipment
5-453870

FRANCE

Paris
Gepsi
1-554-9742

GERMANY

Munich
Technitron
49(89)629-4141

THE NETHERLANDS

Compudata Benelux B.V.
73-215700

Exploration and exploitation of new worlds
are the goals of Bob Merry's two-part game *Star System*.

STAR SYSTEM

STAR SYSTEM is a game of exploration where the program will create a planetary system for you to explore and exploit. Some of the planets may be inhabited and you will have the chance to contact them and, if you are lucky, establish friendly relations which can lead to the exchange of gifts.

In designing the game, I have given the option of stopping it at any point and recording the position so that the game can be played using new data or data saved from a previous game. Because of

the complexity of the game, the playing part fully occupies 8K and the instructions and preparation are put into a separate program.

This first program creates a Star System, consisting of several planets each with its own environment, which is determined by a mixture of luck and logic, e.g., while the atmosphere of a planet is randomly selected, the temperature is determined by its orbital position relative to the star and the other planets. Once the system is created, it is recorded as a data

tape, which is saved for use in the game program.

Because of this and the use of machine code for part of the display, it would be difficult to implement the program on systems other than the Pet for which it is intended — I would be very interested to hear of anyone who does manage to translate the ideas contained in the game on to other systems. The program listings given are written for the old ROMs, but since I have both sets of ROMs available thanks to a Basic Switch, I have developed

Table 1. Machine-code section of program.

033A	A9 00	LDAIM 00	;Stores address 32768	038C	20 9A 03	JSR	BLANK	;Gosub blank-string
033C	85 01	STAZ 01	;in zero-page					printer
			locations	038F	A2 4B	LDXIM 4B		;Load X with the
033E	A9 80	LDAIM 80	;01 and 02					required Offset
0340	85 02	STAZ 02	;	0391	20 AC 03	JSR	INCADD	;Move to the next
0342	A9 48	LDAIM 48	;Loads 72 into the					address
0344	8D F9 03	STA 03F9	;COUNT 1 location	0394	CE F8 03	DEC	COUNT2	;LOOP3 allows for
			(1017)					nine repeats
0347	A9 04	LDAIM 04	;Loads 4 into the	0397	D0 F1	BNE	LOOP3	;of the 5 blank
0349	8D F8 03	STA 03F8	;COUNT 2 location					string
			(1016)	039A	60	RTS		;Return to the Basic
034C	A9 66	LDAIM 66	;CHR\$(166) in A					program
034E	A2 01	LDXIM 01	;Increment in X					
0350 LOOP1	81 00	STAIX 00	;CHR\$(166) to 32768	039A BLANK	8D F9 03	STA 03F9		;Set COUNT 1
0352	20 AC 03	JRS INCADD	;Gosub increment	039D	A9 20	LDAIM 20		;Put CHR\$(32) in A
			address	039F	A2 01	LDXIM 01		;Put increment of 1
0355	CE F9 03	DEC COUNT1	;LOOP1 allows for					in X
			840	03A1 LOOP4	81 00	STAIX 00		;Print blank at
0358	D0 F6	BNE LOOP1	;repeats of					indirect indexed
			CHR\$(166) at					address
035A	CE F8 03	DEC COUNT2	;successive screen	03A3	20 AC 03	JSR INCADD		;Move to the next
			locations					address
035D	D0 F1	BNE LOOP1	;i.e., 21 lines.	03A6	CE F9 03	DEC COUNT1		;LOOP4 counts the
035F	60	RTS	;Return to Basic					number of
			program	03A9	D0 F6	BNE LOOP4		;Blanks passed to it
0360	A9 30	LDAIM 30	;Stores address	03AB	60	RTS		from main program
			32816	03AC INCADD	A8	TAY		;Return
0362	85 01	STAZ 01	;in zero-page					;Save current value
			locations	03AD	18	CLC		of A in Y
0364	A9 80	LDAIM 80	;01 and 02	03AE	8A	TXA		;Set 'Carry' to zero
0366	85 02	STAZ 02	;	03AF	65 01	ADC 01		;Put X in A
0368	A9 0A	LDAIM 0A	;Loads 10 into the					;Add A to zero
036A	8D F8 03	STA 03F8	;COUNT 2 location	03B1	90 02	BCC CLEAR		page 01; store in A
			(1016)					;Check 'Carry' and
036D LOOP2	A9 0C	LDAIM 0C	;Number of blanks	03B3	E6 02	INCZ 02		add 1 to
			in string	03B5 CLEAR	85 01	STAZ 01		;Zero page 02 if set
036F	20 9A 03	JSR BLANK	;Gosub blank-string					;Put new address in
			printer	03B7	98	TYA		zero page 01
0372	A2 44	LDXIM 44	;Load X with the	03B8	60	RTS		;Recover value of A
			required offset					;Return
0374	20 AC 03	JSR INCADD	;Move to the next	03B9	A9 48	LDAIM 48		;Stores address
			address					33608
0377	CE F8 03	DEC COUNT2	;LOOP2 allows for	03BB	85 01	STAZ 01		;in zero-page
			10 repeats					locations
037A	D0 F1	BNE LOOP2	;of the 12 blank	03BD	A9 83	LDAIM 83		;01 and 02
			string	03BF	85 02	STAZ 02		;
037C	60	RTS	;Return to Basic	03C1	A902	LDAIM 02		;Puts 2 into the
			program	03C3	8D F8 03	STA 03F8		;COUNT 2 location
								1016
037D	A9 4A	LDAIM 4A	;Stores address	03C6 LOOP5	A9 50	LDAIM 50		;Number (80) of
			32842					blanks required
037F	85 01	STAZ 01	;in zero-page	03C8	20 9A 03	JSR BLANK		;Gosub blank-string
			locations					printer
0381	A9 80	LDAIM 80	;01 and 02	03CB	CE F8 03	DEC COUNT2		;LOOP5 gives two
0383	85 02	STAZ 02	;					times 80 blanks
0385	A9 09	LDAIM 09	;Loads 9 into the	03CE	D0 F6	BNE LOOP5		;i.e., four lines at
0387	8D F8 03	STA 03F8	;COUNT 2					the bottom of the
			locations (1016)	03D0	60	RTS		screen
038A LOOP3	A9 05	LDAIM 05	;Number of blanks					;Return to Basic
			in string					program

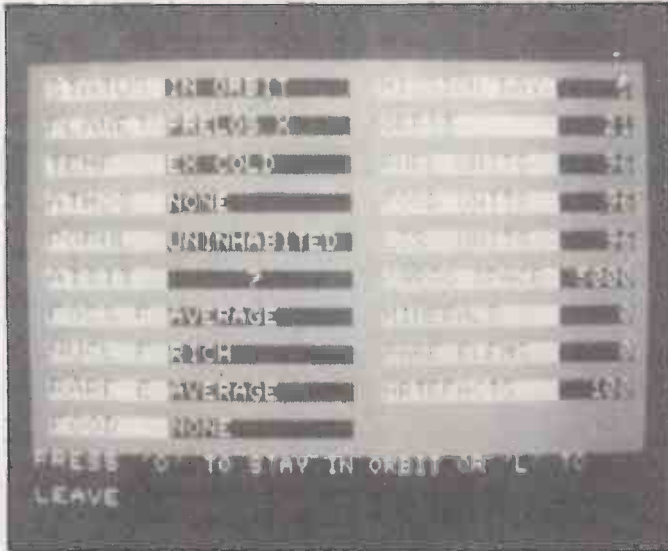


Figure 1.

a version for the new ROM and will give you conversion details.

As you will find out when you run the program, you are presented with a good deal of information about the planet you are orbiting and one of the first things I considered when designing the game was how to present this information. I decided on a display that looks like figure 1 which is a display from early in the game. Initially, I implemented this in Basic and did so by first considering the basic grid, which is shown in figure 2. This can be thought of as being in three sections: firstly, there is the background, which consists of 21 lines of CHR\$(166) — the shifted & graphics character; next, we have 10 windows each consisting of 12 blank spaces and separated by two lines; finally, there are nine other windows of five blanks each.

Basic too slow

Looked at in this way, the display can be described in programming terms by a series of For . . . Next loops, with appropriate movements of the cursor to start the action in the proper place and put the correct gaps between the windows. The two sets of windows need to be thought of separately, as they will carry two different sets of information — those on the left refer to the planet you are orbiting, while those on the right concern your spaceship — and they will be updated at various times in the program.

My first attempt at the program produced the display using Basic. However, it soon became apparent that this was less than satisfactory for two reasons. One was the pressure on memory space to give me sufficient scope for all the variable factors and complexities I wished to introduce. The other was the time it took the program to print the display. This would not have been important had I needed to print it only once, but it is an important part of the program that you use the screen for

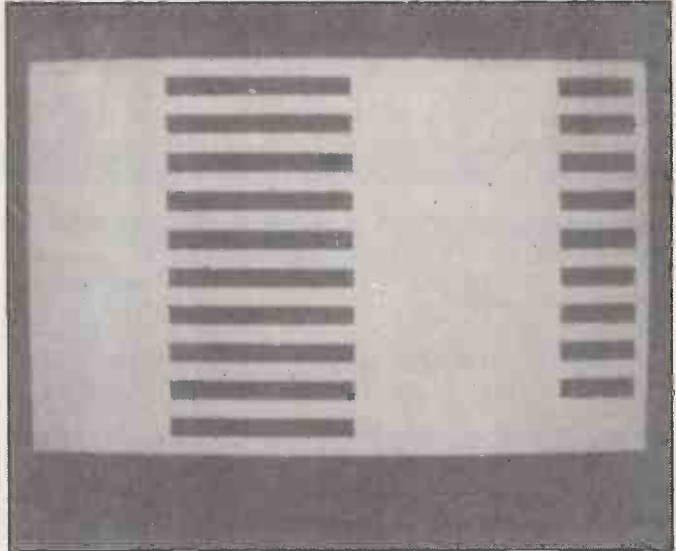


Figure 2.

several other read-outs when you are exploiting a planet.

The display of several seconds while the display was reconstructed was becoming tedious and it soon became obvious that I should try to develop a machine-code routine which would suit my purpose. If I could also lodge this routine in the second cassette buffer — a useful piece of spare memory — I would also free more memory for the game. Up to this point I had not tried any serious machine-code programming, so this was to be a voyage of discovery. The fact that I was successful should encourage other tyros to have a go and improve the speed of their programs.

First, for those who are not familiar with what is meant by machine code, a few words on how your microprocessor receives its instructions. An eight-bit microprocessor, such as the 6502 at the heart of the Pet, 'understands' words consisting of eight binary digits, from 00000000 to 11111111. These words can represent numbers or instructions and will be appropriately interpreted by the microprocessor according to their context.

Although the microprocessor can only deal with numbers in this form, it is an inconvenient form for a human operator to have to work and various high-level languages are available, such as Basic. These need to be interpreted into a series of numbers for the microprocessor and it is this process that makes a program written in Basic run much more slowly than one applied directly to the microprocessor.

Machine-code programs consist, therefore, of a series of eight-bit binary words. Numbers like 01001011, are, however, cumbersome for a human and not easily understood at a glance. Instead, the same numbers can be expressed in two other ways, decimal and Hexadecimal. In decimal notation our range of eight-bit numbers lies between 0 and 255, inclusive, and this is the form in which the machine-

code program appears in the Data statements in the Basic program.

Binary words can also be considered as consisting of two four-bit numbers in the range 0000 to 1111. This range can be represented by 16 symbols, the numbers 0 to 9 and the letters A to F. Thus each eight-bit word is represented by a two-digit Hexadecimal — base 16 — number, in the range 00 to FF. This Hexadecimal notation is extended to higher numbers. For example, the location 826 in memory can also be referred to as 033A, meaning 0 times 16³ plus 3 times 16² plus 3 times 16¹ plus A(10) times 1.

Hex instructions

This Hexadecimal form is used in the listing of the machine-code program given in table 1. Remember, these two-digit words can be instructions, addresses or actual numbers — it is up to the microprocessor to decide which according to the context.

Now let us consider the machine-code itself. Eventually, it will be placed in memory from locations 826 to 976 — 033A to 03D0 — and these memory locations are listed down the left-hand column of table 1. In the next column, at various points in the program, the names and start positions of particular sections of the program are given to which a jump has to be made. These labels are an aid to understanding and are not entered as part of the program. The next three columns are the program itself.

The first of these three columns contains instruction words and these instructions may be followed by 0, 1 or 2 other numbers. Some instructions stand alone and need nothing after them; others refer to a number in the range 0 to 255 and have one number after them, while others refer to a full address needing a four-digit Hexadecimal number. We will see examples of all the types as we study the program.

(continued on page 85)

Transdata's Cx500 Microcomputer Family

Multi-user hard disc

Single-user floppy disc



The Transdata Cx 500 family of Business and Scientific Microcomputers features upgrade potential from the Cx 502 single user 8" floppy disc system to the Cx 504 multi-user hard disc system. All Cx 500 systems feature an advanced multi-processor architecture which results in higher performance with simple expansion.

Experienced End Users, Computer Professionals and Distributors will value the quality, reliability and after sales support offered with these advanced U.K. manufactured microcomputers.

Cx 500 Features & Expansion

- Z80A Master Processor 4 MHz
- 64Kb RAM, ROM BOOTSTRAP
- Four V24 Serial Interfaces
- 8" IBM compatible floppy disc
- 20 Megabytes Winchester Hard Disc
- Cartridge Tape Back-up
- Extended memory with bank switching

Cx 500 The Complete Family

- Cx 502** - Dual 8" Floppy Disc System
- Cx 503** - Winchester Hard Disc System with 8" Floppy
- Cx 504** - Hard Disc System with Cartridge Tape Backup & 8" Floppy

Operating Systems

SINGLE USER choose either CP/M or MicroCobol BOS
MULTI-USER choose MP/M or MBOS

Proven Software

Wide choice of languages for CP/M and MP/M including BASIC, FORTRAN, COBOL and APL.

Quality Commercial Accounting packages for BOS and MBOS.

COMSPAK: Transdata's Communications Software Package for connecting Cx 500 Systems to most remote computers (The modem interface is a standard feature of all configurations).

NETWORKING: Connect Cx 500's and share resources.

System Upgrade

The Cx 500 family offers upgrade potential with compatible software.

Customer Support

Cx 500 Systems are fully supported in the field by Transdata's own Field Service Division - not a third party organisation.

Peripherals

Choose from our range of VDU's, Printers and Paper-tape equipment to complete your Cx 500 configuration.

*OEM Discounts Available.
Dealer and Distributor enquiries welcome.*

Cx 500 Microcomputers - The Problem Solvers

TRANSDATA LIMITED

DATA TERMINALS AND COMMUNICATION SYSTEMS
Sales and Marketing Division Telephone: 01 403 5115
Battlebridge House, 87-95 Tooley Street, LONDON, SE1 2RA.

Please send me
more information
about your
Cx 500 Family of
Microcomputers

Name _____
Company _____
Address _____
Tel _____

(continued from page 83)

Next in table 1, we have another version of the program, using mnemonic symbols which are more easily interpreted by the reader than the Hexadecimal numbers. This form is known as assembly language and can be used when writing machine-code. In this case, I wrote the original program in this form and then translated it into the Hexadecimal and decimal listings later, but it is also possible to use an assembler program which will allow you to compile the machine-code directly into memory by entering the mnemonic symbols into your computer.

The assembly listing is given to allow you to follow the working of the program more easily, and to this end there are a number of remarks included on the right of table 1, explaining what is happening.

Program sections

The program consists of four main sections, each a program in its own right, plus two subroutines. 033A to 035F contain a program for printing a backing of 21 lines of CHR\$(166) and is called by SYS 826. 0360 to 037C print 10 strings of 12 blank spaces — CHR\$(32) — in the appropriate positions on the display and is called by SYS 864. 037D to 0399 prints nine strings of five blank spaces towards the right of the display and is called by SYS 893.

Next in the program are two subroutines: 039A to 03AB is known as Blank and prints blank spaces for the number of times it is told by the program that calls it; 03AC to 03B8 is labelled INCADD and is used to modify the address of the screen location to that needed for the next printing. Finally, 03B9 to 03D0, which was added as an afterthought after the successful development of the other routines, is used to clear the bottom of the screen by printing four rows of blanks on lines 22 to 25.

The significant feature of the Pet that allows machine-code routines like these to be used is the screen appearing to the system as just another area in memory. You will probably be already familiar with this concept if you have ever used Poke and Peek. The screen information is allocated a 1K block of memory, starting at 8000 — 32768 — and we can put a symbol directly on to the screen by finding the number which represents that symbol and then Poking it into the correct memory location.

For example, POKE 32768, 102 puts a shifted & symbol into the top left-hand corner of the screen — try it. Note, however, that this number for Poke is not always the same as the CHR\$ number — the same symbol can be seen using PRINT CHR\$(166) and our machine-code program uses CHR\$(166) and CHR\$(32), a blank space, which correspond to the Hexadecimal —

decimal — numbers of 66(102) and 20(32).

Putting one of these symbols on to the screen would be easy if there were an instruction for the microprocessor which said: "Put N into memory location M". However, such an instruction would contain two unknowns, M and N, and this is not possible. Instead, we have to use intermediate registers to store one of the unknowns. The registers we have available in the 6502 are the A, X and Y registers.

They are eight-bit registers and differ in their intended uses. The A register is the arithmetic register and there are instructions to allow you to modify its contents in ways which are arithmetic operations. The X and Y registers are index registers and can be used in other ways.

To return to the problem of putting N into M, one way to do this is to put N into A — load A immediately with N — and then transfer the contents of A to M — store A at M. There are instructions for this and, in fact, we use such a sequence starting at 0342, where we store the Hexadecimal number 48 in 03F9. As far as storing numbers in screen locations is concerned, we must bear in mind that these locations must be altered after each print action.

Consequently, a more indirect approach is required, using a form such as: "Store the contents of A at a memory location given by the contents of p". This allows us to modify the contents of p so that the next location's position is stored there. This is the approach the program uses and the first consideration is where to have p. We can consider the memory available in terms of blocks — for example, 1K blocks — which might seem a convenient form of subdivision.

There is, however, a smaller subdivision which is also useful. This is the amount of memory which can be defined by one eight-bit number; 00 to FF gives a total of 256 addresses and this is known as a page. The easiest page to define is the one from 0000 to 00FF, known as the zero page and there are several instructions which can be given to the 6502 to direct it to the zero page.

For this reason, much of the zero page is occupied with the operating system of the Pet, but we can borrow two locations which will not be needed. Zero-page locations 01 and 02 are normally used to store a reference address for the USR function. This is not involved in our program so we will store the relevant screen location in these two spaces.

The least-significant part of the address goes in 01 and the most-significant part in 02. This is done initially by the section of a program from 033A to 0341, where we first load 00 directly into the A register and then store the contents of A at zero-page address 01, followed by loading A with 80 and storing the contents of A at zero page 02.

The two numbers we store next are

counters to determine the number of times we print the shifted & symbol. We want to do this for 21 lines of the screen; 21 times 40 = 840. However, a single eight-bit number gives us a count of only 256, so we need to make three counts of 256 — which equals 768 — plus the remainder of 72.

Now we have the first screen location loaded into the zero page and have set our counters, we load A with the symbol to be printed, CHR\$(166) and the X register with the increment in the screen address we want. Since we are printing CHR\$(166) at every location in the first 21 lines, the increment is simply 1.

Now we give the print command using an instruction which will find the address we stored in the zero page. STAIX 00 tells the microprocessor to store the contents of A at an address which will be found in the zero-page location 00 plus the contents of the X register (1).

Having found the address 8000 — 32768 — the contents of A are now stored there. Note, however, that the A register will not be cleared, but will still have 66 — 102 decimal — left in it. The overall result of this process is to print CHR\$(166) in the top left-hand corner of the screen. We now need to increment the address in 01 and 02, before the next print command and this is the purpose of the subroutine INCADD to which the program is now directed.

Arithmetic functions

In INCADD, we will need to carry out an arithmetic operation involving the use of the A register, but we have not finished with the contents of the A register, so the first step is to find a temporary place to store the A register contents. The Y register is not needed for anything else, so we use this as it needs only a single instruction TAY.

The arithmetic function we are to use involves a flag which is set to 1 if the A register contents are increased above FF. Although the A register would go from FF to 00, the carry flag would be set to show that this has occurred.

Now we put the desired increment into A (TXA) and add to it the contents of zero page 01. Eventually, after this subroutine has been visited several times, this would result in A exceeding FF and the carry flag would be set. If this should happen then zero page 02 is incremented by 1, but if it does not, this INCZ instruction is bypassed.

The BCC instruction tells the program to go forward two steps if the carry flag stays clear. The new contents of A are stored at zero page 01, the old contents of A — CHR\$(166) — are transferred back from Y and the main program is rejoined at 0355.

So far, we have printed CHR\$(166) at 32768 and increased the indirect address in

(continued on next page)

(continued from previous page)

the zero page to 32769. We will now print at this new address and make another increment in the address and so on. We must also keep track of how many times we do this so that we end after 840 such actions. That is where the two counters enter. We first decrease COUNT 1 by 1, from decimal 72 to 71 and then test to see if this resulted in a zero answer — another flag is used for this.

Obviously, it does not happen this time so the program is told to branch if not equal to zero. This branch instruction is followed by a number, F6. Branch instructions allow for forward and backward branching. We use 00 to 7F to indicate forward branching and FF down to 80 for reverse branches. FF means one step back, FE two steps and so on. Thus F6 means 10 steps and we need to know from where to count.

After the microprocessor has read F6, its program counter will have stepped on to the next position, so one step back takes it back to the F6, two steps to D0, etc. — 10 steps takes it back to 0350, the instruction to print CHR\$(166) at the next screen location. This process continues until COUNT 1 reaches zero when, instead of branching back, the program decreases COUNT 2 from 4 to 3 and since this does not result in zero, branches back 15 steps to continue printing.

The next decrement of COUNT 1 results in its going from 00 to FF and the program will, therefore, go through another 256 cycles of printing before COUNT 1 again reaches 00 and COUNT 2 is decreased to 2. After another two sets of 256 cycles, making a grand total of 72

+ 256 + 256 + 256 = 840, COUNT 2 reaches zero and the RTS instruction is reached which returns control to the Basic program.

The other three programs are all similar in that they print a series of blank spaces. The first two, starting at 0360 and 0370, print out strings of blanks, separated by two lines on the screen. The sum of the length of the string and the increment needed to locate the next string has to be decimal 80.

The first stage is to load the first address that we will need into the zero-page locations 01 and 02. Then we enter the number of times we want the string repeated in COUNT 2. Next, we put the length of the string into the A register and we are ready to call subroutine Blank.

This starts at 039A and firstly stores A in COUNT 1. Then it reloads A with 20 — CHR\$(32) — the number which represents a blank space, and loads X with 1, as this will be the initial increment required. STAIX 00 has the effect of printing a blank at the first memory location indicated by the contents of zero page 01 and 02.

Subroutine INCADD is used to step the screen location on one and this process is repeated for the number of blanks required, as determined by the contents of COUNT 1. Once COUNT 1 reaches zero, we exit the loop and return to the main program at 0372.

Back at 0372, we load X with the increment needed to move from the screen position at the end of the string to the start of the next string, two lines further down the screen. The offset is given by subtracting the length of the string from

80. Then we use INCADD to increment the screen address in the zero page. The loop controlled by COUNT 2 will allow for the string of blanks to be repeated the required number of times. Program 037D operates in an identical manner to this, while 03B9 involves only the use of the BLANK subroutine to print out two strings of 80 blanks.

That then is the machine-code routine to be used in Star System. It is contained in the Data statements in lines 120 to 190 of the Basic program. In this program, they will be put on to the data tape in line 600 and in the next program they will be transferred from the tape into the second cassette buffer. If you wish to check that you have entered these Data statements correctly, first enter the program down to line 190 and save it. Next add the 192 FOR I = 1 TO 22: READ NS: NEXT 194 FOR I = 826 TO 976: READ D: POKE 1,D: NEXT

196 SYS 826: SYS 864: SYS 893: SYS 953
198 WAIT 59410,4,4

This should result, when run, in a display like figure 2, and the program will end to give Ready when Space is pressed. Delete the additional lines and continue entering the program.

For those of you with new ROMs, here are the necessary modifications:

Line 560 Delete the two POKE commands
Delete lines 1110 to 1140
Delete GOSUB 1110 in lines 570, 580, 590, 600, 610, 620

As you may realise, the purpose of these additions for the old ROMs are to give a more reliable Data Tape, with correctly separated blocks of data and a correct header at the start of the tape.

Next month, we will give you the game program itself. □

READY.

```

10 REM** *STAR SYSTEM** **
20 REM**
30 REM**A SFACE EXPLORATION GAME **
40 REM** IN TWO PARTS **
50 REM** FOR AN BK PET (OLD ROM) **
60 REM** BY R.C.HERRY. JAN 1981 **
70 REM*****
80 REM**SEE ARTICLE FOR CONVERSION**
90 REM** FOR NEW ROM **
100 DATA VARDOS,LEXOH,HTROS,VEGA,GORSIK,HVLOG,PRELOS,DARIX,RENDOR,SIROLA
110 DATA 1,1111,IV,V,VI,WI,WII,XI,XII
120 DATA 169,0,133,1,169,128,133,2,169,72,141,249,3,169,4,141,248,3,169,102
130 DATA 162,1,129,0,32,172,3,206,249,3,208,246,206,248,3,208,241,96,169,48
140 DATA 133,1,169,128,133,2,169,10,141,248,3,169,12,32,154,3,162,68,32,172,3
150 DATA 206,248,3,208,241,96,169,74,133,1,169,128,133,2,169,9,141,248,3,169,5
160 DATA 32,154,3,162,75,32,172,3,206,248,3,208,241,96,141,249,3,169,32,162
170 DATA 1,129,0,32,172,3,206,249,3,208,246,96,169,24,138,101,1,144,2,230,2
180 DATA 133,1,152,96,169,72,133,1,169,131,133,2,169,2,141,248,3,169,88,32
190 DATA 154,3,206,248,3,208,246,96
200 DATA 100,100,100,5000,0,0,100,1
210 DIMP$(12)
220 PRINT"STAR SYSTEM CREATION
230 PRINT"THIS PROGRAM CREATES THE STAR SYSTEM
240 PRINT"TO BE USED IN YOUR GAME. IF YOU WANT
250 PRINT"THE FULL INSTRUCTIONS, PRESS 'V'; PRESS
260 PRINT"ANY OTHER KEY TO OMIT THESE.
270 R=RND(1):GETR$:IFR$=""THEN270
280 IFR$="V"THENGOSUB690
290 PRINT"PLEASE WAIT WHILE THE SYSTEM IS CREATED
300 R=INT(10*RND(1)+1):FORI=1TOR:READS$:NEXT
310 IFR=10THEN30
320 FORI=R+1TO12:READD$:NEXT
330 H=INT(5*RND(1)+8):FORI=1TON
340 READS$:P$(I)=S$+"*"+P$
350 IFLEN(P$(I))<12THENP$(I)=P$(I)*" ":GOTO350
360 T=INT(1067+1):P$(I)=P$(I)+RIGHT$(STR$(T),1)
370 E=INT(5*RND(1)+1):P$(I)=P$(I)+RIGHT$(STR$(E),1)
380 IFT<2ORT<6ORE=STHENP$=GOTO410
390 IFRND(1)<.2THENP$=GOTO410
400 P=INT(7*RND(1)+1)
410 P$(I)=P$(I)+RIGHT$(STR$(P),1)
420 P$(I)=P$(I)*"6"
430 FORJ=1TOD:J=INT(30*RND(1)+1):P$(I)=P$(I)+RIGHT$(STR$(J),1):NEXT
440 IFT<3ORT=5)AND(E=3ORE=4)THENP$="2":GOTO470
450 IFT=4AND(E=3ORE=4)THENP$="3":GOTO470
460 F$="1"
470 P$(I)=P$(I)+F$+"00"
480 O=0+INT(30*RND(1)+1)+O$=STR$(O)
490 IFLEN(O$)>3THENO$=RIGHT$(O$,2):GOTO510
500 O$="0"+RIGHT$(O$,1)
510 P$(I)=P$(I)+O$+NEXT
520 IFN=12THEN540
530 FORI=N+1TO12:READD$:NEXT
540 PRINT"PLEASE LOAD A BLANK DATA TAPE. PRESS
550 PRINT"SPACE WHEN READY."WAIT59410,4,4
560 POKE244,2:POKE243,12:OPEN1,1,1

```

```

570 PRINT#1,S$:GOSUB1110
580 PRINT#1,N$:GOSUB1110
590 FORI=1TON:PRINT#1,P$(I):GOSUB1110:NEXT
600 FORI=826TO984:READM:PRINT#1,M:GOSUB1110:NEXT
610 OB=INT(35*RND(1)+5):PRINT#1,OB:GOSUB1110
620 FORI=1TON:PRINT#1,0:GOSUB1110:NEXT
630 CLOSE1
640 PRINT"THE DATA FOR YOUR GAME IS NOW READY.
650 PRINT"THE STAR SYSTEM IS CALLED "S$" AND
660 PRINT"THESE ARE "N" PLANETS IN IT. REWIND YOUR
670 PRINT"DATA TAPE, LOAD AND RUN THE GAME PROGRAM
680 END
690 PRINT"YOU ARE THE COMMANDER OF A DEEP-SPACE
700 PRINT"EXPLORATION STARSHIP. YOUR MISSION IS TO
710 PRINT"EXPLORE THE STAR SYSTEM AT WHICH YOU
720 PRINT"ARRIVE. WHEN YOU COME OUT OF WARP DRIVE
730 PRINT"YOU WILL HAVE LIMITED AMOUNTS OF FUEL,
740 PRINT"FOOD AND LIFE SUPPORT. ONE OF YOUR TASKS
750 PRINT"IS TO COLLECT SUFFICIENT OF THESE ITEMS
760 PRINT"FROM THE PLANETS IN THE SYSTEM TO RETURN
770 PRINT"TO EARTH. YOU NEED AT LEAST 1000 UNITS
780 PRINT"OF EACH. PRESS SPACE AT THE END OF EACH
790 PRINT"PAGE OF INSTRUCTIONS TO CONTINUE."WAIT59410,4,4
800 PRINT"BECAUSE THIS IS A GAME OF EXPLORATION - A
810 PRINT"ADVENTURE INTO THE UNKNOWN - YOU ARE LEFT
820 PRINT"TO DISCOVER FOR YOURSELF HOW THE VARIOUS
830 PRINT"FACTORS IN THE GAME INTERRELATE (E.G.
840 PRINT"HOW ATMOSPHERE AND TEMPERATURE AFFECT
850 PRINT"MINING CONDITIONS AND EFFICIENCY), YOU
860 PRINT"WILL EARN POINTS FOR ESTABLISHING GOOD
870 PRINT"RELATIONSHIPS WITH CONTACTED RACES, WHO
880 PRINT"WILL RANGE FROM PRIMITIVE TO SUPER-RACE
890 PRINT"ACCORDING TO THE STAR-TRAVEL LEVEL).
900 PRINT"IF THEY LIKE YOU THEY MAY GIVE YOU GIFTS
910 PRINT"AND YOU CAN INFLUENCE THEM WITH GIFTS."WAIT59410,4,4
920 PRINT"ONE OF YOUR TASKS IS TO SURVEY THE STAR
930 PRINT"SYSTEM. A SHORT SURVEY OF A PLANET CAN
940 PRINT"BE DONE BY STAYING IN ORBIT FOR TWO DAYS
950 PRINT"WHILST A COMPLETE SURVEY TAKES OVER TEN
960 PRINT"DAYS. YOU SHOULD DO A SHORT SURVEY ON
970 PRINT"ALL THE PLANETS AND A COMPLETE SURVEY
980 PRINT"WOULD BE DONE OF INHABITED PLANETS.
990 PRINT"THE ON-BOARD COMPUTER WILL AUTOMATICALLY
1000 PRINT"SURVEY THE PLANETS AND SEND THE RESULTS
1010 PRINT"BACK TO EARTH."WAIT59410,4,4
1020 PRINT"WHEN YOU ARE READY TO RETURN TO EARTH,
1030 PRINT"OR IF YOU WISH TO TAKE A REST, YOU CAN
1040 PRINT"ENTER YOUR DESTINATION AS '99'. THIS
1050 PRINT"WILL GIVE YOU THE CHOICE OF SAVING THE
1060 PRINT"CURRENT POSITION ON A DATA TAPE, OR OF
1070 PRINT"ADDING UP YOUR POINTS. THERE IS A LARGE
1080 PRINT"PENALTY FOR ATTEMPTING TO RETURN TO
1090 PRINT"HEARTH WITH INSUFFICIENT SUPPLIES."WAIT59410,4,4
1100 FORI=1TO10 GETR$:NEXT RETURN
1110 IFPEEK(625)<180THEN RETURN
1120 POKE59411,53:T=1
1130 POKI(12)THEN1130
1140 POKI59411,61:RETURN

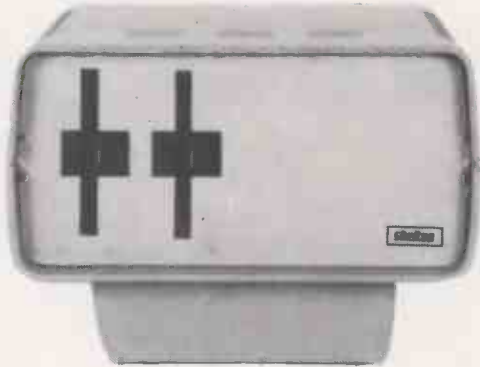
```


sig|net

If the front panel....

and the basic specification...

- * 4MHz Z80 processor and full 64K RAM
- * 2 or 4 dual density mini floppy disk drives
- * Serial RS 232 printer and VDU interfaces
- * CP/M compatible



make you think you've seen it all before, then take a closer look at the....

sig|net range of microcomputers from **shelton**

A confident new approach to micro design, which combines the cost advantages of single board computers with the flexibility of bus systems

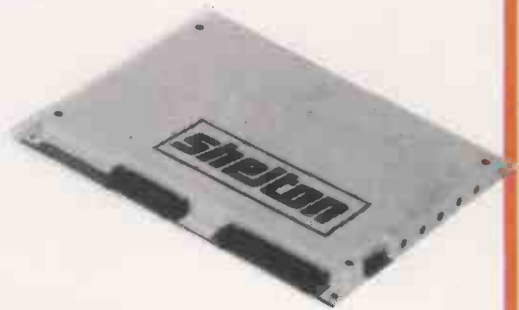
and the price! **£1299** for a twin-drive system including CP/M—
expandable to

- * Multi-user/multi-processor operation
- * Virtually unlimited flexible or hard disk storage capacity
- * Support an almost unlimited number of other peripherals and users under MP/M, CP/NET or CP NOS

OEMs — take advantage of the outstandingly
low cost of sig|net modules

CPU-RAM: 4 MHz, Z80, 64K and hard disk controller interface
FDC: supports 4 single, double or quad density drives — 8 or 5¼ in.
TWO-SER: twin serial I/O RS 232, 80baud — 19.2kbaud (64kbaud synchronous)
PSU-CPU: modules power supply
PSU-FDD: disk drive power supply

£299.50
£159.50
£89.50
£49.50
£69.50



sig|net microcomputers
another leading idea from
shelton THE RESOURCE CENTRE

shelton

Sig net is a trade mark of Shelton Instruments Ltd.

Shelton Instruments Ltd.,
22-26 Copenhagen Street,
London N1 0JD.
01-278 6273/4
TELEX 869559 GECOMS G

Make the most of your Sinclair ZX Computer... Sinclair ZX software on cassette.

£3.⁹⁵ per cassette.

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

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.



Cassette 1 - Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT - your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

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

CRASH - simple addition - with the added attraction of a car crash if you get it wrong.

MULTIPLY - long multiplication with five levels of difficulty. If the answer's wrong - the solution is explained.

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.

SPELLING - up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 - Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE - set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD - a powerful, easy-to-run system for storing and



retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT - a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 - Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING - bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction - but watch the fuel gauge! The screen displays your flight status - digitally and graphically.

TWENTYONE - a dice version of Blackjack.

COMBAT - you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE - on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

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.

BALANCE - tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES - 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES - what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES - convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP - Volumes, temperatures - and their combinations.

How to order

Simply use the order form below, and either enclose a cheque or give us the number of your Access, Barclaycard or Trustcard account. Please allow 28 days for delivery. 14-day money-back option.

Sinclair ZX SOFTWARE

Sinclair Research Ltd,
6 Kings Parade, Cambridge,
Cams., CB21SN. Tel: 0276 66104.

To: Sinclair Research, FREEPOST 7, Cambridge, CB2 1YY

Please print

Please send me the items I have indicated below.

Qty	Code	Item	Item price	Total
	21	Cassette 1 - Games	£3.95	
	22	Cassette 2 - Junior Education	£3.95	
	23	Cassette 3 - Business and Household	£3.95	
	24	Cassette 4 - Games	£3.95	
	25	Cassette 5 - Junior Education	£3.95	
	17	*8K BASIC ROM for ZX80	£19.95	
	18	*16K RAM pack for ZX81 and ZX80	£49.95	
		*Post and packing (if applicable)	£2.95	
Total £				

*Please add £2.95 to total order value only if ordering ROM and/or RAM.

I enclose a cheque/PO to Sinclair Research Ltd for £

Please charge my Access*/Barclaycard/Trustcard no.

*Please delete as applicable.

Name: Mr/Mrs/Miss _____

Address: _____

SOF06

SUN

NOW THE INTEGRAL SYSTEM WITH PERFORMANCE, QUALITY, EXPANDABILITY & RELIABILITY; ESSENTIAL FOR A BUSINESS SYSTEM.

FULL 12 MONTHS WARRANTY



ABC 24:— 620K BYTES ON DUAL MINI FLOPPY DISKS

ABC 26:— 2.3 MBYTES ON DUAL 8 INCH FLOPPY DISKS

LOOK AT THESE STANDARD Ai FEATURES, INCLUDED IN THE PRICE.

- * DOSKET OPERATING SYSTEM
- * FORTRAN IV
- * UTILITIES
- * DIAGNOSTICS
- * BASIC INTERPRETER/COMPILER
- * Z80 ASSEMBLER
- * LIBRARY
- * EDIT (& MORE)

HARDWARE

- * 64K BYTES RAM
- * REAL-TIME CLOCK (INTERVAL TIMER)
- * GREEN SCREEN
- * SEPARATE KEYBOARD
- * SECURITY LOCK
- * HARD DISK AVAILABLE
- * MULTI USER HARD DISK AVAILABLE SOON
- * SEPARATE SCREEN BUFFER
- * IEEE 488 INTERFACE BUS
- * LARGE GRAPHICS SET
- * 12 FULL RS232 PORTS
- * 16 SEPARATE USER DEFINABLE KEYS
- * DMA FOR HARD DISK ATTACHMENT

Ai ELECTRONICS ABC 24 £3350 Ai ELECTRONICS ABC 26 £4750

OPTIONAL SOFTWARE

- | | |
|-----------------------------|------|
| * CP/M | £150 |
| * SALES LEDGER | £200 |
| * PURCHASE LEDGER | £200 |
| * NOMINAL LEDGER | £200 |
| * STOCK CONTROL | £200 |
| * WAGES/SALARIES | £200 |
| * ABOVE INTEGRATED PACKAGES | £800 |
| * WORDSTAR & MAILMERGE | £350 |
| * ISR DATABASE | £400 |

ALL WITH SUPPORTING DOCUMENTATION AND LICENSING AGREEMENTS.

ALL PRICES EXCLUDE VAT

A NATIONAL DEALERSHIP NETWORK WILL BE OPERATIVE FOR THIS POWERFUL MACHINE SOON. IF YOU ARE AN ESTABLISHED AND PROFESSIONAL DEALER, WISHING TO APPLY, PLEASE CONTACT:

SUN Computing Services Ltd
138 Chalmers Way
North Feltham Trading Estate
Feltham
Middlesex
TEL. 01-751 5044 TWX 8954428 SUNCOM 6

CENTRONICS 730

SPECIAL PRINTER OFFER £375 VAT EXCL

STANDARD FEATURES

10 CPI

- 100 characters/second
- 80 characters/line

16.5 CPI

- 165 characters/second
- 132 characters/line

10 CPI or 16.5 CPI selectable by software command.

Expanded character selection for both 10 and 16.5 CPI.

- 3-way paper handling: A4 cut sheet, paper roll and fanfold.
- 7 x 7 dot matrix
- 96 character ASCII plus five selectable European character sets
- Microprocessor electronics
- Undirectional print at 10 IPS
- 6 LPI vertical
- Centronics colours and logo

INTERFACES

- Centronics Parallel (Standard)
- RS 232/V24 Serial (Option)

RIBBON SYSTEM

Continuous ribbon 9/16" (14mm) wide, 20 yards (18.3 meters) long
Mobius loop allows printing on upper and lower portion on alternate passes.

OPERATOR CONTROLS

Power on/of
Reset switch — allows disabling of printer without dropping AC

DATA INPUT

7 or 8 bit ASCII parallel, TTL levels with strobe
Acknowledge pulse indicates that data was received.

ELECTRICAL REQUIREMENTS

60 Hz; 115VAC, + 10%/—10% of Nominal
50 Hz; 230VAC, + 10%/—10% of Nominal

PHYSICAL DIMENSIONS

Weight: less than 10 lbs./5 kg
Width: 14.5 inches/37cm
Depth: 11.0 inches/28cm
Height: 4.89 inches/13cm

Dimensions exclusive of roll paper holder.

TEMPERATURE

Operating: 40° to 100°F (4.4° to 37.7°C)
Storage: —35° to 140°F (—37.2° to 60°C)



HUMIDITY

Operating: 20% to 90% (No Condensation)
Storage: 5% to 95% (No Condensation)

FORMS HANDLING

Roll Paper: 8.5 in. x 5.0 dia. with 1 in. core
maximum dimension.
3.5 in. wide with .38 in. core minimum
dimension

Fan Fold: 9.0 in./22.9cm wide pin to pin
9.5 in./24.1cm wide overall

Up to 3 ply paper with 2 carbons (total thickness not to exceed
.012 inches)

Cut Sheet: Maximum width 8.5 inches

FREE! Personal Computers 132
column software option.

Personal Computers Limited

194-200 Bishopsgate London EC2M 4NR

Telephone: 01-626 8121

NPV AT 12.5 % IS -109.62

NPV AT 10.5 % IS 4.65

P	ICAPITAL	WORKING ICAPITAL	REVENUE	TAXATION	CASH FLOW	NPV	CUM NPV	P	ICAPITAL	WORKING ICAPITAL	REVENUE	TAXATION	CASH FLOW	NPV	CUM NPV
00	- 3000	+ 1000	+ 50		- 1950	- 1950	- 1950	00	- 3000	+ 1000	+ 50		- 1950	- 1950	- 1950
01	- 500		+ 150		- 850	- 801	- 2751	01	- 500		+ 150		- 850	- 809	- 2759
02		- 300	+ 275	+ 1475	+ 1450	+ 1289	- 1462	02		- 300	+ 275	+ 1475	+ 1450	+ 1312	- 1447
03		- 250	+ 350		+ 100	+ 84	- 1378	03		- 250	+ 350		+ 100	+ 86	- 1361
04		- 250	+ 350	- 300	- 200	- 158	- 1536	04		- 250	+ 350	- 300	- 200	- 164	- 1525
05			+ 350		+ 350	+ 261	- 1275	05			+ 350		+ 350	+ 273	- 1252
06			+ 400	- 300	+ 100	+ 70	- 1205	06			+ 400	- 300	+ 100	+ 74	- 1178
07			+ 450		+ 450	+ 298	- 907	07			+ 450		+ 450	+ 317	- 861
08			+ 500	- 400	+ 100	+ 62	- 845	08			+ 500	- 400	+ 100	+ 67	- 794
09	+ 750	+ 300	+ 200		+ 1250	+ 736	- 109	09	+ 750	+ 300	+ 200		+ 1250	+ 798	+ 4
	- 2750		+ 3075	+ 475	+ 800	- 109			- 2750		+ 3075	+ 475	+ 800	+ 4	

This - the True Rate of Return on this project is 10.5%

Making capital out of appraisal methods

Careful financial appraisal of capital expenditure and investment are often thought to be necessary only in very large companies which spend large sums of money. Yet even the smallest business could and should employ adequate appraisal methods — both for examining potential investment opportunities and for comparing alternative investments. EG Acraman reports.

AN EXAMPLE of the application of such appraisal methods might be where a business must choose between two machines, one of which is more expensive than the other but has a greater capacity and longer life. Evaluating the nett present value, NPV, of the additional cost could solve the problem of which to choose.

One method which can give seriously-misleading results is the "payback" method which judges comparative investments on the length of time taken to recover the initial outlay. This method pays no regard to the timing of cash-flows or the total income from the project over its useful life.

The technique currently accepted as most efficient is that of discounted cash-flow, DCF. When a business makes an investment, it pays cash today in the expectation of receiving more in the future. This cash-flow and the timing of it is the basis of the appraisal. All "book" adjustments such as depreciation, profit or loss on the sale of an asset, etc., are ignored, but all cash-flows — even notional ones — should be brought into account.

Thus, if an existing asset — such as a building — is to be utilised in a project being evaluated, the cash value of that asset should be charged to the project. Similarly, requirements for working capital, tax reliefs on purchase of plant, etc., should be included in the calculations.

The discounted-cash-flow method recognises the importance of the timing of cash flow, i.e., at a discount rate of 10 percent, £10 to be received in one year is worth only £9.09 today, and £10 to be received in four years is worth only £6.83 today.

Thus, to evaluate a project by the DCF method, the cash-flows throughout its life are estimated and discounted back to the NPV at the desired rate of return. The discount rate at which the NPV is zero is

the true rate of return on the project.

The program will first ask for the name of the project, the number of periods per annum, i.e., one for annual rests, four for quarterly, 12 for monthly etc., and the total number of years concerned.

The cash-flows for each period — + for income, — for expenditure — are then input under the categories: capital expenditure, working capital, revenue and taxation. Finally, the rate of discount to be applied is entered. The Pet then displays the NPV of the project at the rate of discount given. You then have a choice of:

- Trying another discount rate. This will recalculate the NPV of the cash-flows already entered, using the revised rate of discount.
- Determining the true rate of return. If the total NPV returned was positive, this indicates that the true rate of return is higher than the rate quoted. Conversely, if the NPV was negative, the true rate of return is lower than that quoted. To calculate the true rate of return, i.e., that at which the NPV is zero or as close to zero as possible, the rate already in the variable R is increased/decreased by 0.1 and the calculations repeated in a loop until the total NPV is 5 or less.

This value can be amended — line 470 — to suit particular requirements, but if it is set too low and the figures involved in the project are large, you may be caught up in a perpetual loop. On the other hand, if it is set too high, you could obtain a slightly erroneous answer.

- Changing any entry. To test the value of a project under varying circumstances, or to test the sensitivity of the result to possible changes in specific items, it is often useful to have the answers to "what if?" questions. This facility enables you to revise one particular figure without having to re-enter every single item of data.
- Displaying the table on the screen, or printing it out. The program is written to print out to a Commodore printer, and the printout gives, for each period and the total, the four figures input plus the total cash-flow, the NPV and the cumulative NPV to the period. The cumulative NPV indicates the break-even point, i.e., the period in which the sign changes from negative to positive.

The screen display, due to limitations of size on the 40-column screen, consolidates the first two columns and omits the last one.

```

100 REM**INVESTMENT APPRAISAL**
110 REM**USING DISCOUNTED CASH FLOW**
120 REM**COPYRIGHT(C)-E. G. ACRAMAN**
130 REM**1ST JANUARY 1981**
140 PRINT "DISCOUNTED CASH FLOW"
150 REM**DIM FOR TOTAL NUMBER OF PERIODS**
160 DIM B(60),O(60),R(60),P(60),C(60),T(60),V(60)
170 INPUT "PROJECT NAME";P$
180 INPUT "HOW MANY PERIODS PER ANNUM";A
190 INPUT "HOW MANY YEARS";B:P=A*B
200 FOR X=0 TO F-1:PRINT "PERIOD ";X:INPUT "CAPITAL EXPENDITURE ";B(X)
210 INPUT "WORKING CAPITAL ";C(X):INPUT "REVENUE ";O(X)

```

```

220 INPUT "TAXATION ";R(X):NEXT
230 B1=0:P1=0:O1=0:C1=0:R2=0:T1=0:X1=0
240 FOR X=0 TO F-1
250 C(X)=B(X)+P(X)
260 T(X)=O(X)+R(X)+R(X)
270 B1=B1+B(X):P1=P1+P(X):O1=O1+O(X):C1=C1+C(X)
280 R2=R2+R(X):T1=T1+T(X):NEXT
290 INPUT "ANNUAL RATE OF DISCOUNT ";R
300 X1=0
310 R1=(R*.01):GOSUB 460
320 PRINT "N P V AT "R% IS"INT(X1*100+.5)/100

```

(continued on next page)

(continued from previous page)

```

330 PRINT"PRESS ANY KEY TO CONTINUE"
340 GETX$:IFX$=""GOTO340
350 PRINT"DO YOU WISH TO -"SPC(67)"1) TRY ANOTHER RATE OF DISCOUNT"
360 PRINT"0 2) KNOW THE RATE OF RETURN"
370 PRINT"0 3) CHANGE ANY ENTRY"
380 PRINT"0 4) DISPLAY ON SCREEN"SPC(59)"5) PRINT OUT THE TABLE"
390 PRINT"0 6) END",,,"ENTER COMMAND BY NUMBER (1-6) ?"
400 GETC$:IFC$<"1"ORC$>"6"GOTO400
410 PRINT"0":ONVAL(C$)GOTO290,420,520,680,760,940
420 R=R+SGN(X1+1)/10
430 R1=(R*.01)
440 X1=0:GOSUB460:GOTO470
450 REM**CALCULATE NPV OF CASH FLOW**
460 FORX=0TOP-1:V(X)=T(X)/((1+R1)(X/A)):X1=X1+V(X):NEXT:RETURN
470 IFABS(X1)>5GOTO420
480 PRINT"RATE OF RETURN IS "R%"
490 PRINT"PRESS ANY KEY TO CONTINUE"
500 GETX$:IFX$=""GOTO500
510 GOTO350
520 PRINT"CHANGE OF ITEM"
530 PRINT"1) CAPITAL EXPENDITURE",,"2) WORKING CAPITAL "
540 PRINT"3) REVENUE",,,"4) TAXATION"
550 INPUT"ENTER COMMAND BY NUMBER (1-4)":K
560 IFK<1ORK>4GOTO520
570 INPUT"PERIOD NUMBER":L
580 IFL>P-1THENPRINT"PERIOD NUMBER TOO HIGH":GOTO570
590 INPUT"REVISED AMOUNT ":E
600 IFK=1THENB(L)=E
610 IFK=2THENP(L)=E
620 IFK=3THENO(L)=E
630 IFK=4THENR(L)=E
640 PRINT"DO YOU WISH TO CHANGE ANY OTHER ITEM?"
650 GETX$:IFX$<"Y"ANDX$<"N"GOTO650
660 IFX$="Y"GOTO520
670 GOTO230
680 PRINT" P CAP REV TAX TOTAL NPV "
690 FORX=0TOP-1
700 PRINTXTAB(5)C(X)TAB(12)O(X)TAB(19)R(X)TAB(26)T(X):
710 PRINTTAB(33)INT(V(X)+.5):NEXT
720 PRINTTAB(5)C1TAB(12)O1TAB(19)R2TAB(26)T1TAB(33)INT((X1)+.5)
730 PRINT"PRESS ANY KEY TO CONTINUE"
740 GETX$:IFX$=""GOTO740
750 GOTO350
760 A$="991 ZZ 31":D$=" 999999 31"
770 A$=A$+D$+D$+D$+D$+D$+D$+D$
780 FORX=1TO3:OPENX,4,X-1:NEXT:PRINT#3,A$
790 B$="991 "+MID$(A$,7,74)+" 31"
800 PRINT#1," PROJECT - ":P$
810 PRINT#1:PRINT#1," PERIOD IS ":12/A:"MONTHS":PRINT#1
820 PRINT#1," NPV AT "R%" IS"INT(X1*100+.5)/100:PRINT#1
830 PRINT#1," _____":
840 PRINT#1," _____"
850 PRINT#1," | | | | | WORKING | | ";
860 PRINT#1," |"TAB(8)"| CASH |"TAB(8)"| CUM |";
870 PRINT#1," | P |CAPITAL |CAPITAL |REVENUE |TAXATION| FLOW | ";
880 PRINT#1," NPV | NPV |":C$="|-----":GOSUB930:T=0:FORX=0TOP-1
890 N=INT(V(X)+.5):T=T+N:PRINT#2,0,X,B(X),P(X),O(X),R(X),T(X),N,T
900 NEXT:GOSUB930:PRINT#3,B$:PRINT#2,0,B1,P1,O1,R2,T1,X1:C$="|-----"
910 PRINT#1," |-----"C$C$C$C$C$C$C$":PRINT#3,A$
920 CLOSE1:CLOSE2:CLOSE3:GOTO350
930 PRINT#1," |-----"C$C$C$C$C$C$C$":RETURN
940 END

```

READY.

□

After the Wedding... business as usual at the 1981 Micro Show

and that means plenty!

- Britain's most comprehensive Microcomputer Exhibition
- Sensible Seminars covering -
Small Computers in Business
Advances in Micro Technology
Micros in Education

**Wembley Conference Centre
30, 31 July, 1 August**

Tickets to the exhibition can be purchased from the Online Offices at a pre-show price of £3.00 for 3 tickets (minimum). This offer closes on 20 July.

Tickets at the door are £1.50. All ticket requests must be accompanied by cheque/postal order and suitable SAE.



<i>online</i>	PC
Please send me details of the 1981 Microcomputer Show	
<input type="checkbox"/> I may wish to exhibit	
<input type="checkbox"/> I am interested in attending the seminars	
<input type="checkbox"/> I request.....exhibition tickets at the pre-show price of £3.00 for 3 tickets (minimum).	
Name _____	
Company _____	
Address _____	
Telephone _____	
Please return to: Online Conferences Ltd., Argyle House, Northwood Hills, Middx. HA6 1TS. Tel: Northwood (09274) 28211 Telex: 923498	

HAVING presented the programmed multiple-choice test as an educational tool for examination and revision purposes — December 1980 — I realised that it was possible to carry the idea to its logical conclusion and to program the complete cycle of events which comprises the multiple-choice system.

A complete system must have a comprehensive library of questions to be revised and updated when necessary. Each question is allocated a difficulty factor, DF, which is modified after each use of the question within a test. Thus, when questions are selected to form a test, their set of difficulty factors is used to guarantee the fairness of the test — to ensure that an average candidate will have, say, a pass mark of between 50 percent and 60 percent, if this is the required average mark bandwidth.

The complete system must start with the library, proceed with a selection of questions from the library and the make-up of a test paper, which can be checked and given to the candidates who sit the exam. Results can then be gathered and checked for fairness, and for anomalies, the accepted results can be fed back to the library and necessary amendments carried out.

From the start, teachers using the exams must be submitting useful questions to the

by Rex Tingey

library, while revising their own ideas through experience of the system, both in the marking/revising of questions, and in the writing of balanced papers. The library team are the scheme experts and offer advice and help in programming examination make-up and in marking results, as well as being responsible for revision of the library. They will also check and accept new questions, discarding questions which prove to be without merit.

The examination room should have at least two microprocessor units coupled to a single floppy-disc unit and a printer, which will also be used by the library team and examining teachers when not used for tests. The Commodore Pet fills the bill exactly, say, six 16K 3001s, a 3022 printer and a 3040 dual-drive floppy-disc unit making the ideal set-up. All programming work is carried out to and from floppy discs in either program or sequential form.

The library consists of programs on disc which are re-written as sequential data. The question sets can then be read by an outline question-paper program from the floppy disc, and the data inserted into the program as a series of overlays, making up the complete paper, as selected by the examiner.

A test-paper program contains fundamentals to read data, present the exam to the candidate and to record his results in memory, retained after CLR or NEW. In memory, the results can be extracted by another program. The

A complete micro-based examination system

program reads and writes as sequential information to the floppy disc for later detailed analysis and correlation after all the candidates have finished the test. Then, the extracted results can be printed out and examined for anomalies and, if the difficulty factors seem wildly in error, the marks can be re-examined and possibly balanced toward the norm.

Amended results can be issued to the apprehensive candidates and returned to the library team for further analysis and for the updating of the library questions used for both content and DF. The library data program allows for this procedure, as well as the printout of complete or selected sets of answer/questions in a form similar to that screened for a test.

Difficulty factors are used to select a series of questions which can be expected to be answered by the average candidate in such a manner that he will achieve an average result. To this end, DFs are selected so that they can be plotted to approximate a Standard Deviation (Gaussian) Curve in distribution.

In our case, we have a base range, x axis, of 0 to 20, with every candidate correctly answering a question with a DF of 0, and none correctly answering one with a DF of 20. There is unlikely to be a question in data which a candidate will not, sooner or later, misunderstand, and up goes the DF from 0 to 1 or 2.

A DF of 20 usually means that there is something wrong with the question. New questions should enter the field with a pre-judged DF close to the median, and for a difficulty factor to rise to 20 means that it is never correctly answered. For this to happen could be due to one of four possibilities:

- Its source is obscure or from a high information level, beyond the scope of the course.
- The question is ambiguous.
- The "wrong" answer is correct.
- That part of the subject has not been taught.

The use of the question within the scheme will quickly root out any to which the last three apply, but it may take a few more passes through the system to conclude that the first is the reason for the high DF.

It is unlikely, anyway, that many questions will retain difficulty factors above 16 or 17 for long since post-exam inquests bring out sufficient information to pass answers to the difficult questions through the grape vine, which is one of the reasons why a good, growing library system is essential.

It can also be seen that the questions in the library can be for the lowest to the highest levels of examination, with a considerable overlap of difficulty factors.

The values selected for a particular

paper need only an approximate Gaussian curve in distribution, particularly with only 25 questions to a paper. The ends will necessarily be clipped off the very high and very low factors. The factors given in the program listing are for example only, and should be re-started around the median. The last figures of the set should be zeroed.

Additional questions

The example library data program given is written for economics at about O level, but the data can, of course, be changed for 50 questions on any other subject, but following the same rules of entry. Further, the library need not be limited to 50 questions per subject, but additional question/answer sets require that all the relevant numbers in For/To sequences will need changing from either 50 or 350 to the new requirement. Note that there are seven data elements to each set.

Each complete data set contains one element which is multiple data — the sixth of each set — which keeps together the library number, the difficulty factor as a letter and the correct answer as a letter; A, B, C or D. The last element of the seventh group is a figure for the number of times the question has been used, to modify the difficulty factor, moving it to and from the mean.

In the Pet, the use of the Integer feature will always move the DF back, should the most recent figure be only one lower. Should the most recent figure be two or three higher, for a well-used question, the DF will not necessarily shift forward. Line 40050 may need adjustment mathematically if the DFs over-optimistically move backwards every run.

That can obviously be achieved by finding the difference between the complete value and the integer, adding 1 whenever it is above .5. Yet since any modifications are semi-manual, this can be kept in check by the library team.

The first five elements of a data set are the question and four answers — one answer and three distractors. The line numbers are made to correspond, in the manner shown, with the actual question numbers so that finding and entering data is simplified. The question can be up to 72 elements long, including spaces, as can the answer/distractor four; if longer, an error condition will prevail during subsequent extraction of this data.

Each library data program should have at its end the various sequences given here, to operate the data update, extraction, check-through, and sequential data write. The check-through program will operate to either the screen or to the printer, as selected, and the printer

sequence will either print out all the data in proper order, or printout selected data only.

The first purpose of the multiple make-up program is to extract required data sets from the library, now existing as sequential data on the disc. This is achieved by line 0, and then 20000 on. Lines 60000-on are a mean of cancelling this first purpose part after it has completed its task.

Data extraction takes place by reading through the data, in sequence, until the required set is reached when it is screened complete with correct line numbers, "DATA", and the required five commas on each of three lines. It can then be checked, visually, to ensure that it is the required set, and returned over to place it into the data structure of the program now being formed.

Since this procedure clears variable and string memory automatically, it is necessary to Poke the progressing line numbers being created into a more substantial form. In this case, byte 1000 of the second cassette buffer is used. Further use is later made of this unused part of memory for results, candidate number and library numbers. There is no practical need for a second cassette recorder within the scheme.

Line numbers are made to match question set position $\times 10$, so that the next two lines of data can be given +2, +2, and then the elementary number itself is incremented by one, giving up to 256 question numbers if required.

Note that this part of the scheme gives no limit, up to 256, to the number of question sets it is possible to overlay, but the number of read questions is limited in line 20010 to 50 library questions. As the library is expanded, this figure will need to be increased to match.

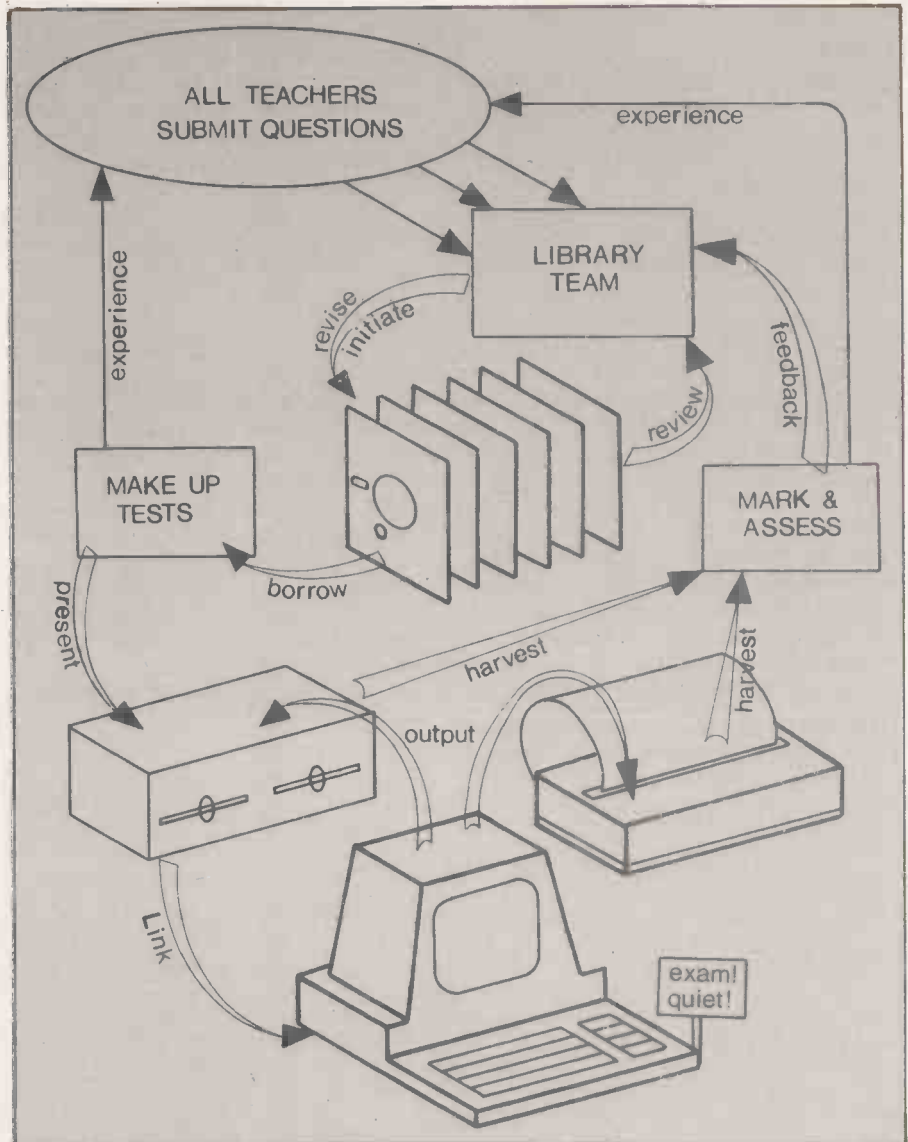
Standard form

The cursor is moved in conjunction with the print lines to be over the first line of data and to proceed downwards with the carriage returns to include the GOTO 20000. On the 25th question, however, the cursor should be shifted down to the lower-screened line which reads GOTO 60000. Returning over this produces a column of numbers, cancelling the now unwanted part of the program from useful memory.

The program now consists of the new data and all requirements to run, present and score the examination. Note that all inputs print three cursor-rights, a diamond, and three cursor-lefts. This produces on error a Re-do from start and a repeat Input request for all numerical inputs only, preventing a run failure and Ready.

However, string inputs will accept the diamond or other symbol and may abort because of this. The way to avoid this error is to follow the input with the line: 5052 IF N1\$ = " \diamond " GOTO 5050

This is not necessary here as the string is



The multiple-choice examination system.

used only in the final score routine. Save the completed test paper to the floppy disc.

The examination is presented in a standard form, but with the questions appearing in a random order which is decided by the initial shuffle of 25 figure pairs. If the test contains more than 25 questions, the figure-pair string will have to be concatenated with the extra numbers required, and the figures on lines 5100 and 5200 will need amending, and the score section will need to be altered to suit the percentage requirement.

As the questions are answered, they score four marks each for a correct response and zero for an incorrect response. The correct answer must still be sought and given or the test will not proceed; further marks cannot be lost or gained on that particular question.

There is no reason why a candidate should not be informed of a correct answer after failing to know it during the test. Line 6060 could be modified to print the correct response. Seeing the correct response after making the error is good revision work.

As each question is answered, a byte in the second cassette buffer corresponding to the question number is Poked with the score, 4 or 0, so that at a later stage a For-To loop can collect scores in a correct sequence of question position. At the same time the value of Q\$ is extracted with the same order and Poked some 50 bytes up from that group, forming another series.

Score reviewed

At the end of the test, a score is displayed, however the candidate should be informed that the score is open to review, and that his result could be subject to alteration, dependent on overall results.

The harvest results program is for the invigilator to go to each computer in the examination room in turn and to load this program into memory and select whichever method of data transfer is required to access the results from the second cassette buffer area.

Results can be printed to the screen, printed out on the printer, both with

(continued on next page)


```

6020 GETZ:IFZ#=""GOTO6020
6030 IFZ#>"D"GOTO6020
6040 IFZ#<"A"GOTO6020
6050 V#:=RIGHT$(Q#,1)-IFZ#<V#GOTO7000
6060 PRINTZ#;"IS INCORRECT";K#:=GOTO6020
7000 I:=K:J:=J+1:PRINT"INCORRECT"SPC(1);V#:=SPC(14);J#:=SCORE:I:=I#+"00000"
7020 K1:=900+A:POKEK1,K:V1:=VAL(Q#):K2:=949+A:POKEK2,V1
7040 IFTI#<"000003"GOTO7040
7050 GOTO5100
7999 END
8000 PRINT"THE ECONOMICS # MULTIPLE CHOICE"RETURN
9000 GOSUB8000
9010 PRINT"THE CANDIDATE "N1#" SCORES:"PRINTTAB(15)I""
19999 END
20000 PRINT"ADDING QUESTIONS FROM DATA":I#="DATA":J#="":P1:=PEEK(1000)
20008 PRINT"QUESTION NUMBER "P1
20010 INPUT"ENTER DATA NUMBER";X:OPEN2,8,2,"1:DATA,S,R":FORAI=1TO50
20030 FORA=1TO7:INPUT#2,B#:=A#(A):A#:=NEXT:IFA1=XGOTO20100
20040 NEXTA
20100 P=P1+10:PRINT"NUMBER";I#A#(1):P=P+2:PRINTP:I#A#(2)J#A#(3)J#A#(4)J#A#(5)
20110 P=P+2:PRINTP:I#A#(6)J#A#(7):P1=P+1:POKE1000,P1:CLOSE2:PRINT"GOTO20000"
20120 PRINT"*****GOTO60000:RETRURN OVER AT END*****RETRURN OVER DATA
29999 END
50000 PRINT"*****00000*****00000*****0010*****20030*****00000*****0040
50010 PRINT"20100*****00110*****00120*****00000*****00010*****00000
60020 PRINT"HOME CURSOR & RETURN OVER!
READY.

```

Listing 3. Harvest results program.

```

1 REM COPYRIGHT (C) REX L TINSLEY © 1981
10 DIMA(26)
100 FORA=0TO25:B=900+A:C=PEEK(B)Z=A:A(Z)=C:NEXT:A=0
110 FORZ=1TO25:A=A+R(Z):NEXT:Z=B
200 PRINT"EXAMINATION RESULTS
300 PRINT"SELECT PRESENTATION MODE
320 PRINT"R#:=PRESS# 'A' FOR SCREEN RESULTS.
340 PRINT"R#:=PRESS# 'Z' FOR PRINT-OUT
350 PRINT"R#:=PRESS# 'D' FOR DATA TRANSFER TO DISK
360 PRINT"R#:=FOR LIST OF LIBRARY QUESTION NUMBERS #:=
900 GETZ:IFZ#=""GOTO8000
810 IFZ#="Z"GOTO2000
820 IFZ#="D"GOTO3000
830 IFZ#="P"GOTO4000
1010 PRINT"THE CANDIDATE NUMBER "A(0) " SCORE "B
1020 PRINT"1-"A(1),"2-"A(2),"3-"A(3),"4-"A(4)
1030 PRINT"5-"A(5),"6-"A(6),"7-"A(7),"8-"A(8)
1040 PRINT"9-"A(9),"10-"A(10),"11-"A(11),"12-"A(12)
1050 PRINT"13-"A(13),"14-"A(14),"15-"A(15),"16-"A(16)
1060 PRINT"17-"A(17),"18-"A(18),"19-"A(19),"20-"A(20)
1070 PRINT"21-"A(21),"22-"A(22),"23-"A(23),"24-"A(24),"25-"A(25)
1080 PRINT"R#:=PRESS# Z TO CLOSE: OTHER TO RE-RUN."
1100 GETZ:IFZ#=""GOTO1100
1110 IFZ#="Z"THENEND
1120 RUN
2000 OPEN4,4:PRINT#4:PRINT#4,"THE CANDIDATE NUMBER "A(0) " SCORE "B
2010 PRINT#4:PRINT#4
2020 PRINT#4,"1-"A(1)," 2-"A(2)," 3-"A(3)," 4-"A(4)," 5-"A(5)
2030 PRINT#4:PRINT#4,"6-"A(6)," 7-"A(7)," 8-"A(8)," 9-"A(9)," 10-"A(10)
2040 PRINT#4:PRINT#4,"11-"A(11),"12-"A(12),"13-"A(13),"14-"A(14),"15-"A(15)
2050 PRINT#4:PRINT#4,"16-"A(16),"17-"A(17),"18-"A(18),"19-"A(19),"20-"A(20)
2070 PRINT#4:PRINT#4,"21-"A(21),"22-"A(22),"23-"A(23),"24-"A(24),"25-"A(25)
2080 PRINT#4:CLOSE4:PRINT"MC TO CLOSE: OTHER TO RE-RUN"
2100 GETZ:IFZ#=""GOTO2100
2110 IFZ#="Z"THENEND
2120 RUN
3000 PRINT"TRANSFER RESULTS TO DISK"

```

```

3010 PRINT"REMEMBER ONLY #LINE# AT PRESENT!"
3020 INPUT"ENTER CANDIDATE'S NUMBER";C
3100 OPEN15,8,15:PRINT#15,"11"CHR$(13)
3110 IFC=1THENOPEN2,8,2,"1:1,S,R"
3112 IFC=2THENOPEN2,8,2,"1:2,S,R"
3113 IFC=3THENOPEN2,8,2,"1:3,S,R"
3114 IFC=4THENOPEN2,8,2,"1:4,S,R"
3115 IFC=5THENOPEN2,8,2,"1:5,S,R"
3116 IFC=6THENOPEN2,8,2,"1:6,S,R"
3117 IFC=7THENOPEN2,8,2,"1:7,S,R"
3118 IFC=8THENOPEN2,8,2,"1:8,S,R"
3119 IFC=9THENOPEN2,8,2,"1:9,S,R"
3200 FORZ=0TO25:PRINT#2,R(Z)CHR$(NEXT_CLOSE2):CLOSE15
3300 PRINT"MC #TO CLOSE#: OTHER TO RE-RUN"
3310 GETZ:IFZ#=""GOTO3310
3320 IFZ#="Z"THENEND
3330 RUN
4000 OPEN4,4:PRINT#4:PRINT#4,CHR$(1)"ECONOMICS "
4020 FORA=1TO25:B=949+A:C=PEEK(B):PRINT#4,A#"C":NEXT:PRINT#4:CLOSE4
4300 PRINT"MC #TO CLOSE#: OTHER TO RE-RUN"
4310 GETZ:IFZ#=""GOTO4310
4320 IFZ#="Z"THENEND
4330 RUN
READY.

```

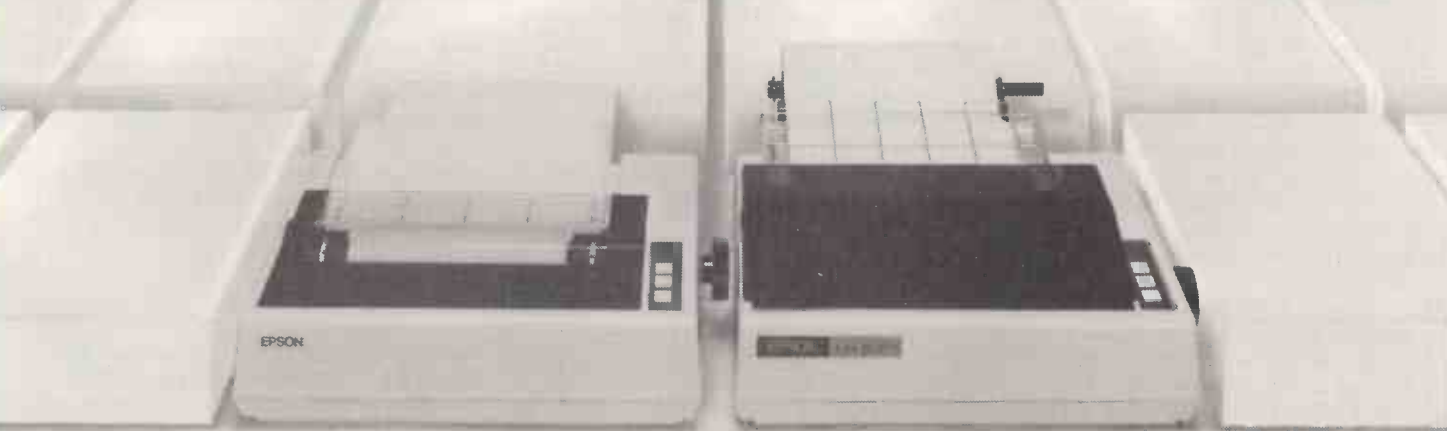
Listing 4. Assess difficulty factor.

```

10 DIMA(26) DIMR(25) DIMB(25) DIMC(25) DIMD(25) DIME(25) DIMF(25) DIMG(25)
20 DIMH(25) DIMI(25) DIMJ(25)
100 GOSUB60000:IFN=0THENGOSUB50020
110 IFN=0THENPRINT"NUMBERS ENTERED":GOSUB50000
200 N#:=1:IFN=0THENPRINT"THATS ALL":GOTO10000
210 INPUT"THE CANDIDATE NUMBER (Z IF ALL)";Z#(N):Z#(N)
220 IFZ#(N)=""Z"THENN#:=1:GOTO10000
230 IFZ#(N)=""GOTO210
240 A:=VAL(Z#(N))
300 IFA=1GOTO1000
310 IFA=2GOTO2000
320 IFA=3GOTO3000
330 IFA=4GOTO4000
340 IFA=5GOTO5000
350 IFA=6GOTO6000
360 IFA=7GOTO7000
370 IFA=8GOTO8000
380 IFA=9GOTO9000
1000 OPEN2,8,2,"1:1,S,R"
1010 FORB=0TO25:INPUT#2,B#:C#:=RIGHT$(B#,2):A(B)=VAL(C#):NEXT:CLOSE2:GOTO1000
2000 OPEN2,8,2,"1:2,S,R"
2010 FORB=0TO25:INPUT#2,B#:C#:=RIGHT$(B#,2):B(B)=VAL(C#):NEXT:CLOSE2:GOTO1000
3000 OPEN2,8,2,"1:3,S,R"
3010 FORB=0TO25:INPUT#2,B#:C#:=RIGHT$(B#,2):C(B)=VAL(C#):NEXT:CLOSE2:GOTO1000
4000 OPEN2,8,2,"1:4,S,R"
4010 FORB=0TO25:INPUT#2,B#:C#:=RIGHT$(B#,2):D(B)=VAL(C#):NEXT:CLOSE2:GOTO1000
5000 OPEN2,8,2,"1:5,S,R"
5010 FORB=0TO25:INPUT#2,B#:C#:=RIGHT$(B#,2):E(B)=VAL(C#):NEXT:CLOSE2:GOTO1000
6000 OPEN2,8,2,"1:6,S,R"
6010 FORB=0TO25:INPUT#2,B#:C#:=RIGHT$(B#,2):F(B)=VAL(C#):NEXT:CLOSE2:GOTO1000
7000 OPEN2,8,2,"1:7,S,R"
7010 FORB=0TO25:INPUT#2,B#:C#:=RIGHT$(B#,2):G(B)=VAL(C#):NEXT:CLOSE2:GOTO1000
8000 OPEN2,8,2,"1:8,S,R"
8010 FORB=0TO25:INPUT#2,B#:C#:=RIGHT$(B#,2):H(B)=VAL(C#):NEXT:CLOSE2:GOTO1000
9000 OPEN2,8,2,"1:9,S,R"
9010 FORB=0TO25:INPUT#2,B#:C#:=RIGHT$(B#,2):I(B)=VAL(C#):NEXT:CLOSE2:GOTO1000
10000 OPEN4,4:PRINT#4:PRINT#4,CHR$(1)"DIFF. FACTORS"
10050 FORA=1TO25:R(A)=A(A)+B(A)+C(A)+D(A)+E(A)+F(A)+G(A)+H(A)+I(A)+J(A)/N
10100 S(A)=INT(R(A)*5):R(A)=20-S(A):B=949+A:C=PEEK(B)
10200 PRINT#4,A#"R(A),"C#"CHR$(1)"NEXT
49999 CLOSE4:END
50000 PRINTZ#(1) "Z#(2) "Z#(3) "Z#(4) "
50010 PRINT"TAB(B)Z#(5) "Z#(6) "Z#(7) "Z#(8) "Z#(9)
50020 PRINT"R#:=PRESS# R TO RE-RUN"
60000 PRINT"ASSESSMENT OF D.F.":RETURN
READY.

```

Peruse & choose



Epson printers may share a super, slim, stylish exterior but underneath are the differences which makes them really special. The MX-80 range has a worldwide reputation for reliability, superior print quality and price. Now there's a choice to suit your precise needs and pocket. Take these two for instance. MX-80 F/T offers the usual Epson features - bi-directional, 80 cps, 9 x 9 matrix, standard parallel interface, cartridge ribbon, PLUS the option of friction or tractor feed. MX-80 Plotter/Printer not only gives you an international character set (USA, UK, Germany & France) in 40, 68, 80 and 132 column widths and high general mechanism setting of 6, 115 and 159 column widths, but also boasts high resolution graphics. So now you can print illustrations, charts, graphs, block lettering etc.

We make more printer mechanisms than anyone else in the world - it makes a big difference

Find out more - contact Epson today!

EPSON

Epson (UK) Ltd

Sherwood House, 176 Northolt Road, South Harrow, Middlesex HA2 0ED Tel: 01 422 5612/4 Telex: 8814169

Simulating 350K of virtual memory capacity

THE FULL 340K of the Pet disc memory and the 32K of main memory can be used with the appearance of being virtually continuous. Thus a database of some 350K is possible giving a facility normally available only on much larger machines. The method I describe to obtain this has been written with the Pet in mind but, it is readily transferable to other systems.

The term virtual memory was one made much of by IBM during its launch of the facility some years ago but as I said in my article on co-ordinate drilling in the

by J A Forbes

February 1981 issue, there is not much that is new, and, indeed, the facility of virtual memory and its concept first appeared in this country when computing was in its infancy. I believe that in fact it was the Argus range of computers.

Many articles have been written on how, by judicious use of Poke, one can preserve the variables from another program. However, this has the problem that such arrangements are normally valid only for one specific set of circumstances. What this means is that if any of the characters are changed, the linking arrangement must also be changed.

As an introduction to the subject, I would refer you to Nick Hampshire's book *The Pet Revealed* and in particular to pages 68 to 73 where the method and structure of linking Basic lines is discussed. In particular, page 71 gives a line-find routine which will print out the link address contents of a given line while page 72 shows how this information may be used to link programs together.

Let us first examine overlay/main subroutine-linking arrangements. In the Pet, line numbers and the location of program lines and their contents are organised as follows.

The user program starts from memory location 1024 and upwards. The first two bytes of a program line contain the address of the next program line — the link address. The third and fourth bytes contain the user line number in binary format and the remaining bytes are the program line contents up to the address of the next line. The end of a statement is indicated by a zero byte. This can be shown diagrammatically as in figure 1.

The first two bytes of the last line give the address of a location which contains two zeros which is used to indicate the end of the program.

When a program is loaded using a load command contained in a program already in the computer memory, the new pro-

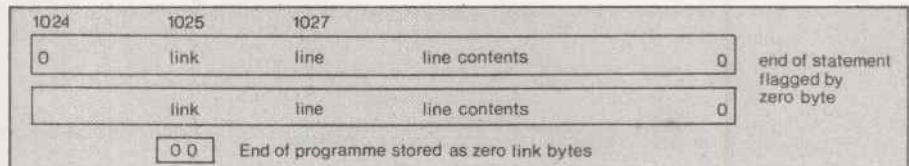


Figure 1.

gram will be loaded from memory location 1024 upwards, as described. Clearly, the new program will overwrite an area of memory equal to its own length. To overcome this problem when loading the various overlay programs, we must ensure that the main program loaded occupies an area of memory greatly exceeding that of any subsequent program and that the parts of the original program which we wish to leave undisturbed have line numbers greater than those used in any subsequent overlay. We must also ensure that a means exists for linking the end of the new program to the beginning of the undisturbed portion of the original program.

This may be more clearly illustrated diagrammatically by figure 2.

From this consideration of how lines are held in memory and how a main program would have to be constructed to allow overlays, let us now look at a typical main-core program which has the following features:

- A menu of selectable overlays each of which can be up to, say, 10K long.
- A set of standard utilities which are called by each overlay.

It is also necessary to determine at the start what other programs you may wish the main program to call into memory. For example, a reverse-field facility may be required which can be used by either the main program or the overlays and which can reverse field lines, blocks or even lines in sequence. This program is written in Hex and located in the cassette 1 buffer and is called Reverse. The listing given here may be entered into memory by the machine-code monitor, then saved and recalled by the main program when it is first run.

To use this program it is necessary to provide it with some basic information prior to calling it during a program. The following Pokes are required

- POKE 714, Number of columns in from edge of screen.
 POKE 715, 128
 POKE 716, Screen line number of start — 1 to 25 from top of screen.
 POKE 717, Number of lines in the block.
 POKE 718, Number of columns in block.

0292 98 48 18 A9 28 65 01 EA
 029A 85 01 EA A9 00 65 02 EA

0292 85 02 EA 68 A8 60 48 98
 029A 48 8A 48 AE 7C 02 20 82
 02A2 02 CA D0 FA AE 7D 02 AC
 02AA 7E 02 B1 01 49 80 91 01
 02B2 88 D0 F7 CA F0 06 20 82
 02BA 02 4C A9 02 68 AA 68 A8
 02C2 68 60 00 00 00 00 00
 02CA 00 00 00 00 00 00 00
 02D2 AD CA 02 85 01 AD CB 02
 02DA 85 02 EA AD CC 02 8D 7C
 02E2 02 AD CD 02 8D 7D 02 AD
 02EA CE 02 8D 7E 02 4C 98 02

This reverse-field function can be called by a SYS (722) command preceded by the necessary Pokes. An example of its use is in alternately flashing the words letter and number in the option legend which appears at the bottom of each displayed overlay page. See subroutine at line 40000 in the main program listing.

The calling line for this and any other utilities must be entered as the very first lines in the main-core program. This will ensure that they are loaded when the main program is first run but, of course, these lines will be later destroyed as they are overwritten by the first overlay called.

Next the filler area is entered up to the point where the filler has occupied an area of memory slightly greater than the maximum size of the largest overlay. In my case I used an area occupying 10K. One can calculate in Hex what the equivalent decimal value is of the filler area required and, when keying in the filler, periodically examine memory.

Memory check

For example, 10K = 2710 in Hex, therefore, when the entered filler reaches 2710 you know that there will be an area of 10K for overlays. The filler area can be filled in by simply entering sequential print statements and typing in anything at all. One method is to load any old 10K program, re-number it using a re-number program and then enter the initial call lines previously mentioned.

It is essential to use low line-number values, and increments, so that high values are preserved for the main program, e.g., make a rule that line numbers from 1 to 1900 are reserved for overlays or filler and line numbers of 20000 upwards for the main program.

Having generated a filler area, it now

remains to complete the main program. The exact format will depend on the application but will probably comprise a menu page which branches on selection to display the first page of the selected overlay and, while this page is being read by the user, the remaining pages are being loaded into the filler area, transparently to the user.

The next requirement would probably be a means of allowing users to progress through the overlay pages at their own reading rate and, therefore, a legend-generating subroutine is incorporated into the main program which, when called by the overlay, will print "PRESS ANY LETTER TO CONTINUE" and "PRESS ANY NUMBER FOR MENU".

In addition, there is a timer incorporated into the subroutine which will return the display to the menu if no key has been depressed for 40 seconds.

The fact that the timer is entered by a Gosub from an overlay but exited by a branch to menu would normally result ultimately in an out-of-memory error as the stack eventually overflows. However Basic performs a Run after each selection and this re-initialises the stack after each menu selection.

A sample program listing is given for both main and overlay programs. While this is only a demonstration program, it will work and should be loaded and run to develop a feel for the system. Only one overlay is given to show the principle.

The main program shows the utility calling lines at lines 2 and 3; the filler area at lines 2110 to 2250; the menu at lines 20000 to 20640; two overlay first pages — the others indicated in the menu are implied but not shown; the timer and key depression check at lines 40000 to 40030 — note the Poke and SYS (722); commands which use the Reverse program to reverse field the words Letter and Number; and finally the legend subroutine at lines 41000 to 41010.

The overlay listing shows the SYS(29808) command which alters the link address for line 18000 to that of line 20000 in the main program. The Gosub at line 10 and 20 print the legend on line 24 and 25 after the overlay has been loaded from disc. Note that the last line before line 18000 returned you to the menu indicating that the last page has

been viewed but there is no reason why one could not offer a choice of either the menu or that overlay's first page at line 25500.

Having created both the overlay and main program, it is now time to examine the method of linking the two. Since this linking program is of general interest, the assembly listing is given in full. First let us consider the method given in *The Pet Revealed*. The problem with that method is the linking commands apply not to a line number value but rather to the location of that line in the overlay when in memory. What this means is that should you change the number of characters before the last line, the link arrangements are no longer valid and have to be re-calculated.

Link address

What is required is a means of finding and changing the link address of a given line number value regardless of its position in memory. A short assembly-language program called Link has been prepared which is loaded by the main program during its initial run and stored in a protected area at top of memory. The reason that it sits some 2K down is to allow for insertion of other utilities such as a soft Toolkit, etc.

When the overlay in question is loaded, line 5 will cause Link to search through memory until it finds line 18000 and then change its link address to that of line 20000 in the main program. It is fast and effective provided that the last line is always 18000 and that the filler area or any other line prior to line 20000 in the main program is not altered in quantity since that would move the location of line 20000.

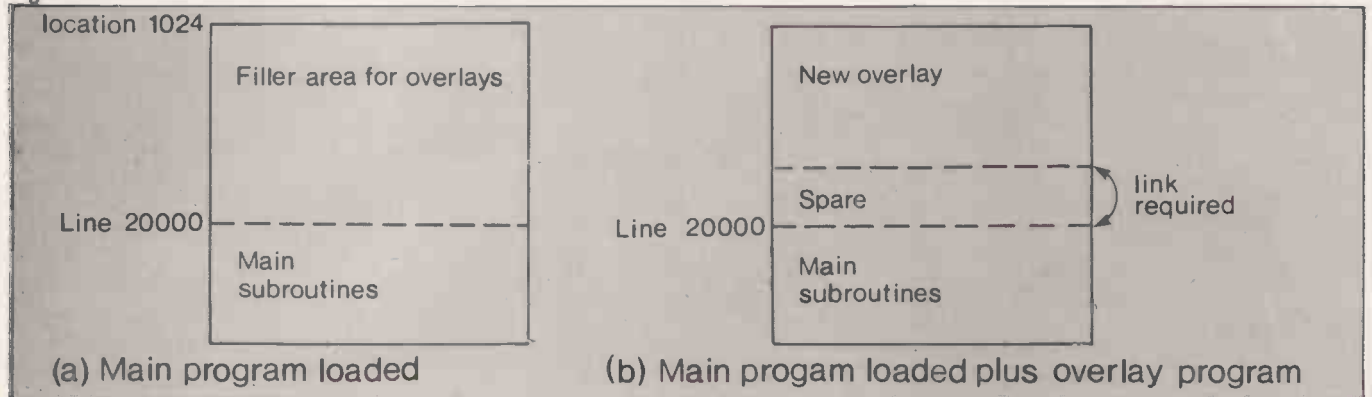
The value of the line which Link is seeking may be changed just as the link address to which it will link that line, may also be changed. The values incorporated in the listing are obviously those for this demonstration but may be changed by Poking new values or changing them permanently, their locations are given here;

HEX LOCATION	CURRENT VALUE	FUNCTION
7490	50	Sought line number LO
74BE	46	Sought line number HI
74D3	43	Main program link

Listing	Address	Instruction	Comment
74DD	06		address LO Main program link address HI
7470	AD 01 04	LDA	Get base address from
7473	85 01	STA	0401 and 0402 and store
7475	AD 02 04	LDA	as address LO in 01
7478	85 02	STA	as address HI in 02
747A	START A501	LDA	Get base address LO
747C	18	CLC	Clear carry
747D	69 02	ADC # 2	Add to base address LO to get
747F	85 01	STA	location of line number LO
7481	85 4B	STA	and store in 01 and 4B
7483	A5 02	LDA	Get base address HI, add carry
7485	69 00	ADC 0	if any.
7487	85 02	STA	Store line address HI
7489	85 4C	STA	in 02 and 4C
748B	A2 00	LDX #0	Set register X to zero.
748D	A1 01	LDA(X)	Load Acc with value of contents
748F	C9 50	CMP #50	at 01 and compare to Hex 50
7491	FO 22	BEQ CHECK HI	Branch if equal the CHECK HI
7493	NEXT 38	SEC	Subtract 2 from line addresses.
7494	A5 01	LDA	to restore link address
7496	E9 02	SBC # 2	and
7498	85 01	STA	store as LO on 01/ 4B
749A	85 4B	STA	HI in 02/4C
749C	A5 02	LDA	
749F	E9 00	SBC # 2	
74A0	85 02	STA	
74A2	85 4C	STA	
74A4	A1 01	LDA(X)	Using current link address
74A6	85 01	STA	get and store next link
74A8	E6 4B	INC	address as LO in 01
74AA	DO 02	BNE	
74AC	E6 4C	INC	
74AE	A1 4B	LDA(X)	
74B0	85 02	STA	HI in 02
74B2	4C 7A 74	JMP	No match found so jump to START
74B5	CHECK HI E64B	INC	Having found LO equal 50
74B7	DO 02	BNE	now check line HI

(continued on next page)

Figure 2.



Essential tools for repetitive sums

ANALYTICALLY, if we let C_n be the number of comparisons made in sorting n elements, and let M_n be the number of movements or exchanges made, then considering a randomly-unsorted collection of n items:

Bubble-sort:
 $C_n = (n^2 - n)/2$ $M_n = 3(n^2 - n)/4$
 Insertion:
 $C_n = (n^2 + n - 2)/4$ $M_n = (n^2 - 9n - 10)/4$

To give an example, Bubble-sort will, on average, make no less than 1,248,750 comparisons and exchanges in sorting 1,000 numbers.

From these results, we say that the complexity of computation in both Bubble-sort and Straight Insertion sort is of order n squared. In contrast, that of Shell-sort is approximately of order n to the power (1.2), and though a vast improvement, it is still slow when we

by Mark Walker

appreciate that complexities of order ($n \log n$) are theoretically possible. We therefore illustrate one of the fastest sorting algorithms, Quick-sort — see table 1.

Quick-sort was developed by CAR Hoare and like all the best algorithms, it is fundamentally simple. Given n objects a_1, \dots, a_n to be sorted in an array A , we choose an element x from them and construct a partition of A into A_1 and A_2 where:

$$A_1 = \{a_i : a_i > x\}$$

$$A_2 = \{a_i : a_i \leq x\}$$

and then construct partitions of A_1 and A_2 based on new elements x_1, x_2 chosen from them, and so on. The array A becomes sorted when the partitions are of unit size.

It is usual to choose each x as the middle, median element of the partition considered. This is because if x is the median of the array, both the best and average performance of the algorithm and good, since a random number tends to lie near the median.

The algorithm lends itself very easily to a recursive definition, and a procedure to perform Quick-sort is given in a slightly-altered form of BCPL — with [] replacing ! Conversion to Pascal is easy.

```

LET quicksort (lowup,array) BE (
  LET k,j := lowup
  LET x := array[ (lowup)/2 ]
  WHILE k<=j DO (
    WHILE array[k]<x DO k := k + 1
    WHILE x<array[j] DO j := j - 1
    IF k<=j THEN (
      LET y:=array[k]
      array[k] := array[j]
      array[j] := y
      k := k + 1
      j := j - 1
    )
  )
  IF low<j THEN quicksort(low,j,array)
  IF k<up THEN quicksort(k,up,array)
)
and is called with quicksort(1,n,A)
    
```

Table 1. Time in ms. to sort 512 keys in a CDC6400 Pascal implementation.

	Ordered	Random order	Inverse order
Straight insertion	23	1444	2386
Binary Insertion	125	1027	2090
Bubble-sort with flag	8	4270	6542
Shaker-sort	9	3642	6520
Quick-sort	69	146	79

The listing in Basic is much less clear, due mainly to Basic's lack of local variables, and is consequently non-recursive. It assumes the data to be sorted is in an array A of N elements. M is a constant for a stack composed of two arrays SL,SR which contain the left and right bounds of the current partition to be further partitioned. S is the point of most recent entry to this stack.

Since the following code is of itself difficult, the routine should merely be copied line for line when required. The recursive version should be studied since it neatly embodies the essentials of the Quick-sort algorithm.

```

5 REM NON-RECURSIVE QUICKSORT ROUTINE
100 M=12 : DIM SL(M),SR(M)
110 S=1 : SL(1)=1 : SR(1)=N
115 REM TAKE TOP REQUEST FROM STACK
120 L=SL(S) : R=SR(S) : S=S-1
125 REM SPLIT A(1) ... A(R)
130 I=L : J=R : X=A( INT((L+R)/2) )
140 IF A(I)<X THEN I=I+1 : GOTO 140
150 IF X<A(J) THEN J=J-1 : GOTO 150
160 IF I>J THEN 190
170 W=A(I) : A(I)=A(J) : A(J)=W
180 I=I+1 : J=J-1
190 IF I<=J THEN 140
200 IF I>=R THEN 220
205 REM STACK REQUEST TO SORT RIGHT PARTITION
210 S=S+1 : SL(S)=I : SR(S)=R
220 R=J
230 IF L<R THEN 130
240 IF S<>0 THEN 120
    
```

Consideration of table 1 shows how great an improvement Quick-sort is over the elementary sorting algorithms.

Numerical analysis is a major area of activity for computers, since it involves large quantities of repetitive computation to solve systems of linear equations, differential equations or partial differential equations. Matrices and determinants are essential tools in this area, so we pause briefly to consider each in turn.

Matrices can be thought of as a shorthand method of writing a grid of numbers, usually equation coefficients. They have no value, and are usually represented as a two-dimensional array. A determinant is also a grid of numbers, but has a single value which may be computed thus:

Set of Equations: $3x - 2y + z = 7$
 $x + 5y - z = 9$
 $x - y + 4z = -2$

Matrix of coefficients: Determinant:

$$\begin{vmatrix} 3 & -2 & 1 \\ 1 & 5 & -1 \\ 1 & -1 & 4 \end{vmatrix} = \begin{vmatrix} 3 & -2 & 1 \\ 1 & 5 & -1 \\ 1 & -1 & 4 \end{vmatrix} = 61$$

Operations on matrices are very simple, the following routine adds matrices A and B — each $N \times N$ elements — to give matrix C , subtracts them to give D , multiplies them to give E and transposes A to give F .

```

100 FOR I=1 TO N
110 FOR J=1 TO N
120 C(I,J) = A(I,J) + B(I,J)
130 D(I,J) = A(I,J) - B(I,J)
140 E(I,J)=0 : FOR K=1 TO N
150 E(I,J) = E(I,J) + A(I,K) * B(K,J)
160 NEXT K
170 F(I,J) = A(J,I)
180 NEXT J,I
    
```

Matrices need not be square. Generally, if a matrix has r rows and c columns then it is a ($r \times c$) matrix. Matrices may be added and subtracted only if they are the same size. Two matrices may be multiplied only if they conform to the rule:

$$(p \times m) \cdot (m \times n) = (p \times n)$$

Any matrix may be transposed.

We now consider the evaluation of determinants, the mathematics is well covered in the references, and the program emulates the process shown in table 2.

Essentially then, we reduce the determinant successively from an $N \times N$ to a 1×1 . The value of the determinant is then this value multiplied by the scaling factors removed. These factors are removed to make the largest element in the column unity, rows are exchanged to ensure that this element is on the diagonal for reasons of numerical stability. Appropriate multiples of this column are added to the others to reduce their upper elements to zero as shown.

In this routine, A is an $N \times N$ array whose determinant is to be evaluated in D . This method uses a form of Gaussian elimination with partial pivoting, a technique explained more fully when considering solution of equations. Note that the routine does not preserve the matrix A .

```

5 REM DETERMINANT EVALUATION ROUTINE
100 D=1
110 FOR I=1 TO N
115 REM PLACE MAX. COEF. OF ROW I ON DIAGONAL
120 R=I : M=A(I,I)
130 FOR K=I+1 TO N
140 IF A(I,K)>M THEN 160
150 M=A(I,K) : R=K
160 NEXT K
165 REM IF ZERO THEN FINISH
170 IF M=0 THEN D=0 : GOTO 330
180 IF R=I THEN 230
185 REM MAX. COEF. NOT ON DIAGONAL SO SWOP ROWS
190 FOR K=1 TO N
200 M=A(K,I) : A(K,I)=A(K,R) : A(K,R)=M
210 NEXT K
215 REM DETERMINANT CHANGES SIGN AS ROWS SWAPPED
220 D=-D
225 REM REMOVE SCALING FACTOR
230 D=D * A(I,I)
240 IF I=N THEN 330
245 REM DIVIDE TO MAKE PIVOTAL ELEMENT UNITY
250 FOR J=N TO I STEP -1
260 A(I,J)=A(I,J) / A(I,I)
270 NEXT J
280 FOR J=I+1 TO N
285 REM SET MULTIPLIER FOR NEXT ROW
290 M = -A(J,I)
300 FOR K=I TO N
310 A(J,K) = A(J,K) + A(I,K) * M
320 NEXT K,J,I
330 PRINT "VALUE OF DETERMINANT IS "D
    
```

(continued on next page)

LOCAL DEALERS

LONDON

Belmartin Services
194 Union Street
London SE1 0LH
Tel: 01-928 5322/3

Eurocalc Limited
128/132 Curtaln Road
London EC2
Tel: 01-739 8484

Lion House (Retail) Limited
227 Tottenham Court Road
London W1P 0HX
Tel: 01-637 1801

Personal Computers Limited
194-200 Bishopsgate
London EC2M 4NR
Tel: 01-626 8121

PROVINCES

Avon
Decimal Business Machines
Limited
Decimal House
Thomas Lane
Bristol BS1 6JH
Tel: 0272 214093

Noteset Computer Systems
34 Tyndalls Park Road
Clifton
Bristol BS8 1PR
Tel: 0272 34058

Berkshire
The Computershop Group
7-9 Gosbrook Road
Caversham
Reading RG4 8BD
Tel: 0734 481008

Buckinghamshire
Chiltem Microcomputers Limited
7 Amersham Hill
High Wycombe HP13 6NQ
Tel: 0494 20416

Cheshire
McNab and Company
27 Sunfield
Romiley SK6 4PJ
Tel: 061 494 9410

Cornwall
Diskwise Limited
25 Fore Street
Callington PL17 7AD
Tel: 05793 3780

Exleigh Business Machines
Limited
11 Market Place
Penzance TR18 2JB
Tel: 0736 66577

Hertfordshire
CCS Microsales
7 The Arcade
Letchworth SG6 3ET
Tel: 04626 73301

Greater Manchester
Executive Reprographics &
Business Consultants Limited
2/4 Oxford Road
Manchester M1 5QA
Tel: 061 228 1637

Merseyside
Currie (Business Equipment)
Limited
8 Upton Road
Claughton
Birkenhead L41 0DF
Tel: 051 658 5111

Norfolk
Anglia Computer Centre
88 St. Benedicts Street
Norwich NR2 4AB
Tel: 0603 29652

Oxfordshire
Alphascan Limited
Little Bourton House
Southam Road
Banbury OX16 7SR
Tel: 029 575 8202

Hyford Business Machines
Limited
120 Botley Road
Oxford OX2 0HH
Tel: 0865 723511

Surrey
T & V Johnson Limited
(Microcomputers Etc.)
Johnson House
75-79 Park Street
Camberley GU15 3XE
Tel: 0276 20446

Warwickshire
Business and Leisure Micro
Computers
16 The Square
Kenilworth CV8 1EB
Tel: 0926 512127

Gallid Limited
1 Bilton Road
Rugby CV22 7AA
Tel: 0788 74442/3

West Midlands
Camden Electronics Limited
462 Coventry Road
Small Heath
Birmingham B10 0UG
Tel: 021 773 8240

C.P.S. (Data Systems) Limited
Arden House
1102 Warwick Road
Acocks Green
Birmingham B27 6BH
Tel: 021 707 3866

Worcestershire
Arrow Business Computers
Limited
Royal House
11 Market Place
Redditch B98 8AA
Tel: 0527 62733

Yorkshire
Saville Audio Visual Limited
Salisbury Road
York YO2 4YW
Tel: 0904 37700

SCOTLAND

Strathclyde
Tumkey Computer Technology
Limited
23 Calderglen Road
St. Leonards
East Kilbride G74 2LQ
Tel: 03552 39466

Video Vector Dynamics Limited
39 Hope Street
Glasgow G2 6AE
Tel: 041 226 3481/2

WALES

South Glamorgan
David Potter Office Equipment
Limited
164 Richmond Road
Cardiff CF2 3BX
Tel: 0222 496510

West Glamorgan
Croeso Computer Services
516 Mumbles Road
Mumbles
Swansea SA3 4BW
Tel: 0792 60624

Switch this data terminal off-line...



...and you've got a daisy wheel typewriter.

SCRIPTA £998 + VAT (RO Version £836 + VAT)

Manufactured in W. Germany by **OLYMPIA INTERNATIONAL**

SOLE UK DISTRIBUTOR: **DATAPLUS LTD.**

- * Does the work of both a data terminal and an electronic typewriter.
- * Saves you hundreds of pounds in machine costs.
- * Full word processing capability.
- * Library of easily-changed daisy typewheels.
- * Optional tractor unit allows continuous feeding of single or multi-part forms.
- * 'Lift-off' and 'Cover-up' correction facilities available.
- * RO version available without keyboard.
- * Contact your nearest dealer or the address below for more detailed information.

DATAPLUS

DATAPLUS LTD.,
39-49 Roman Road, Cheltenham GL51 8QQ.
Telephone 0242 30030 or 37373. Telex: 43594

• Circle No. 177

String routines

JEFF TOCK'S contribution to the Z-80 Zodiac in the April 1981 issue of *Practical Computing* caught my eye as a very useful subroutine and apart from an error in line 200 was soon in RAM and running, writes John Attfield of Benfleet, Sussex.

However, I felt that it should be possible, using string manipulation, to achieve the same result in less space. The result as you can see confirms this and apart from the statement

```
SCREEN X, Y
```

in line 270, the program should run on almost any machine with string-handling facilities. The program is easily extended using string arrays to display any number of strings following each other in an endless loop.

Variables:

```
A = counter
D = delay speed
L = string length
X & Y screen co-ordinates
AS = main string
BS = right of string
CS = left of string
200 A=0:X=10:Y=7:D=200
210 CLS
220 AS="TICKER TAPE TEST STRING"
230 L=LEN(AS)
240 A=A+1:IFA=L THEN A=1
250 BS=RIGHT$(AS,L-A)
260 CS=LEFT$(AS,A)
270 SCREENX,Y:PRINTBS+CS
280 FOR C=1TOD:NEXTC
290 GOTO240
```

More instructions

IF YOU are a user of the Z-80 microprocessor at assembly level, then you should have been reading David Peckett's series on machine code. Shame on you if you have not, writes Kieron Leech of Warrington, Cheshire.

However, he has missed a very interesting point, namely it has more instructions than Zilog tells you. For example, if you look at the list of rotate and shift instructions you will see:

```
RL Rotate left
RLC Rotate left, copy bit 7 into carry
RR Rotate right
RRC Rotate right, copy bit 0 into carry
SLA Shift left arithmetic
SRA Shift right arithmetic
SRL Shift right logical
```

You should be able to see that there is an odd one out, SLA. It has no "SLL", shift left logical going with it. In fact, one exists. When Zilog wrote the original specifications for the Z-80, a shift left logical was included.

Unfortunately, when the microprocessor was tested, it was found that the "SLL" function did not work. Rather than spending thousands trying to correct it, it was simply omitted from the specifications. The nature of its failure is very simple, however, and easy to correct. If you look at the Shift right logical you will see it does

```
0 → [ 7 0 ] → CY
or so the programming manual tells us. If you try the "SLL" you will see that it does this:
```

```
CY ← [ 7 0 ] ← 1
```

It puts a 1 in bit 0 where it should put a 0. This is easily corrected by a re-set of the affected bit. The codes for our new instruction, "SLL", are in table 1 — a total of 10. They will probably be of use sometimes, if you remember where they go wrong. However, there is more to the Z-80 than this. If you look through the programming manual at the way the IX and IY registers are used, you can see some very interesting happenings. For example:

```
LD A,(HL) 7E
LD A,(IX + IND) DD 7E XX Where
ADD A,(HL) 86 XX = IND
ADD A,(IX + IND) DD 86 XX
etc., the same for IY, DD replaced by FD
```

It appears that normal codes which "drive" the HL register pair, drive the IX register if they are prefixed by "DD", and IY if they are prefixed by "FD".

The reason for this could be as follows. If we assume there are two two-bit address pointers in the Z-80, P1 and P2, behaving something like the IFF1 and IFF2 flip-flops used for interrupts. Normally, P1 decides which register the instructions for "HL" will go to, "DE", "HL", "IX" or "IY".

The reason "DE" is included is that the "EX DE, HL" instruction only takes four clock periods to execute, and since it takes that many clock periods to move the data in one eight-bit register to another I do not think it has enough time to swap two 16-bit registers around. All it probably has time for is to change that pointer so that instructions for "DE" are now routed to "HL", and *vice versa*.

Now "DD" seems to save P1 in P2 so it can be recalled when the instruction concerning IX has finished, and then it forces its own code into P1 so that the next "HL" instruction operates on "IX". "FD" will do a similar thing, but for "IY" instead of "IX".

If you look in the Zilog programming manual, however, not all the "HL" codes seem to have equivalent "IX" and "IY" codes. It seems worthwhile, therefore, to put "DD" and "FD" in front of these "HL" only instructions and see what happens.

In fact, it gives you an extra 88 instructions. Most of these seem to operate on the low- and high-order bytes of "IX" and "IY" individually, treating them exactly the same as "HL", i.e., splittable into two eight-bit registers. See table 2 for all the new codes.

Not all the codes we might expect to work, however, do. In particular, the prefix "ED" seems to re-set P1 so that the following instruction is not transferred to "IX" or "IY". I cannot make the rotate and shift instructions work either — they do nothing. It should also be obvious that you cannot say anything like "EX DE, IX", since the exchange instruction changes P1.

Table 1.

Shift Left Logical — SLL. This is the instruction Zilog wrote out of the Z-80 specifications because it did not work

properly. It was supposed to place bit 7 of the byte operated on into the carry flag, shift the byte left then place a 0 in bit 0 but instead it places a 1 there.

```
SLL (HL) CB 36
SLL (IX + IND) DD CB XX 36 Where XX
SLL (IY + IND) FD CB XX 36 = IND
SLL A CB 37
SLL B CB 30
SLL C CB 31
SLL D CB 32
SLL E CB 33
SLL H CB 34
SLL L CB 35
```

Condition bits affected

```
S: Set if result is negative, re-set otherwise
Z: Set if result is zero, re-set otherwise
H: Re-set
P/V: Set if parity even, re-set if parity odd
N: Re-set
C: Data from bit 7 of source
```

Table 2 is a list of the 'new' op-codes operating on the IX and IY registers.

The list is in numerical order.

```
DD 24 FD24 INC IXH INC IYH
DD 25 FD 25 DEC IXH DEC IYH
DD 26 nn FD26nn LD IXH,n LD IYH,n
DD 2C FD2C INC IXL INC IYL
DD 2D FD 2D DEC IXL DEC IYL
DD 2E nn FD2E nn LD IXL,n LD IYL,n
DD 44 FD 44 LD B,IXH LD B,IYH
DD 45 FD 45 LD B,IXL LD B,IYL
DD 4C FD 4C LD C,IXH LD C,IYH
DD 4D FD 4D LD C,IXL LD C,IYL
DD 54 FD 54 LD D,IXH LD D,IYH
DD 55 FD 55 LD D,IXL LD D,IYL
DD 5C FD 5C LD E,IXH LD E,IYH
DD 5D FD 5D LD E,IXL LD E,IYL
DD 60 FD 60 LD IXH,B LD IYH,B
DD 61 FD 61 LD IXH,C LD IYH,C
DD 62 FD 62 LD IXH,D LD IYH,D
DD 63 FD 63 LD IXH,E LD IYH,E
DD 65 FD 65 LD IXH,IXL LD IYH,IYL
DD 67 FD 67 LD IXH,A LD IYH,A
DD 68 FD 68 LD IXL,B LD IYL,B
DD 69 FD 69 LD IXL,C LD IYL,C
DD 6A FD 6A LD IXL,D LD IYL,D
DD 6B FD 6B LD IXL,E LD IYL,E
DD 6C FD 6C LD IXL,IXL LD IYL,IYL
DD 6F FD 6F LD IXL,A LD IYL,A
DD 7C FD 7C LD A,IXH LD A,IYH
DD 7D FD 7D LD A,IXL LD A,IYL
DD 84 FD 84 ADD A,IXHADD A,IYH
DD 85 FD 85 ADD A,IXL ADD A,IYL
DD 8C FD 8C ADCA,IXH ADC A,IYH
DD 8D FD 8D ADC A,IXL ADC A,IYL
DD 94 FD 94 SUBA,IXH SUB A,IYH
DD 95 FD 95 SUB A,IXL SUB A,IYL
DD 9C FD 9C SBC A,IXH SBC A,IYH
DD 9D FD 9D SBC A,IXL SBC A,IYL
DD A4 FD A4 AND A,IXH AND A,IYH
DD A5 FD A5 AND A,IXL AND A,IYL
DD AC FD AC XOR A,IXH XOR A,IYH
DD AD FD AD XOR A,IXL XOR A,IYL
DD B4 FD B4 OR A,IXH OR A,IYH
DD B5 FD B5 OR A,IXL OR A,IYL
DD BC FD BC CPA,IXH CPA,IYH
DD BD FD BD CPA,IXL CPA,IYL
```

IXH is the highest bits of IX, i.e., bits 8 to 15 IXL if the lowest eight bits of IX, i.e., bits 0 to 7.

The instructions change the flags in the same way the "HL" equivalent instructions do. □

Long division

THE SEVERE arithmetic limitations of the ZX-80 present a challenge to one's ingenuity, particularly the inability of the computer to handle any number greater than 32767 and the rounding down to nought in using the computer for division, writes Robin Allott of Seaford, Sussex.

However, by a combination of the use of arrays and loops, these arithmetic limitations can be overcome as the following program for very long division shows; it allows the division of a number of any size by a number of any size, e.g., a 40-figure number by a 20-figure number or by a single-figure number. If one wants to use the program for large numbers it is better run on the ZX-80 with the 16K add-on memory.

The program is very simple to run. After Run, it first calls for ND — the number of digits in the number to be divided — and then for DD — the number of digits in the divisor.

It then calls for X — the number to be divided — input each figure separately — and then for Y — the divisor — input each figure separately. It prints out the answer without initial noughts; the program can be adapted very simply to produce as many decimal places as required.

Telephone pad

HERE IS a program for storing a telephone directory on the ZX-80 using the program listing to store the data, writes MG Ormerod of Reigate, Surrey. This has the advantage over other methods of storing data in that the data is not lost by inadvertently using the Run command. The basic program consists of three lines.

```
10 PRINT "GIVE REQUIRED NAME"  
20 INPUT US  
30 GO TO (CODE(US)—37)*100 + (CODE  
(TL$(US))—37)*2
```

Each entry of the directory consists of a line number, print instruction and a string giving name and telephone number. When

making an entry to the directory, a new line is added to the program. The line number is calculated by taking the first letter of the name and putting A=1 or B=2, etc., and then multiplying by 100 and adding the value of the second letter × 2, e.g.,

```
1030 PRINT "JONES", "ALAN", "01-644-  
9821"
```

```
1031 GO TO 20
```

```
3826 PRINT "SMITH", "JOHN", "063-  
8948", "SMITH", "PETER", "278-  
4539"
```

```
3827 GO TO 20
```

The line number + 1 is used to return control to line 20.

Die cast

IN FEEDBACK, January 1981, Neville Falkiner lists a Double Dice Throwing program, writes Brian Horsfield of Middlesbrough.

Here is a shorter Double Dice Display which fits the basic ZX-80 and allows either die to assume the higher value.

```
1 REM B. HORSFIELD  
10 LET A$="*. *"  
20 LET B$="* *"  
30 LET C$="* * *"  
40 LET D$="* * * *"  
45 CLS  
50 LET X=RND (6)  
60 LET Y=RND (6)  
70 IF X=1 THEN PRINT "....C$"  
80 IF X=2 THEN PRINT ".B$.....D$"  
90 IF X=3 THEN PRINT ".B$. . . . .C$ . . . .D$"  
100 IF X=4 THEN PRINT ".A$ . . . . .C$ . . . .A$"  
110 IF X=5 THEN PRINT ".A$ . . . . .C$ . . . .A$"  
120 IF X=6 THEN PRINT ".A$ . . . . .C$ . . . .A$"  
130 IF Y=1 THEN PRINT "....C$"  
140 IF Y=2 THEN PRINT ".B$.....D$"  
150 IF Y=3 THEN PRINT ".B$. . . . .C$ . . . .D$"  
160 IF Y=4 THEN PRINT ".A$ . . . . .C$ . . . .A$"  
170 IF Y=5 THEN PRINT ".A$ . . . . .C$ . . . .A$"  
180 IF Y=6 THEN PRINT ".A$ . . . . .C$ . . . .A$"  
190 INPUT N$  
200 IF N$=" " THEN GO TO 45  
210 STOP
```

Copyrights

WE HAVE all seen program listings with the first line showing who wrote the program or who holds the copyright and, perhaps, wondered how to do it effectively, writes David Bailey of Leeds, West Yorkshire. It is easy enough to make the first line of a

program a Rem statement with the appropriate message, but this is far too easy to erase.

So, how about making the message line 0? Try entering line 0. As you cannot do it by normal means — the computer treats it as a direct command — try this: make the first line of your program a Rem statement containing your message less its first character. If the message were going to be Acme Programs, the first line would be 1 REM CME PROGRAMS

Now, as direct commands enter the following:

```
POKE 16425,0  
then  
POKE 16426,38.
```

When the listing is returned to the screen the first line of the program reads 0 ACME PROGRAMS

Now try to erase line 0 in the normal way. If that does not work try to edit it. You cannot do either. Line 0 has no effect on a program providing it does not have a command after the line number. If it has a command after the line number, it will form part of the program and the computer will carry it out.

How was it done? Well, location 16425 in RAM is the first line number so POKEing that with 0 makes the first line number 0. Location 16426 is the command in the first line, so POKEing that location with 38 makes A the first character after the line number.

Super docker

THIS PROGRAM is called Super Docker, writes S Farr of Fareham, Hampshire. It runs on a 1K machine, and has some new features; the cursor controls act as movement indicators, e.g., if you want to go left, you enter 5.

This program has also magnitude, e.g., if you want to go up three lines, you enter 7 — to go up — n/1 then 3 n/1 and the ship moves three lines. If you continue to press n/1, the ship continues to move up

Long division

```
1 GOTO 350  
10 FOR A=1 TO ND  
20 LET C=0  
30 FOR J=1 TO DD  
40 LET E(J)=A(A+DD-J)  
50 NEXT J  
60 FOR B=1 TO DD  
70 LET E(B)=E(B)-B(DD+1-B)  
80 IF B=DD THEN GOTO 150  
90 FOR F=1 TO DD-B  
100 IF E(B-1+F)<0 THEN LET E(B+F)=E(B+F)-1  
110 NEXT F  
120 FOR F=1 TO DD-B  
130 IF E(B-1+F)<0 THEN LET E(B-1+F)=E(B-1+F)+10  
140 NEXT F  
150 NEXT B  
155 IF DD=1 AND E(DD)>-1 THEN GOTO 170  
160 IF E(DD)<0 THEN GOTO 200  
170 LET C=C+1  
175 IF DD=1 AND E(DD)=0 THEN GOTO 250  
180 IF E(DD)>0 THEN GOTO 60  
200 IF A=ND THEN GOTO 250  
210 FOR J=1 TO DD  
220 LET A(A+DD-J)=A(A+DD-J)-C*B(DD+1-J)  
221 IF A(A+DD-J)<0 THEN LET A(A+DD-J-1)=A(A+DD-J-1)-1  
222 IF A(A+DD-J)>0 THEN LET A(A+DD-J)=A(A+DD-J)+10  
230 NEXT J  
240 LET A(A+1)=A(A+1)+10*A(A)  
250 LET D=D+1  
260 LET C(D)=C
```

```
270 NEXT A  
280 FOR D=1 TO ND  
285 LET L=C(D)+L  
286 IF L=0 THEN GOTO 300  
290 PRINT C(D);  
300 NEXT D  
310 STOP  
350 INPUT ND  
360 INPUT DD  
370 LET D=0  
371 LET L=0  
400 DIM A(ND+DD-1)  
410 DIM B(DD)  
420 DIM C(ND)  
430 DIM E(DD)  
440 PRINT "X "  
450 FOR J=1 TO ND+DD-1  
460 IF J<DD THEN LET X=0  
470 IF NOT J<DD THEN INPUT X  
480 IF NOT J<DD THEN PRINT X;  
490 LET A(J)=X  
500 NEXT J  
510 PRINT " DIVIDED BY Y "  
520 FOR K=1 TO DD  
530 INPUT Y;  
540 PRINT Y;  
550 LET B(K)=Y  
560 NEXT K  
570 PRINT "=";  
600 GOTO 10
```



```

2  RANDOMISE Criss-cross
4  DIM A(8)
6  LET B=0
8  PRINT "NL FOR MY GO"
10 INPUT A $
12 LET D=0
14 GOSUB 96
16 FOR C=0TO7
18 IF A(X)+A(Y)+A(Z)=122 THEN GOTO 38
20 IF A(X)+A(Y)+A(Z)=104 THEN IF D=1 THEN GOTO 38
22 IF A(X)+A(Y)+A(Z)=104 THEN LET D=1
24 GOSUB 98
26 NEXT C
28 IF D=1 THEN GOTO 14
30 LET E=RND(9)-1
32 IF NOT A(E)=0 THEN GOTO 30
34 LET A(E)=61
36 GOTO 44
38 IF A(X)=0 THEN LET A(X)=61
40 IF A(Y)=0 THEN LET A(Y)=61
42 IF A(Z)=0 THEN LET A(Z)=61
44 CLS
46 LET B=B+1
48 FOR F=0 TO 8
50 PRINT CHR$(A(F));
52 IF F=8 THEN GOTO 66
54 IF F=2 OR F=5 THEN GOTO 60
56 PRINT "a";
58 NEXT F
60 PRINT
62 PRINT "aaaaa"
64 NEXT F
66 PRINT
68 PRINT
70 GOSUB 96
72 FOR G=0 TO 7
74 IF A(X)=A(Y) AND A(X)=A(Z) AND NOT A(X)=0 THEN GOTO 110
76 GOSUB 98
78 NEXT G
80 IF B=9 THEN GOTO 122
82 IF (B/2)*2=B THEN GOTO 8
84 PRINT "ENTER YOUR GO 0-8"
86 INPUT G
88 IF G>8 THEN GOTO 84
90 IF NOT A(G)=0 THEN GOTO 84
92 LET A(G)=52
94 GOTO 44
96 LET B$="02147685264536048"
98 LET X=CODE(B$)-28
100 LET B$=TL$(B$)
102 LET Y=CODE(B$)-28
104 LET B$=TL$(B$)
106 LET Z=CODE(B$)-28
108 RETURN
110 IF (B/2)*2=B THEN GOTO 116
112 PRINT "I";
114 GOTO 118
116 PRINT "YOU";
118 PRINT " WIN"
120 GOTO 124
122 PRINT "DRAW"
124 PRINT "NL TO PLAY AGAIN"
126 INPUT C$
128 CLS
130 IFC$= "" THEN RUN
    
```

three lines. If you are one line away from the place marked

DDOCK * DOCK
and you are still going three lines up, the ship will crash. To stop it doing that, you have to counteract the three lines up, so you enter: 8 — to go down — n/1 and 2 n/1, you are now travelling one line upwards, because three up — two down = one line up.

At the start of the program, you will be moving at a random velocity so this has to be counteracted. The program is also equipped with fuel. If you go down four lines you lose four fuel units. It also tells you when you have run out of fuel.

Here are some warnings: the ship may not touch the sides of the screen, the bottom of the screen or the top dotted part of the screen.

Criss-cross

THE PROGRAM enables you to play noughts and crosses against a ZX-80 with 1K of RAM, writes Robert Wray of Cottingham, North Humberside. The program does not think more than one move ahead, so if it is not able to block an opponent's line or complete one of its own — the preference is to block the opponent's line — it takes a random move into an unoccupied space.

The computer is always given the first move, by responding to the printout "NL FOR MY GO" by pressing newline, which gives it a reasonable chance of winning. You are then requested to enter the space you wish to take — illegal co-ordinates are rejected — which range from 0, the top-left position, to 8 — at the bottom right.

Thus, if you wish to place your nought — the computer always plays crosses — in the centre, input 4 followed by newline. The program detects the end of the game, and states the winning side or draw and also offers another game obtained by pressing newline.

In the computer, the board positions

are stored as the nine elements in the array A. Lines 10 to 42 generate the computer's move using the subroutine at lines 96 to 108 which scan all the lines on the board. Lines 44 to 68 display the board, 70 to 80 watch for the end of the game. Line 82 tests to see if it is the computer's turn — when B is even — otherwise, it continues to lines 86 to 94 which process the player's move. Lines 110 to 130 print out the result of the game and offer another. The lower-case 'a' in lines 56 and 62 represents the graphic character obtained by keying shift A.

Print statements

I CANNOT recall having seen any comment about the ZX-80 Basic structure Print x, where x is a decimal integer, writes Eric Deeson of Highgate, Birmingham. When the instruction is executed, x is printed.

Thus

```

10 PRINT 3
20 PRINT 2
30 PRINT 1
40 PRINT 0
    
```

When Run gives

```

3
2
1
0
    
```

I find the facility of great value during program development, when wishing to do a check Run of an unfinished program. If we use X PRINT X where X is the line number addressed by a Goto or Gosub statement, it is easy to see if the Run is correct. Here is an example.

```

10 PRINT "TYPE 1,2 OR 3"
20 INPUT A
30 IF A < 1 OR A > 3 THEN GO TO 50
40 GO SUB A * 100
50 PRINT 50
60 STOP
100 PRINT 100
110 STOP
190 RETURN
200 PRINT 200
210 STOP
290 RETURN
300 PRINT 300
310 STOP
    
```

390 RETURN

When Run, this far-from-complete program will show that intended jumps are executed correctly. In the program, by the way, OR can be typed with a single key-stroke, and stored in a single byte, rather than four. It is worth noting that all the shift keywords — AND, OR, NOT, THEN, TO — can be used in Print statements.

Super docker

```

10 RANDOMISE
20 LET Z=70
30 LET F=10
40 LET W=RND(4) -2
50 LET M=0
50 LET I=RND(4) -2
70 LET V=RND(10)+5
80 LET H=RND(25) +2
90 IF W<-1 OR W<1 OR I>1 THEN GOTO 120
100 IF V=-1 AND H=14 THEN PRINT "DOCKED"
... "SCORE="; Z+(3*F)
110 IF V=-1 AND H=14 THEN STOP
120 IF W<0 OR W>17 OR H<0 OR H>29 THEN PRINT "CRASHED";
130 IF H=14 AND V<0 THEN PRINT ">TOOFAST>"
140 IF W<0 OR W>17 OR H<0 OR H>29 THEN STOP
150 LET Z=Z-2
160 PRINT "(Shift d's) DOCK (Shift r)>>*(Shift e) DOCK (Shift f)"
170 IF V<1 THEN GOTO 210
180 FOR V=1 TO V
190 PRINT
200 NEXT V
210 IF H<1 THEN GOTO 250
220 FOR X=1 TO H
230 PRINT "STAR";
240 NEXT X
250 PRINT "CO"
260 IF F<1 THEN GOTO 500
270 PRINT "FUEL =";F;"KG."
280 PRINT "DIRECTION=";
290 INPUT G$
300 PRINT G$
310 IF G$="" THEN GOTO 350
320 PRINT "MAGNITUDE=";
330 INPUT M
340 IF M<0 THEN GOTO 330 -
350 CLS
360 IF M>F THEN LET M=F
370 LET V=V+M
380 LET H=H+I
390 IF G$="" THEN LET M=0
400 LET F=F-M
410 IF G$="5" THEN LET H=H-M
420 IF G$="5" THEN LET I=I-M
430 IF G$="6" THEN LET V=V+M
440 IF G$="6" THEN LET W=W+M
450 IF G$="7" THEN LET V=V-M
460 IF G$="7" THEN LET W=W-M
470 IF G$="8" THEN LET H=H+M
480 IF G$="8" THEN LET I=I+M
490 GOTO 90
500 PRINT "NO FUEL",,,, "YOU ONLY HAVE N/L"
510 INPUT G$
520 GOTO 350
    
```

Space saving

THE INSTR\$-Function is a fine space saver, writes Rolf-Fr. Matthaei of Hamburg, West Germany. I am updating my programs from a two-line version of

```
20 AS=""
30 AS=INKEY$:IF AS="" THEN 30
```

to a one-line version which saves about 18 bytes:

```
20 AS=INSTR$(1)
```

I found that INSTR\$ also works very well inside expressions:

```
old: 20 AS=INKEY$:IF AS="" THEN 20
      ELSE BX=ASC(AS)
new: 20 BX=ASC(INSTR$(1))
```

The space-saving hint in Tandy Forum, April 1981, is also valid for the TRS-80 Model I.

Pascal roots

TANDY'S cassette-based Tiny Pascal is an inexpensive but effective way of getting to grips with the Pascal language, but there is an error in the Tiny Pascal manual which can have disconcerting results, writes JE Swann of Henley on Thames, Oxfordshire.

If you run the following program:

```
BEGIN
  WRITE(SQR(4) # )
END.
```

you will obtain the answer 16.

In other words, the SQR(exp) function squares — and does not find square-roots as described in the manual. Of course, Tiny Pascal handles only integer data types so a square-root function has limited application. Here is a Tiny Pascal program which produces integer answers

to square-root problems:

```
(*SQUAREROOTS*)
VAR NUMBER,ROOT:INTEGER;
BEGIN
  REPEAT
    READ (NUMBER #.);
    BEGIN
      ROOT:=1
      REPEAT
        ROOT:=(NUMBER DIV ROOT + ROOT)
        DIV 2
      UNTIL ABS (NUMBER DIV SQR(ROOT)-
        1) < 1;
      WRITE (ROOT #, 13)
    END
  UNTIL NUMBER = 1
END.
```

Little and large

OWNERS of TRS-80s who have recently bought a Radio Shack TRS-80 Line Printer II may be interested to know that the printer, I have found, will produce four character faces, writes David Bishop of Doncaster, South Yorkshire. That is two additional ones to the two mentioned in the printer manual. The two mentioned are normal-size and double-size letters. The other two I have discovered are half-size and bold letters. For a demonstration of the four faces try the following short program:

```
1 LPRINTCHR$(27);CHR$(14);"Double size letters"
2 LPRINTCHR$(27);CHR$(20);"Half size letters"
3 LPRINTCHR$(27);CHR$(14);"Bold letters"
4 LPRINTCHR$(27);CHR$(19);"Normal size letters"
Double size letters
Half size letters
Bold letters
Normal size letters
```

You will notice that each instruction has to have CHR\$(27) followed by

CHR\$(X), where X is the code number for the face you require. Sadly, however, it is not as simple as this.

What CHR\$(X) prints depends on what face was printed last. A normal-size face (CHR\$(19)) followed by the instruction CHR\$(14) will produce double-size face. However, if the instruction CHR\$(14) follows half-size face (CHR\$(20)) has been used, bold letters are produced.

If a plain LPRINT or LLIST instruction is executed after double-size face has been used, the printer reverts to normal-size face. If bold face has been used, the printer reverts to half-size face. If normal or half-size faces have been used, the face remains the same.

Finally, printing in double-size or bold face lasts only one line and if your line is too long, some is liable to be lost. Normal and half-size faces wrap around to the next line with no problems — it is possible to LLIST in half-size face, which produces an interesting listing.

Screen draw

THIS program enables the user to draw on the screen using the keypad, writes James Hallows of Solihull, West Midlands. First of all, type the program and after you have successfully used the program to draw graphs, diagrams, etc., start experimenting with it. For example, try adding the following to the program:

```
68 PRINT CHR$(23)
```

Then type the following which enables the computer to draw a diagram at random. It is best to leave out line 68 if the computer is to draw at random.

```
25 GOTO 325
325 L=INT(RND(1024)):B=L+15360:F=1
330 POKE B,191
332 G=INT(RND(10)):F=F+1
335 IF F=1000 THEN END ELSE 345
345 IF G="1" THEN 200
350 IF G="2" THEN 210
360 IF G="3" THEN 220
370 IF G="4" THEN 230
380 IF G="5" THEN 332
390 IF G="6" THEN 240
400 IF G="7" THEN 250
410 IF G="8" THEN 260
420 IF G="9" THEN 270
430 GOTO 332
10 CLS:PRINT 507,"SKETCHING"
20 FOR N=1 TO 1000:NEXT:CLS
30 PRINT"INSTRUCTIONS (Y/N)?":INPUT A
40 IF A="Y" THEN 280
50 CLS:PRINT"ENTER STARTING POINT (1
TO 1024)":INPUT B
60 X=B+15359:IFX<15360 OR > 16383
THEN 50 :CLS
70 POKE X,191
80 R#=INKEY$:IF R#=""THEN 80
90 IF R#="E" THEN 320 ELSE 100
100 IF R#="C" THEN 50 ELSE 110
110 IF R#="1" THEN 200 ELSE 120
120 IF R#="2" THEN 210 ELSE 130
130 IF R#="3" THEN 220 ELSE 140
140 IF R#="4" THEN 230 ELSE 150
150 IF R#="5" THEN 80 ELSE 160
160 IF R#="6" THEN 240 ELSE 170
170 IF R#="7" THEN 250 ELSE 180
180 IF R#="8" THEN 260 ELSE 190
190 IF R#="9" THEN 270 ELSE 195
195 PRINT R#;GOTO 80
200 X=X+63:POKE X,191:GOTO 80
210 X=X+64:POKE X,191:GOTO 80
220 X=X+65:POKE X,191:GOTO 80
230 X=X-1:POKE X,191:GOTO 80
240 X=X+1:POKE X,191:GOTO 80
250 X=X-65:POKE X,191:GOTO 80
260 X=X-64:POKE X,191:GOTO 80
270 X=X-63:POKE X,191:GOTO 80
280 CLS:PRINT:PRINT"USE THE KEYPAD
TO DRAW ON THE SCREEN"
290 PRINT "8=UP,2=DOWN,6=RIGHT,
4=LEFT,7=NORTH WEST,9=NORTH EAST,"
300 PRINT "1=SOUTH WEST,3=SOUTH EAST.
PRESS E WHEN YOU HAVE"
303 PRINT "FINISHED DRAWING AND C IF
YOU WANT TO CLEAR THE "
305 PRINT"SCREEN. IF ANY OTHER KEY
IS PRESSED, THEN THE"
307 PRINT"CHARACTER ON THAT KEY WILL
BE PRINTED. KEEP TO"
309 PRINT"THE MIDDLE OF THE SCREEN.
DO NOT TRY TO GO BEYOND"
310 PRINT"THE EDGES OF THE SCREEN.
ENJOY YOURSELF.":GOTO 500
320 CLS:PRINT"ANOHTER GO?":INPUT G:
IF G="Y" THEN 30 ELSE END.
500 PRINT:PRINT:PRINT"PRESS ANY KEY."
510 I#=INKEY #:IF I#="" THEN 510
ELSE 50
```


UK101 FRE(X)

ROGER CUTHBERT's excellent discussion of the FRE(X) problem on the UK 101 6502 Special, January 1981, is much appreciated, writes J Ryson of Hyde, Cheshire. I have implemented the suggested change to BAS 3 in the form of a 5V 2716. The modification appears to work perfectly; my general-purpose file program which hung up when sorting large files, now runs correctly thanks to the garbage-clearance routine, and no problem has arisen during two weeks regular use.

I am writing to encourage other UK 101 users to adopt the method. The rest of the article suggested that EPROM implementation was difficult; I believe that this solution is easier than the alternatives suggested and certainly more effective.

The single-voltage 2716 is very easy to program requiring a single 50 millisecond pulse at TTL level for each memory location. If you switch the top three address lines manually, data and other address lines can be controlled by a single PIA device and one of the control lines to provide the program pulse.

I used the extended monitor to move the BAS 3 into RAM, where the necessary bytes were modified and then programmed the EPROM under Basic control through a 6521 PIA.

The method of plugging the EPROM into the BAS 3 socket may be crude, but has two overwhelming advantages: It is easy and it works. Low-profile Texas diodes will plug into a socket. Take a 24-pin socket and bend pins 18, 20 and 21 out horizontally, solder a wire to pin 24 as close under the socket as possible and solder the other end to pin 21 which is Vpp and is thus connected to +5V as is required for read and standby.

Solder a flying lead between pin 18 (CE) of the socket and pin 11 of IC 16. Solder another flying lead between pin 20 (OE) of the socket and the rear left hand connection of W6 which is situated to the left of IC 17.

Plug this socket — except pins 18, 20 and 21 — into the socket for BAS 3 (IC 11) and then insert the programmed EPROM. To revert to the masked ROM, remove the EPROM and socket and plug in the ROM. No changes have been made to the board.

Same socket

AS A relative newcomer to computing, I found the January 1891 issue extremely enlightening about the use of interrupts as well as useful in eliminating the UK101 Basic3 string, writes R L Curd of Farnborough, Hampshire.

Others interested in Roger Cuthbert's 2716 EPROM replacement may be interested to know the following hardware changes. This will enable the use of the original socket on the board.

PIN 21 goes to plus 5V

THE 6502 SPECIAL is dedicated exclusively to the exchange of information between 6502 users. It is up to you, the reader, to help establish this page with your ideas, problems and guidance for other 6502 users. Please mark your letters 6502 Special. We pay £5 for each contribution published.

PIN 18 goes to ICI6e pin 11 as suggested

PIN 20 goes to IC21b pin 4

I have carried out this modification and it works exceptionally well. Roger Cuthbert is to be congratulated on the clarity of his article.

ASCII characters

FOR HARD-UP Microtan 65 users, this program will type any character by inputting its ASCII code on the Hex keypad writes Bill Crasnell of Churchdown, Gloucestershire.

```
0400 20 FA FD
      3  A501
      5  E930
      7  0A
      8  0A
      9  0A
      A  0A
      B  8550
      D  20 FA FD
0410  A501
      2  E940
      4  100D
      6  A501
      8  E92F
      A  18
      B  6550
      D  2075 FE
0420  4C00 04
      3  18
      5  6909
      7  4C 1A 04
```

Type in Hex ASCII Code

New restore

WHEN THE command New is used on the UK101 one of the many things to happen is that the first link bytes held in memory locations 0301 & 0302 Hex are set to zero, writes Alan Brown of Newbridge, Midlothian. The program is still in memory — it just cannot be listed or run.

If you accidentally New a program, it can be saved as follows:-

```
FOR J= 800 TO 769 STEP -1: IF PEEK
(J)<>3 AND PEEK (J+2)<>0 THEN NEXT
```

This should be typed as one line without a line number. When OK is printed J will be the value of the memory location that holds the end (00) of the first program line. If you now type:

```
POKE769,J- 769:POKE770,3
```

This will restore the first link bytes. The program can now be listed and should be saved immediately since other program pointers will have been re-set and the system is in danger of crashing. On no account should you try to erase any spurious line numbers which appear — the result can be quite spectacular. The memory locations mentioned are for the new-monitor EPROM and may have to be altered for other monitors.

Screen dump

THIS following machine-language program provides a very convenient means of obtaining a screen dump to printer. It can be used when the machine is in either Basic mode or DOS mode writes LM Goddard.

```
                                ORG F000H
F000 21 20 F0.                   LD    HL,F020H
F003 16 4F.                       LD    D,4FH
F005 1E 00.                         LD    E,00H
F007 3E 0B.   LOOP                LD    A,0BH
F009 43.                             LD    B,E
F00A 0E 00.                         LD    C,00H
F00C CF.                             RST   8
F00D 3E 13.                         LD    A,13H
F00F 06 4F.                         LD    B,4FH
F011 0E 0D.                         LD    C,0DH
F013 CF.                             RST   8
F014 1C.                             INC   E
F015 7B.                             LD    A,E
F016 D6 18.                         SUB   18H
F018 C2 07 F0.                      JP    NZ,LOOP
F018 C9.                             RET
```

The program is entered most easily using DEBUG, but can, of course, be entered in assembly code and assembled. If using DEBUG to enter the program, use DUMP to store it on disc with start = F000 and END = F01B — Program name, SCRDMPI/CMD.

Enter this following program in Basic.

```
100 SYSTEM "LOAD SCRDMPI/CMD"
110 DEFUSR = HF000
120 X = USR (0)
130 END
```

Save program with the name SCRDMPI/BAS. The utility can be used at any time, as follows:

- Basic mode: enter RUN "SCRDMPI/BAS".
- DOS mode: enter SCRDMPI/CMD.

Non-printing input

IN THE August 6502 1980 Special, Michael Taylor of Peterborough wrote that the UK 101 or its Ohio Scientific Equivalent could be made to produce a non-printing input instruction, writes M J Murphy of Smallfield, Near Horley, Surrey.

The locations 538 and 539 decimal contain the original UK101 and Ohio Scientific Synmon monitors pointed to FF 69 Hex.

Poking 138 into location 538 caused the vector to point to an RTS machine-code instruction in the monitor. Thus, any output after the Poke was not directed to the screen or printer. I have a CIE which on conversion to 48-by-32 video format required a new monitor. I bought the Mutek Cegmon but was not pleased to find that the machine-code "fix" no longer worked.

The Cegmon output routine is located
(continued on next page)

(continued from previous page)

at FF9B not FF69 so that the output vector now points to FF9B, and must be altered from this value to point to an RTS instruction. The nearest RTS to FF9B is at FFBC, so by altering location 538 to contain the decimal equivalent of BC, no output is made to the screen of ACIA.

The original value of location 538 is 9B (Hex), 155 decimal, 188 must be poked in to produce the non-printable input. The routine at FF9B is general-purpose and can be omitted from both keyboard and serial-input routines so that programs may be loaded without being printed on to the screen by preceding the load with a POKE 538, 188. To return to normal printing input POKE 538, 155.

Scroll stopper

MANY UK101 users probably have trouble examining a program while it lists on the screen due to the speed at which it scrolls writes Alan Saul of the Isle of Wight.

Rather than slow all printing with POKE 518, the following routine allows the user to stop scrolling with the space bar and to re-start by pressing any key. That enables a program, or any other listing, to be stopped, or slowed to be viewed at leisure.

To enable the program after RESET/W, re-execute line 70. To disable the routine — it may be necessary for example, if a Basic program polls the keyboard — execute;

```
POKE 538, 105:POKE 539,255
10 FOR I = 546 TO 569
20 READ P:POKE I,P
30 NEXT
40 DATA 201,13,208,17,169,253,141,0
50 DATA 223,173,0,223,201,239,208,3
60 DATA 32,0,253,169,13,76,105,255
70 POKE 538,34:POKE 539,2
80 NEW
```

Cassette data

THIS ROUTINE will generate its own Data statements and output them to a cassette recorder, writes Tim Allen of Ash Vale, Hampshire. The format of the statement is exactly the same as that normally typed by the user, i.e., 100 DATA a,b,c,d,e etc.

It is very important that semicolons are used wherever shown. Data in an array D(A) will need to be changed to PEEK(A) commas. PEEK(512) checks that a line has not been filled.

The main use for the routine is to change lengthy machine-code routines into Basic Data statements, in which case D(A) will need to be changed to PEEK(A) etc. The L in line 70 is used to detect the final piece of data and has the value of the dimension of array D(A) i.e., DIM D(L).

The listing is short and self-explanatory so it can be modified easily to suit individual needs. Do not forget that the Data statements become valid program lines only when the tape is re-loaded and works because of the way in which the UK 101 — and Superboard — save programs.

```
10 REM UK 101 DATA SAVER
20 REM
30 A=L:Z=10 INPUT A:Z
40 POKE 517,1
50 PRINT Z,"DATA";
60 PRINT D(A);IF PEEK(512)>=240
THEN 90
70 IFA=L-1 THEN PRINT "," D(A+1):
POKE 517,0:END
80 PRINT ",";A=A+1:GOTO 60
90 A=A+1:PRINT "," D(A):Z=Z+5:
A=A+1:GOTO 50
```

Pay tax

MICHAEL Whittle presents a program which is designed to calculate the pay and tax of monthly-paid staff, and is able to cope with changes in tax code and salary,

including calculating back-dated pay rises.

I am not offering it as a business program since it calculates the tax exactly, he writes, whereas the Inland Revenue uses tax tables which undercharge slightly by rounding down the tax due.

The program is written for the UK101, and will run on the Ohio Superboard without modification. It will run on most other micros if lines 120, 130 and 330 and 340 are modified to invite an INPUT at the end of each month's printout.

Line 180 contains the pensions' calculations for the universities superannuations scheme — that would have to be modified for the individuals own pension scheme.

```
10 REM PAYE CALCULATOR by Mike Whittle
20 AP=****:REM ANNUAL SALARY
30 TC=597:REM TAX CODE
40 NI=32.88:REM NATIONAL INSURANCE
50 DEFFNA(X)=INT(X*100+.5)/100
60 DATA APRIL,MAY,JUNE,JULY,AUGUST,SEPTEMBER
70 DATA OCTOBER,NOVEMBER,DECEMBER,JANUARY
80 DATA FEBRUARY,MARCH,11250,.3,2000,.4,3500
90 DATA .45,5500,.5,5500,.55:REM TAX BANDS
100 DIM M$(12):FOR I=1 TO 12:READ M$(I):NEXT I:PRINT
110 FOR I=1 TO 5:READ BD(I),RT(I):REM BAND & RATE
120 NEXT I:PRINT "PRESS 'SHIFT' TO CONTINUE -"
130 PRINT "CONTROL TO CHANGE VALUES":PRINT
140 FORM=1 TO 12:PRINT M$(M);": ";
150 MF=FNA(AP/12)+BF:REM MONTH'S GROSS PAY
160 CG=CG+MF:REM CUMULATIVE GROSS PAY
170 PRINT TAB(12);"GROSS PAY";MF
180 FM=FNA(.0625*(CG-100/12*M)):REM PENSION
190 FX=FM-FP:FP=FM:PRINT "PENS";FX;
200 CF=CG-FM:REM CUMULATIVE TAXABLE PAY
210 TF=(TC*10+9)*M/12:REM TAX FREE ALLOWANCE
220 NT=CF-TF:REM NETT TAXABLE PAY
230 FOR I=1 TO 5:IF NT<=0 THEN 290
240 TR=BD(I)*M/12:REM TAXABLE AT THIS RATE
250 IF NT<TR THEN TR=NT
260 TT=TR*RT(I):REM TAX AT THIS RATE
270 HI=RT(I):TM=TM+TT:NT=NT-TR:NEXT I
280 TX=FNA(TM-TF):PRINT TAB(15);"TAX";TX;
290 TF=TM:TM=0:PRINT TAB(30);"NAT INS";NI
300 NF=MF-FX-TX-NI
310 PRINT TAB(12);"NETT PAY";NF:BF=0
320 IF M=12 THEN 470
330 A=PEEK(57088):IFA=255 THEN 360
340 IFA=250 AND IFA<252 THEN 330
350 PRINT:NEXT M:END
360 PRINT:INPUT "REVISE SALARY Y/N";Y$
370 IF LEFT$(Y$,1)="" THEN 420
380 INPUT "NEW SALARY";AN
390 INPUT "STARTING MONTH";MN$:FOR I=1 TO M
400 IF LEFT$(MN$,3)=LEFT$(M$(I),3) THEN 450
410 NEXT I:GOTO 390
420 INPUT "REVISE TAX CODE Y/N";Y$
430 IF LEFT$(Y$,1)="" THEN 350
440 INPUT "NEW CODE";TC:GOTO 350
450 BF=(AN-AP)/12*(M-I+1):REM BACKPAY
460 AF=AN:GOTO 420
470 PRINT:PRINT "ANNUAL SUMMARY":PRINT
480 PRINT "GROSS PAY";CG:PRINT "TAXABLE PAY";CF
490 PRINT "HIGHEST TAX RATE";HI*100;"%"
500 PRINT "TOTAL TAX";TF:PRINT "PENSION";FM:FND
```


Memory dump

DATA statement writer, which I have written for the new-ROM Pet will dump any part of memory into data statements as explained in the remark statements, writes SP Folmer of Grantham, Lincolnshire.

When run, the program will ask for the start and end addresses and will then proceed to create the data statements relating to the point of memory selected if insufficient memory has been reserved for the data statements, the error is trapped and a warning message is displayed. There will be data statements present but they will be incomplete.

The Stop key is disabled during execution. The program self-deletes on completion. The logic involved is similar to my Blank Suppression program published in the August 1980 edition of *Practical Computing*.

As not all Pet owners have an assembler, it is desirable to accompany an assembly listing with the correspondence data statements which can be Poked into memory.

Normally, for small programs, this is no great problem. For large programs, however, it is not only extremely tedious but also very error-prone.

This program will do in seconds what would otherwise take hours and might have hidden errors. Another use could be to copy part of the operating system and play with it.

Graphic print

I HAVE a 16K Pet and use it with a standard Teletype or another fast printer, neither of which permit Pet graphics, writes A Walker of St Ives, Huntingdon, Cambridgeshire. However, even with the standard 96-character ASCII set, there are a large number of graphical projects which can be carried out.

To do this it is often necessary, due to the format of the data or the structure of the graphics, to produce the display by Poking characters directly to the screen.

It will operate only with the first 64 screen characters and can be used once a graphics display has been drawn to the screen. It is very simple and merely Peeks at the screen locations and converts the values to ASCII for the printer.

```
1000 REM *** READ & PLOT FROM
      SCREEN TO PRINTER ***
1010 OPEN 1,5,0
1020 P=32768 : X=0
1030 FOR I=0 TO 999
1040 X=X+1
1050 IF X=41 THEN X=1: PRINT #1
1060 C=PEEK(P+1)
1070 IF C > 0 AND C < 32 THEN C=C+
      64
1080 PRINT #1, CHR$(C);
1090 NEXT
1100 PRINT #1:CLOSE 1:RETURN
```

It should be noted that this program as it stands makes no allowance for screen characters with values greater than 63, but inclusions of further conditional statements could be inserted to allow for this.

Zero bugs

WHILE developing a statistical program on the Commodore 8000 series business system, we encountered an interesting problem, write RP Hope and I Powis of the University of Bradford Management Centre. At one point in the program a t-test is calculated on a correlation coefficient. This involves dividing by $SRQ(1-Z*Z)$ where Z is a correlation coefficient. The program was occasionally attempting to divide by zero at this point.

Since the program included a test on Z to bypass the calculation when appropriate — i.e., to avoid the error encountered — considerable head-scratching took place.

Eventually we produced the following short example which illustrates the problem and is self-explanatory. The data used are not invented — they are from our original test data. Also, the occurrence of a nine-digit number subject to the SQR function is not an acceptable explanation of the problem apparent from the con-

tradictory results of statements 20 and 30. The program is consistent over a number of Pets, not just the 8000.

```
10 Z=248.11/SQR(61558.5721)
20 IF Z=1 THEN 50
30 PRINT "Z IS NOT 1...IT IS" Z
40 GO TO 60
50 PRINT "Z IS 1"
60 END
RUN
Z IS NOT 1...IT IS 1
READY
```

Stop-key disable

IT IS often desirable to disable the Stop key, particularly when a program is fully working and the resultant Break and Ready messages interfere with one's screen formats and cursor position, writes AR Browne of Moberley, Cheshire.

It is quite well known that the statement `POKE 144,49` new-ROM Pets does indeed disable the Stop key, but has the disadvantage that it also stops the timer.

The following subroutines combine to
(continued on next page)

```
10 REM#PRODUCED BY 'DATA STMT WRITER' (C) S.P.FOLMER, FEB 81*
11 REM
12 REM INTRODUCTION:
13 REM THIS PROGRAM WILL DUMP ANY PART OF MEMORY INTO DATA STATEMENTS.
14 REM THESE DATA STATEMENTS CAN THEN BE SAVED OR APPENDED TO A PROGRAM.
15 REM USING THIS PROGRAM YOU CAN DUMP AN ASSEMBLER PROGRAM AND RELOAD IT
16 REM BY POKING THE DATA BACK INTO MEMORY.
17 REM IT CAN ALSO PROVE A GREAT TIME SAVER FOR ASSEMBLER PROGRAMMERS WHO
18 REM WISH TO PRODUCE LISTINGS OF THEIR PROGRAMS FOR PEOPLE WITHOUT
19 REM ASSEMBLERS.
20 REM
21 REM TO USE:
22 REM THE DATA STATEMENTS WILL APPEAR IN THE MEMORY AVAILABLE BEFORE LINE
23 REM 63000. THEREFORE YOU SHOULD FILL AS MUCH MEMORY SPACE BEFORE LINE 63000
24 REM AS YOU THINK THE DATA STATEMENTS WILL REQUIRE.
25 REM YOU CAN DO THIS SIMPLY BY PRECEDING LINE 63000 WITH LONG REM STATEMENTS
26 REM UNDER NORMAL CIRCUMSTANCES THE REM STATEMENTS YOU ARE NOW READING
27 REM SHOULD BE MORE THAN SUFFICIENT, HOWEVER YOU CAN ALWAYS ADD MORE.
28 REM PLEASE NOTE: IT IS IMPORTANT THAT THE FIRST LINE OF THE PROGRAM SHOULD
29 REM BE 63000. CHANGE THIS AT YOUR PERIL!
30 REM THIS PROGRAM WILL SELF-DELETE AFTER COMPLETION, SO ALL THAT WILL REMAIN
31 REM ARE YOUR DATA STATEMENTS.
32 REM
33 REM
63000 REM DATA STATEMENT WRITER (C) *S.P.FOLMER*FEB 80*
63001 DEFFNAC(X)=PEEK(X):DEFFNB(X)=PEEK(X+1):DEFFNC(X)=FNC(X)+256*FNB(X):FI=-1
63002 LP=40
63003 LP=FNC(LP):IF FNC(LP+2)<63000 GOTO 63003
63004 POKE 41,INT(LP/256)
63005 POKE 40,LP-PEEK(41)*256
63006 PRINT"DATA STATEMENT WRITER (C) SPF FEB 81"
63007 INPUT"START ADDRESS (DEC) ":SR
63008 INPUT"END ADDRESS (DEC) ":EN
63009 POKE 144,49:LN=100
63010 C1=FNC(1025)
63011 OFS=C1+2
63012 FOR I=SR TO EN
63013 IF DSC<0 GOTO 63019
63014 POKE OFS+1,INT(LN/256)
63015 POKE OFS,LN-PEEK(OFS+1)*256
63016 LN=LN+10
63017 OFS=OFS+2
63018 POKE OFS,131:OFS=OFS+1
63019 A$=STR$(PEEK(I)):A$=RIGHT$(A$,LEN(A$)-1)
63020 FOR J=OFS TO OFS+LEN(A$)-1
63021 POKE J,ASC(MID$(A$,J+1-OFS,1))
63022 NEXT J
63023 OFS=J:DS=DS+1
63024 IF OFS>LP-10 THEN PRINT"*INSUFFICIENT SPACE*":I=EN
63025 IF DSC<20 AND I<EN THEN POKE OFS,ASC(","):OFS=OFS+1:GOTO 63023
63026 DS=0
63027 POKE OFS,0
63028 OFS=OFS+1
63029 POKE C1+1,INT(OFS/256)
63030 POKE C1,OFS-PEEK(C1+1)*256
63031 C1=OFS
63032 OFS=OFS+2
63033 NEXT I
63034 POKE C1,0:POKE C1+1,0
63035 OFS=C1+2
63036 POKE 41,4:POKE 40,1
63037 POKE 623,INT(OFS/256)
63038 POKE 42,OFS-PEEK(623)*256
63039 POKE 43,PEEK(623):POKE 144,46
63040 CLR
63041 END
READY.
```

(continued from previous page)

disable the Stop key without stopping the timer and also to re-enable the Stop key if required. The key to the method is Subroutine D, which forms an extension to the Pet clock-interrupt service routine.

It sets the working storage variable at location 155 to indicate that the Stop key has not been pressed — even if it actually has. Subroutine C modifies the stack to force Subroutine D to be executed immediately on exit from the Pet interrupt routine.

Subroutines A and B serve to bring the method into and out of play. To disable the Stop key, invoke Subroutine A, e.g., by Sys (832). To re-enable it invoke Subroutine B, e.g., by Sys (844). Note that it is not the Stop key itself that is disabled/enabled but the break action associated with it.

The subroutines are here shown to reside as usual in the second cassette buffer and may be deposited there by any of the usual means. With suitable modification of address values the subroutines may of course reside elsewhere.

Subroutine A		
0340	78	SEI
0341	A9 58	LDA #858
0343	85 90	STA 144
0345	A9 03	LDA #803
0347	85 91	STA 145
0349	58	CLI
034A	60	RTS
034B	EA	NOP

Subroutine B		
034C	78	SEI
034D	A9 2E	LDA #82E
034F	85 90	STA 144
0351	A9 E6	LDA #8E6
0353	85 91	STA 145
0355	58	CLI
0356	60	RTS
0357	EA	NOP

Subroutine C		
0358	A2 04	LDX #4
035A	68	PLA
035B	48	PHA
035C	48	PHA
035D	48	PHA
035E	68	PLA
035F	68	PLA
0360	68	PLA
0361	CA	DEX
0362	D0 F6	BNE -10
0364	A9 03	LDA #803
0366	48	PHA
0367	A9 74	LDA #874
0369	48	PHA
036A	BA	TSX
036B	CA	DEX
036C	CA	DEX
036D	CA	DEX
036E	CA	DEX
036F	9A	TXS
0370	4C 2E E6	JMP ISR
0373	EA	NOP

Subroutine D		
0374	08	PHP
0375	48	PHA
0376	A5 9B	LDA 155
0378	09 10	ORA #810
037A	85 9B	STA 155
037C	68	PLA
037D	40	RTI

```

BYTSVE = $00
BRKPNT = $01
TMP0    = $FB
RDOC    = $E7EB
RDOA    = $E7A7
ERROPR  = $E7F7
USRCMD  = $3FA
WARM    = $FD56
*       = $33A
    
```

```

033A A9 4F      LDA #<BREAKP
033C 8D FA 03   STA USRCMD ; STORE START LO
033F A9 03      LDA #>BREAKP
0341 8D FB 03   STA USRCMD+1 ; STORE START HI
0344 A9 00      LDA #00
0346 85 00      STA BYTSVE ; CLEAR SAVE BYTE
0348 85 01      STA BYTSVE+1 ; AND
034A 85 02      STA BYTSVE+2 ; BREAK ADDRESS
034C 4C 56 FD   JMP WARM ; ENTER MONITOR
034F C9 42      BREAKP CMP #'B'
0351 F0 03      BEQ BRKSRV ; HANDLE BREAK?
0353 6C 7B 03   JMP(EXTCMD) ; IF NO, THEN GO
0356 A0 00      BRKSRV LDY #00
0358 A5 00      LDA BYTSVE ; FETCH LAST BYTE
035A 91 01      STA(BRKPNT),Y ; REPLACE IT
035C 20 EB E7   JSR RDOC ; SKIP DELIMETER
035F 20 A7 E7   JSR RDOA ; GET ADDRESS
0362 B0 03      BCS ADDR0K
0364 4C F7 E7   JMP ERROPR ; ERROR IF NONE
0367 A0 00      ADDR0K LDY #00
0369 B1 FB      LDA(TMP0),Y ; FETCH TARGET BYTE
036B 85 00      STA BYTSVE ; SAVE IT
036D A5 FB      LDA TMP0
036F 85 01      STA BRKPNT ; SAVE ADDRESS LO
0371 A5 FC      LDA TMP0+1 ; AND
0373 85 02      STA BRKPNT+1 ; REPEAT FOR HI
0375 98          TYA ; CLEAR 'A'
0376 91 01      STA (BRKPNT),Y ; PUT BREAKPOINT
0378 4C 56 FD   JMP WARM ; ENTER MONITOR
037B F7 E7      EXTCMD .WORD ERROPR
    
```

Machine-code debug

THIS CONCISE program was developed to simplify the debugging of machine-code routines when using the monitor program Tim, writes N Darlow of Pavenham, Bedfordshire. It allows the placement of a Break instruction, after an instruction of interest, in the program under test. In this manner, the tested program may be executed under user-control and the registers examined or modified after the breakpoint is executed.

The routine also saves and restores the byte overwritten by the break instruction so allowing systematic debugging to be achieved with the minimum of effort. The uncomplicated listing is self-explanatory. Re-location may be accomplished by altering the memory pointers at \$033B, \$0340, \$0354 and \$0355 to the appropriate values for a particular memory location area.

After entering the program with either Tim or an assembler, the link to Tim is made with the command .G 033A. This initialises the Tim user-command

extension locations and clears variable storage in page zero. The link to Tim should be made after the machine-code load routine has been used, if at all.

The routine is now ready for use and acts as an extension to the monitor command set. For example a typical debugging session may be as follows:

```

SYS(64785)
*B PC IRQ ...
C6FB E62E      Entry from Basic to machine-
                code monitor
.G 033A        Establish link to Tim, program
                already loaded
.B 0415        Set a breakpoint at $0415
.G 0400        Execute code up to break-point
*B PC IRQ ...
0416 E62E      Break entry at $0415 with
                registers displayed
.B 0430        Set next break-point at $0430,
                replace last one
.G 0415        Execute from previous break-
                point to next
*B PC IRQ ...
0431 E62E      Break entry at $0430 registers
                available for examination, etc.
    
```

As can be seen the routine is very easy to use and saves the need for monotonous cursor manipulation and remembering to replace bytes after inserting break instructions in a program.

Planet path plot

THIS PROGRAM is designed to draw on the screen the paths followed by a number of planets among a number of stars placed on the screen by the user, writes Gareth Ingram of Drayton near Abingdon, Oxfordshire. The starting positions, mass and the velocities of the planets are typed by the user and then the computer moves them step by step across the screen.

This version runs on an Apple II Plus with high-resolution graphics, but because I have no colour, the program plots only in white on black. The insertion of a few colour commands would be simple.

Input routine: The program asks for the number of stars and planets, then a page of instructions follows to show the user the format of input. If you are short of memory, this can be omitted. The user is prompted for the data at the bottom of the screen and then draws up the stars as the co-ordinates are inputted.

However, to save space, no extensive checks are made on this data. There is no means of correcting it so the program must be re-run if an error is made by the user when entering the data. After entering the necessary data, the program returns to the main routine and starts processing.

Three arrays are used to hold all the data; one holds the masses of the objects and the other two hold the co-ordinates and velocities. The velocities are in pairs, one in the horizontal direction and one vertical together giving magnitude and direction.

Now, velocity is change in distance, so the velocities are added constantly to their respective co-ordinates, and the planet appears to move along a straight line as the co-ordinates are incremented constantly by this value.

Computational routine: In the main loop, the effect of gravitational forces between the planets and stars on the planets velocities must be calculated. So that the paths bend under this influence, and the planets do not continue off in a straight line, a change in their velocities is needed.

Change in velocity is acceleration, and the acceleration is then added to the velocities to affect this change. The necessary acceleration can be calculated from Newton's laws of gravitation and motion. Now from Newton's law of gravitation the force, (F), on the planet by a star is given by:

$$F = \frac{\text{Mass of planet} \times \text{Mass of star}}{\text{separating distance squared}}$$

From this we can calculate the acceleration of the planet, (A), from:

$$A = \frac{\text{Force on planet}}{\text{Mass of planet}}$$

Yet because there are no units, the computational routine does not follow exactly these equations. If it did large jumps off the screen would occur when a

planet passes near to a large star. This is not that time-consuming, but there is a force exerted on each planet by every other body and these must all be "averaged" to find the resultant force, and so many calculations are done for each planet in turn. After all of the new velocities have been found in this way, the processing passes on to the next routine.

Plot Routine: The reason why the co-ordinates are updated now and not before is because to plot a line from the old position to the new position, both are needed. So first the old co-ordinates are retrieved and plotted, next the new value is calculated and a line drawn between them thus ensuring that the old co-ordinate is not lost first.

This is done for all of the planets in succession unless a planet is moved out of the screen range. When this happens, the planet is marked "dead" by changing its mass to zero and in future, the two main routines reject and by-pass all zero-mass planets.

Eventually, a point will be reached when all of the planets have exceeded the screen limits or been pulled into endless orbits. So, to stop the program a manual break is needed, since no integral checks are made.

Speed is a prime concern in the program, because of the long slow loops. To keep processing time to a minimum I have made two time-saving measures. Firstly, I replaced all of the constants in the main loops by variables since it takes more time to interpret an ASCII number than to simply retrieve a numerical value.

However, I have still used double-letter named variables which take marginally longer to recognise than single letter names, but the clarity gained in using multi-letter names outweighs any speed advantages. Secondly, I placed the main routines at the head of the program. This is because any GOTOs take less time because the computer looks down the line numbers until it finds the one specified.

As it stands, the program takes into account all the gravitational forces between planets. This can be useful because it makes it possible to examine the movements of large masses moving under each others gravitational influence. Like the search-moon system and binary systems.

The next step with this program is to enable it to work in three-dimensions even though it only plots a two-dimensional view. It is not difficult, and perhaps the stars as well could be made to move.

Variables:

- | | |
|----------|-----------------------------|
| NO | The number of objects |
| NP | Number of planets |
| NS | Number of stars |
| D(NO, I) | The co-ordinates of objects |
| V(NP, I) | Velocities of planets |
| M(NO) | Masses of objects |
| DX | Difference in X co-ordinate |
| DY | Difference in Y co-ordinate |
| X, Y | The maximum screen limits |
| L, N | Set to one and nought |
| AX, AY | Accelerations |
| I, K | Indexing variables in loops |

NA
R

Intermediate acceleration
Power needed in main
Computational routine, 1.5

```

100 REM -----
101 REM TRAJECTORY PLOTTER
102 REM -----
200 REM -----
201 REM BY GARETH INGRAM ON APPLE II
202 REM -----
400 REM -----
401 REM --TO SAVE TIME ALL CONSTANTS HAVE
402 REM --BEEN REPLACED BY VARIABLES --
403 REM --AND THE MAIN ROUTINE PLACED AT
404 REM --THE HEAD OF THE PROGRAM --
800 GOTO 300
900 REM -----
901 REM COMPUTATIONAL ROUTINE
902 REM -----
1000 FOR I = L TO NP
1001 IF M(I) = N THEN 200
1002 AX = N:AY = N
1003 FOR K = L TO NO
1004 IF K = I OR M(K) = N THEN 200
1005 DX = D(K,N) - D(I,N)
1006 DY = D(K,L) - D(I,L)
1007 IF DX = N AND DY = N THEN 200
1008 NA = M(K) / (DX * DX + DY * DY) R
1009 AX = AX + DX * NA:AY = AY + DY * NA
1010 NEXT
1011 D(I,N) = D(I,N) + AX:D(I,L) = D(I,L) +
1012 AY
1013 NEXT
2000 REM -----
2001 REM PLOT PROJECTILES
2002 REM -----
2010 FOR I = L TO NP
2011 IF M(I) = N THEN 300
2012 H$PLOT O(I,N),O(I,L)
2013 D(I,N) = D(I,N) + V(I,N)
2014 O(I,L) = O(I,L) + V(I,L)
2015 IF O(I,N) < L OR O(I,L) < L THEN M(I) =
2016 N:GOTO 300
2017 IF O(I,N) > X OR O(I,L) > Y THEN M(I) =
2018 N:GOTO 300
2019 H$PLOT O(I,N),O(I,L)
2020 NEXT:GOTO 1000
3000 REM ----- END -----
3010 REM ----- INITIALISE VARIABLES
3020 REM -----
3500 LOWMEM = 16384
3510 N = 0:L = 1:I = 0:K = 0
3520 AY = 0:AX = 0:NA = 0:NS = 1
3530 NO = 1:X = 279:Y = 160
3540 DX = 1:DY = 1:NP = 1:R = 1.5
4000 REM -----
4100 DISPLAY INSTRUCTIONS
4110 TEXT:HOME:PRINT "-----"
4120 INPUT "THE NUMBER OF PROJECTILES IS ";
4130 NP
4140 PRINT:PRINT:INPUT"THE NUMBER OF STARS
4150 IS ";NS
4160 NO = NS + NP
4170 IF NO = NS THEN RUN
4180 DIM V(NP,L),D(NO,L),M(NO)
4190 HOME:PRINT "YOU WILL BE ASKED TO ENTER
4200 FIVE PARAMETERS"
4210 PRINT:PRINT"FIRST THE MASS OF THE OB
4220 JECT"
4230 PRINT:PRINT"SECOND AND THIRD THE COO
4240 RDINATES OF THE OBJECT"
4250 PRINT "THESE START AS (5,5) IN THE TOP"
4260 PRINT "LEFT HAND CORNER AND GO TO (275,
4270 155)"
4280 PRINT:PRINT "FOURTH AND FIFTH FOR THE
4290 PLANETS IS THE VELOCITY IN EACH DIREC
4300 TION"
4310 PRINT:PRINT "FIRST YOU WILL ENTER THE
4320 DATA FOR THE STARS"
4330 PRINT:PRINT "PRESS ANY KEY TO CONTIN
4340 UE" :GET WS
4350 REM -----
4360 INPUT ROUTINE
4370 REM -----
4380 HGR:IF NS = N THEN 600
4390 FOR I = NP + L TO NO
4400 HOME:VTAB 21:PRINT "S"; I - NP; " ";
4410 INPUT "MASS , X , Y"; M(I),DX,DY
4420 IF DX < 4 OR DY < 4 OR DX > 276 OR DY >
4430 160 THEN PRINT "X,Y OUT OF RANGE":
4440 GOTO 600
4450 REM -----
4460 PLOT THE STAR
4470 REM -----
4480 H$PLOT DX - 2,DY - 1 TO DX + 2,DY + 1
4490 H$PLOT DX + 2,DY - 1 TO DX + 2,DY + 1
4500 H$PLOT DX - 1,DY - 2 TO DX + 1,DY - 2
4510 H$PLOT DX - 1,DY + 2 TO DX + 1,DY + 2
4520 O(I,N) = OX:D(I,L) = DY:NEXT
4530 REM -----
4540 INPUT ROUTINE
4550 REM -----
4560 FOR I = L TO NP
4570 HOME:VTAB 21:PRINT "P";I; " ";
4580 INPUT "MASS , X , Y"; M(I),D(I,N),
4590 O(I,L)
4600 IF M(I) = N THEN PRINT"MASS IS ZERO:
4610 ILLEGAL QUANTITY":GOTO 700
4620 IF D(I,N) < N OR D(I,L) < N OR D(I,N) > X
4630 OR D(I,L) > Y THEN PRINT "X,Y OUT OF RA
4640 NGE":GOTO 700
4650 INPUT "VELOCITY IN X,Y "; O(I,N),O(I,L)
4660 NEXT
4670 REM -----
4680 RETURN TO MAIN PROGRAM
4690 REM -----
7000 GOTO 100

```

ICL workshops

EASTER SUNDAY, people from all the U.K. homed in on Stoke-on-Trent. The reason was the ICL Mouse Workshop. Eddie George of ICL Kidgrove organised two mazes, oscilloscopes, EPROM programmers, various components and technical and practical advice. About 40 people and 10 mice, in various states of disarray, attended. Everyone I spoke to enjoyed the day.

One group I was particularly pleased to see was from Hayes Manor School, Middlesex. They all live about five miles from me and I had never heard of them. Later on, I noticed them writing LB Electronics on the cover of their mouse and I asked them if they were being sponsored. They said they went into the LB Electronics shop in Hillingdon and talked to the owner about sponsorship. Apparently, he became enthusiastic and has helped them with money and

by Nick Smith

components. The owner apparently said: "Someone came in last year asking for sponsorship and I turned him down. Then he went and won". That was me. I was trying to talk him into giving me stepper motors.

Vernon Gifford — the club co-ordinator of the Amateur Computer Club — was there as an observer. He is trying to organise a one-day seminar on mice/robotics probably at Imperial College in the autumn, and he has also asked me to give a talk to the Croydon ACC on July 7.

Phil Yeardeley and I were furiously working on Brainy Bricks and Sterling Mouse respectively. We both went to compete, at the invitation of the organisers, in the first Paris heat at the Sybex exhibition. We suspected that the reason why there were so few working mice in France was because it was so early in the year.

This was largely confirmed by a M. Marquis and his partner who turned up on my doorstep recently. He came to England from France to buy some spare parts for his E-type Jaguar and to see what a real mouse looked like.

Dumb animal

Pete Boyce was there with his "brainless", i.e., microless-mouse. He displayed it going up and down a straight passage. It looks rather like a flying saucer. Round the outside of the mouse are spring-loaded vertical axles, each one pivoted at the top with a wheel which sticks out on the bottom. When the mouse strays, one or more of the wheels hits a wall and is pushed in. A magnet on the axle then operates a reed switch.

One of the ICL mice was gliding up and down in a straight line, too. Apparently it can either solve mazes or move. Both lots of software were written independently

and will not work together. This has been made worse by the departure of the main programmer.

Other points noticed was a wheel that looked as if it had been pinched from last year's Swiss mouse, Lami, and a chassis with wheels that could be turned through 90°. Both ideas enable a mouse to go up, down, left and right without turning the chassis.

If you have not yet started building your mouse, you would probably have left with mixed feelings. None of the mice on display showed the slightest indication of rushing off to the centre of the maze in double quick time. So you are not far behind. On the other hand several \$10,000 man-hours say it cannot be done without some luck and the occasional prod. Time is beginning to grow short, though to give you some idea, last July I had a chassis with the motors and wheels assembled and it was connected to an output port on my micro. I had also invented my maze-solving algorithm.

Geoff Pike — my partner and mechanic — put the finishing touches to the sensors only three days before the final. I am still trying to improve the sensors. The message is that it is not the building that takes time, it is making it work.

Absolutely everyone has a problem with sensors. Seeing one couple huddled over a pair of Ultra Sonic transducers brought back memories. Another group huddled around an array of eight infra-red detectors. Someone fired a flashgun and all eight sensors detected a wall simultaneously. "They will have to go", said their leader. There really is not a best method which is universally agreed for detecting walls. The only fatal feature in sensors is hysteresis. This effectively eliminates the use of most micro switches.

Do not forget the first British heat at the On-Line Exhibition, Wembley Conference Centre, London, on July 28/31. It is a sad but true fact that the

Nick Smith with Sterling Mouse.



worse the mice the funnier they are so it should be plenty of fun.

Free stepper motors

IMPEX ELECTRICAL — a member of the giant Philips group — has written to me pointing out they it can supply a wide range of new stepper motors from about £13. It can also supply the SAA 1027 stepper motor drive integrated circuit.

Impex would be pleased to hear from anyone interested in stepper-motor applications and is happy to give practical and technical advice if required. In a generous gesture, Impex is prepared to supply a limited number of people building mice, or other novel applications, with free stepper motors. Readers should write, giving details of their application and mentioning the Micro-mouse page to: DS King General Manager, Impex Electrical, Market Road, Richmond, Surrey TW9 4ND.

Les mice à Paris

THE RESULTS of the Micromouse Competition held at the Micro Expo Exhibition in the Palais des Congrès, Paris, were as follows:

First, Nick Smith with Sterling Mouse, reaching the centre in less than 3½ minutes for which he won a Sharp Computer.

Second, Phil Yeardeley with Brainy Bricks. He did not reach the centre but made a splendid effort for which he won a pocket calculator.

In the French Competition: First Kim Mouse which did not reach the centre but made the best effort for which he won an Apple Computer. Second, Carré d'as which only went in a straight line but for its efforts won a Honeywell printer, and third Ariane who, for not much at all won a pocket calculator.

The next contest will be at the Microcomputer Show in the Wembley Conference Centre on July 30 and 31. □

The Sorcerer's Apprentices

	SORCERER Standard System	APPLE II Standard System	PET 4000 Series	TRS 80 LEVEL II With Expansion Interface
Z80 CPU	↓			↓
NUMERIC KEY PAD	↓		↓	↓
48K MEMORY	↓	↓		↓
RS 232 PORT	↓			↓
PARALLEL PORT	↓		↓	
PROGRAMMABLE GRAPHIC CHARACTERS	↓			
FULL ASC II CHARACTER SET including lower case	↓	↓	↓	↓
S100 COMPATIBLE	↓	↓	↓	↓
ROM BASIC				
CASSETTE INTERFACE				
Price for 48K with Parallel Port and Disk capacity over 300K	£1,494	£1,623 (32K only)	£1,525 (Disk capacity 150K only)	£1,535

LIVEPORT
DATA PRODUCTS

The Ivory Works, St. Ives, Cornwall TR26 2HF
Telephone: (0736) 798157

Please send me details of Exidy Computer Systems.

Name _____

Address _____

Tel. No. _____

Accounting
Business Systems

TABS

Low cost, fully integrated, modular accounting business systems.

To meet the ever increasing demand for greater business efficiency the microcomputer is now considered vital in the quest to maximise profitability.

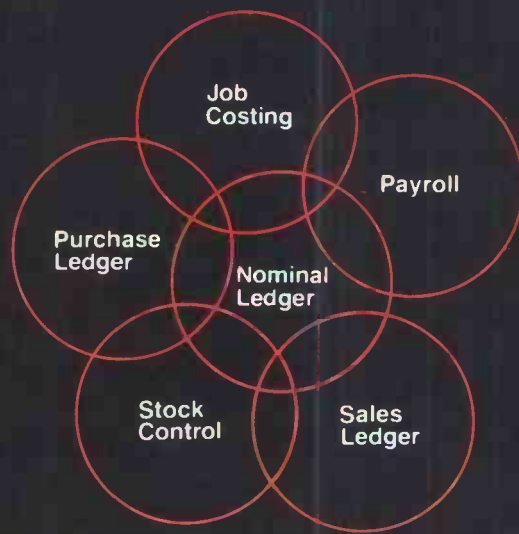
TABS, recognising the need for a simple, low cost accounting business system have developed unique, fully integrated modules for the APPLE II microcomputer which will shortly be available on PET and CPM based machines.

The modules are also designed to be flexible so that whether you run a small manufacturing company or a small retail outlet each one may be adapted to meet your individual requirements exactly.

With over 2000 modules already installed, TABS is rapidly becoming the number one choice for accounting business systems.

Remember, TABS accounting business systems, the red and black way to increase your profits.

Available through our national dealer network or from TABS Ltd, The Old Rectory, Blackford, Yeovil, Somerset.



Minimum System: Apple 48K, VDU, Disk with Controller, Disk without Controller, Sales Ledger Module, Silentype Printer, TABS Firmware Card. Price from £2,250.

Capacity: 400 Customers, 400 Suppliers, 1000 Stock Items.



Maximum System: Apple 48K, Cameo Controller, Ampex 10MB Disk, Paper Tiger Printer, VDU, TABS Business Software. Price from £6,500

Capacity: Over 2000 Customers, over 2000 Suppliers, over 10,000 Stock Items.

Modules include: Sales Ledger, Purchase Ledger, Nominal Ledger, Payroll, Job Costing, Stock Control and Word Processing.

Modules from

£99

TABS, the accounting business systems from TABS Ltd.

Participating Dealers:

LONDON Data Management Systems (N1) 01-739 8692/8695. West London Microcentre (W12) 01-743 9000. Time & People Ltd (EC4) 01-242 4706. AVON DataLink Microcomputer Systems Ltd 0272 213427. CAMBRIDGESHIRE Top Mark Computers 0480 212563. CHESHIRE Kestrel Computers 0625 532535. CORNWALL Diskwise Ltd 05793 3780. DEVON Devon Computers 0803 526303. NICORTEC Ltd 0752 669801. ESSEX Compuskill 0708 751906. MEECE Company 03708 5047. GREATER MANCHESTER Shannons Radio Ltd 061-748 2339. HAMPSHIRE Logan Electronics (UK) Ltd 0425 619761/619786. ACCESS CONTROL Systems Ltd 0730 5274. HERTS. Thorpe Management Technology Ltd 0707 55453. KENT Microspot 0622 858753. MICROLIN Computers Ltd 0732 845412/882759. LINCOLNSHIRE Estate Computer Systems 0529 305637. MERSEYSIDE Rockcliffe, Microcomputer Division 051-521 5830. MIDDLESEX Granada Processing Systems Ltd 01-560 1200. MICRO SOLVE Computer Services Ltd 01-951 0218/910. NORTHAMPTONSHIRE Co-Compute Ltd 0604 33767. OXFORD Courtland Electrical Ltd 0865 779282. SURREY Phillips Business Systems 04862 66096. VEGA Computers Ltd 01-680 4484. SUSSEX Supabeam Computers 0403 61647. GUESTEL Computers Ltd 0273 695264. LEWIS & CO 0293 542244. DATEX MICRO 0903 39290. IDT Computers 044-483 370. SOUTH HUMBERSIDE Computer Facilities Ltd 0724 63167. SHROPSHIRE Cressage Computer Services 0743 69009. WEST MIDLANDS Westwood Computers Ltd 021-632 5824. WORCESTERSHIRE Mike Dennis Associates 0386 48240. CAPRICOM Computers 0905 21541. YORKSHIRE Hallam Computers 0742 663125. SAVILLE DATA SYSTEMS 0904 37700. SCOTLAND Scotbyte Computers Ltd 031-343 1005. WALES Tryfan Computers 0248 52042.

Our thanks to the dealers who have contributed to this advertisement.

If you are interested in TABS low cost Accounting Business Systems, please tick box(es) and return this coupon to us.

User enquiry

- Please send me an invitation to a free seminar.
- Please send me the TABS User Manual (I enclose £5 (postage and packing included))

Dealer enquiry

- Please send me details of your Dealer Plan

NAME _____

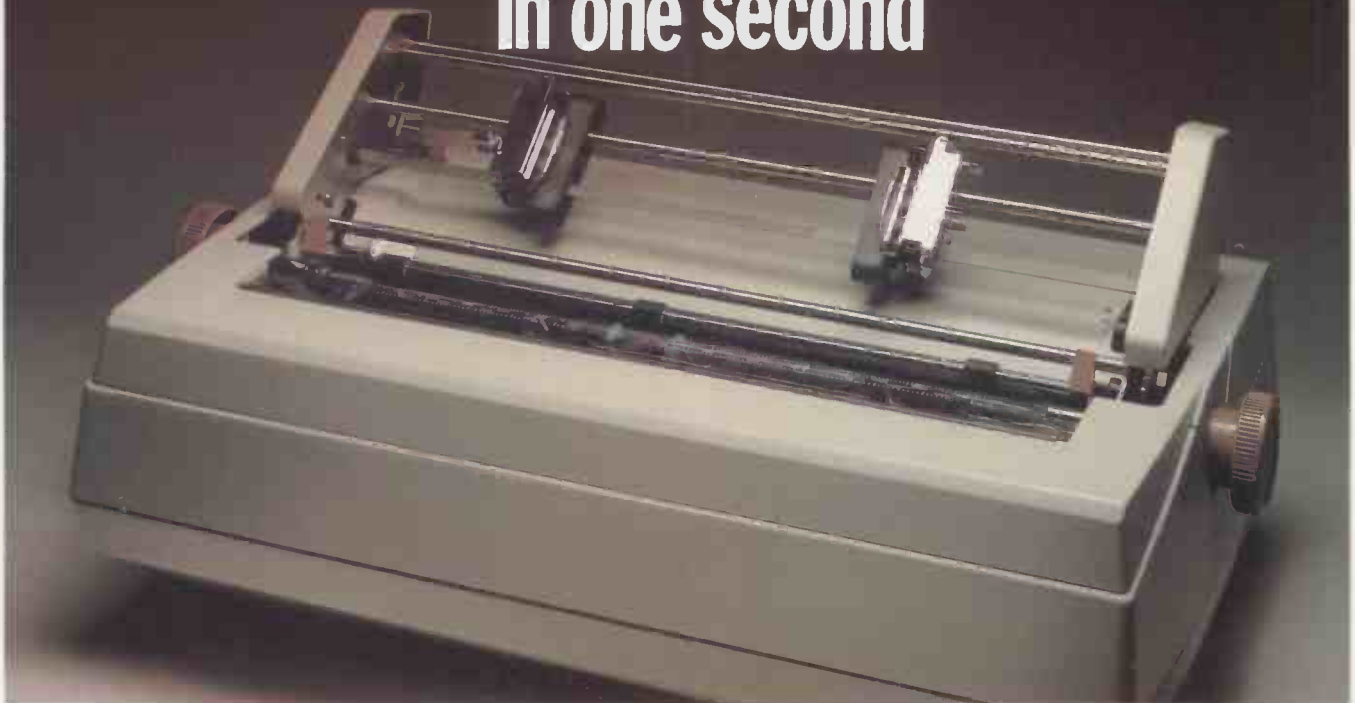
ADDRESS _____

Tel. No. _____

TABS Ltd, The Old Rectory, Blackford, Yeovil, Somerset.
Telephone: North Cadbury (0963) 40164. PC6/81

Accounting Business Systems
TABS

0 to 60^{ch's} in one second



THE RICOH 1600S

If it's high performance you're looking for, the Ricoh 1600S is for you, offering an amazing 60 characters in just 1 second. An updated version of the tried-and-tested 1600, the new S model has been re-designed and fitted with all sorts of extras. Yet one thing hasn't changed — the price, making the 1600S cheaper than any equivalent model on the market. This superb performer incorporates the Z80 micro-processor, auto bidirectional printing and look-ahead logic, increasing speed and efficiency. Other capabilities include proportional spacing, graph plotting and word processing enhancements. The printer includes a standard centronics interface, and RS232 and IEEE options are available.

The Ricoh 1600S is available only from Micropute and their authorised dealers, all backed up with a nationwide service network. If you're interested in the 1600S either as a customer or as a dealer, send the coupon now.

"Picture shows 1600s fitted with tractor feed option"

Please send me details on the Ricoh 1600S.

Name _____
 Position _____
 Company _____
 Address _____
 Tel. No _____

**RICOH 1600S THE PERFORMANCE HAS
 RISEN — THE PRICE HASN'T**

FEATURES COMPETITORS

	DIABLO 630	QUME SPRINT 5	SPIN- WRITER	RICOH RP.1600 (10 DATA)	RICOH RP.1600S
PRINT SPEED (CPS)	40	45/55	55	60	60
PRINT ELEMENT	DAISY- WHEEL	DAISY- WHEEL	THIMBLE	DOUBLE DAISY- WHEEL	DOUBLE DAISY- WHEEL
AUTO BIDIRECTIONAL	Yes	No	No	No	Yes
AUTO LOGIC SEEKING	Yes	No	Yes	No	Yes
PROPORTIONAL PRINT CAPABILITY	Yes	Yes	Yes	No	Yes
EXTENDED CHARACTER SET	No	No	Yes	Yes	Yes
LETTER QUALITY PRINT	Yes	Yes	Yes	Yes	Yes
CUSTOM INTER- FACE OPTION	No	No	No	No	Yes
PRICE	£1675	£1950	£1950	£1450	£1450

The above information was gathered from distributors and abstracted from their current literature. Prices shown are those advertised at the present time.

MICROPUTE
microcomputer systems

9 Prestbury Road, Macclesfield, Cheshire.
SK10 1AU. Tel: Macclesfield 612759

• Circle No. 180

Who do you call when you're out?



When you need supplies and you need them fast, call the Word Processing specialists - WBM.

As distributors of DIABLO, DISAN, QUME, VERBATIM, VIKING ACOUSTIC, and NASHUA, we have everything you need - and a delivery service that is second to none.

Keep our telephone number where you'll find it in a hurry.



BUSINESS SUPPLIES LIMITED
Supporting the Word Processing Revolution

Hipley Street,
Old Woking, Surrey
Telephone Bysfleet 40471

Programming standard Pascal

By R C Holt and J N P Hume. Published by Prentice Hall International, 380 pages, paperback. Price £7.75; ISBN 0-8359-5690-3. Available from any bookshop.

PASCAL is a high-level programming language which is gaining widespread popularity — especially among micro-computer users and in universities and polytechnics. As an Algol-like language, powerful enough to support most programming applications, yet simple enough that compilers can be implemented for all but the smallest machines, it is deservedly replacing Basic and machine-level languages for more and more tasks.

There is no accepted standard for Pascal. The most widely-quoted standard is the Pascal User Manual and Report by Jensen and Wirth, but that is known to contain defects and ambiguities.

The British Standard Institute proposal to ISO for a new international standard has not yet been agreed. Meanwhile, the UCSD Pascal implementation has become used very widely, and many people regard UCSD as the effective industry standard.

Many universities have decided to teach Pascal because it is easy to teach and to learn, and because it supports the structured programming approach to good programming style.

Excellent example

This new book from Holt and Hume has developed from courses in the computer science department of the university of Toronto — it is an excellent example of a modern, introductory programming language course.

After a brief introduction to computers, the features of Pascal are described in eight chapters, each of which provides a richer, self-contained subset of the full language. Pascal subset one, PS1, is sufficient to write complete programs which print out the results of simple calculations, and each of the subsets which follow, PS2 to PS8, introduces new features, enriching the language and

expanding the range of problems which can be solved.

The chapters which describe each language subset are well-illustrated with plentiful examples of complete programs. Each chapter concludes with a detailed summary of the new material and with a number of very good exercises.

The whole approach is designed to start the reader programming in Pascal as early as possible and as much as possible, so that good habits can be formed and reinforced from the beginning.

Between the chapters which introduce new language features are others which contain advice on program design. They teach the techniques which lead to correct programs and which consolidate earlier material. Many examples are concerned with sorting and searching, with manipulation of text and with data structures.

The authors have avoided the trap of regarding Pascal as primarily a language for numerical programming, while providing a valuable short chapter on numerical methods for those who want it.

The final chapters of the book go beyond just teaching programming and Pascal, to provide comparison with PL/1, Fortran 77, Cobol and Algol W, to introduce assembly language programming and machine simulators and to demonstrate the design of a simple compiler. Appendices contain summaries and syntax charts.

The final Pascal subset described, PS8, is less than full Pascal as defined by Jensen and Wirth. The authors have deliberately omitted GOTO statements, sets, variant records, and subprograms as parameters. That is unfortunate — although the ease with which the authors have avoided the need for GOTO should impress many less-disciplined programmers — but the omission is a minor one.

The care which has gone into the order of presentation of Pascal features, the meticulous proof reading, the excellent examples and index all make this a book far above average.

Conclusions

● It is an excellent introduction to programming and to Pascal, strongly recom-

mended both for newcomers to programming and to experienced programmers who wish to learn Pascal.

Martyn Thomas

Musical applications of microprocessors

By Hal Chamberlain Hardback 660 pages. £15.80. John Wiley and sons.

THIS substantial volume purports to be a comprehensive guide to one of the more exciting applications of micro-computers, musical synthesis. The book is very much a product of the age in which we live — it seems that everywhere we go that our lives are dominated by both computers and music. In the supermarket, constant musak and micro-processor-controlled tills are the order of the day; pop music plays constantly on the radio where program controllers use desk-top computers to select their playlists — music and computers are everywhere.

Many people do not realise the impact that microprocessors and the new technology have already made on the music we hear. An increasing amount of our music diet is already performed on instruments which employ the latest silicon-chip technology. A large percentage of modern music will have been recorded in studios that employ microprocessors. The latest development is the introduction of digital recording techniques.

Wide subject

The subject is rather a wide one and so to simplify the matter, the book has been split into three sections. The first of the three sections covers the necessary background material, and also provides the reader with an overview of the subject. Chamberlain states that this is a subject which "encompasses the disciplines of physics, mathematics and computer programming", and everything in between.

Chapters included in this section cover such topics as: basic principles, voltage-control methods, and micro-processors. A particularly-interesting part of the first chapter covers the history of electronic sound synthesis.

The first section would stand up as a work in its own right but the real meat of the book is included in the second two

sections. Devoted to the twin subjects of computer control of analogue synthesisers and purely digital synthesising techniques, these two sections are a complete course in the subject. The first section must be read or at least glanced at first before proceeding to the next two otherwise an inexperienced reader may find himself in deep water. This is not because of any failing in Hal Chamberlain's excellent book, but has much to do with the fact that there is no point buying expensive hardware if you do not yet know what you want to do with it.

Computer-controlled analogue synthesis is the title of the second section and should be fairly self-explanatory. The section deals with the micro-computer as a controlling device. Since control is the primary use for which micro-processors were developed, it is a relatively-simple section — relative, that is, to the third and final section. This section opens with an evaluation of the elements of analogue synthesis, describing the various elements such as the voltage-controlled oscillator and filters, etc.

Digital synthesis

There is a chapter on digital-to-analogue and analogue-to-digital conversion, another on signal routing. Again, as in the rest of the book, these chapters are useful in their own right. The rest of this section is devoted to interfacing.

The last section is bigger than the two — almost half the book in fact — and it deals with the digital synthesis of music. Chapters included discuss digital tone — generation techniques, digital filtering techniques, generating percussion sounds, hardware and software. The chapter on software introduces a custom-written language for the generation of music called Notran.

Conclusions

- This work is an excellent reference book dealing with an interesting microprocessor application.
- Each chapter forms a reference work in its own right.
- At slightly less than £16 this book is excellent value as it contains information which could only otherwise be found in a number of other works.

Bill Bennett



topmark
computers

NEW!



NEW!

FORTAN

(needs language card)

Send only £120 + VAT £18 (Fortran only) or £419 + VAT £62.85 (complete system, includes Pascal and language card)

NEW! NEW! NEW!

NEW! DOS 3.3 — much improved capacity £40 + VAT £6

NEW! Eurocolour card — vastly superior to previous version £113 + VAT £16.95

Official Government and Educational orders accepted.

Contact Tom Piercy at Topmark Computers, 77 Wilkinson Close, Eaton Socon, St Neots, Cambs. PE19 3HJ Huntingdon (0480) 212563

• Circle No. 182

NASCOM SOFTWARE

We offer the following quality software for NASCOM systems:

NASPAS — a 12K PASCAL compiler which produces Z80 code directly i.e. no P code. The compiler offers floating point and integer arithmetic, arrays, sets, strings and all major Pascal statements together with fully recursive functions and procedures with value and variable parameters. The object programs run very quickly.
Price: £35.00.

NASMON — a new monitor for NASCOMs. Occupies 4K and includes a sophisticated screen editor, a 'front panel' mode, blocked and buffered tape routines and powerful debugging commands.
Price: £30.00 in EPROM.

BAS12K — a 12K BASIC Interpreter offering 11 digit precision arithmetic, PRINT USING, IF... THEN... ELSE and other advanced features.
Price: £25.00.

NASGEN — a fast 3K assembler generating a full symbol table and with many assembler directives and commands.
Price: £15.00 on tape, £25.00 in EPROM.

NASMEM — a 2K disassembler which interfaces to NASMON's front panel to produce single step disassembly. Optionally it produces labels, and o/p may be directed to a text buffer suitable for NASGEN.
Price: £10.00 on tape, £15.00 in EPROM.

All the above software runs under NASMON except NASPAS which can run under NASMON or NAS-SYS. All prices are fully inclusive.

FREE: a free CHESS program with every order of NASMON.

Full details may be obtained from:

HISOFT 60 Hallam Moor, ULDEN, SWINDON, Wiltshire

• Circle No. 183

D BRUCE ELECTRONICS

THE BEACON,
BLACKHALL ROCKS
CLEVELAND TS27 4BH
Tel. (0783) 863612

dimensions
75 x 50 x 28mm



The KSI is a single connection to the Sinclair ZX80. FOR EVERY keyboard entry the KSI gives you a short Bleep. The KSI is also supplied with the probe and power supply lead which are already made up, also a diagram is supplied.

A simple connection to the hole already on the Sinclair mainboard takes 5 minutes.

The keyboard sounder adds realism to the Sinclair ZX80 and also cuts eye fatigue. The total cost including p/p is only £15.

• Circle No. 184

Routines to improve your Pet's display

IN LAST month's article we examined some simple machine-code programs designed to improve the graphics display capability of the Pet. The functions included cursor control which allows the cursor to be moved to specific co-ordinates on the screen where a Print statement will be used to display text or graphics on the line following the cursor position.

The calculation of a screen-memory address from co-ordinate values is essential to any machine-code graphics routine. This is done by a routine common to most of the program in these articles and for this reason is repeated again in listing 1.

This month we look at three more routines, filling a block of the screen with a specified character, reverse-fielding a block of the screen and drawing borders around a specified part of the screen. The program in listing 5 is a Basic loader for all the machine-code routines looked at so far in this series.

Block is a routine which fills a designated block of the screen with a previously-defined character. This is done by a process of repeatedly drawing horizontal lines. The number of lines is equal to the block height and the line length equals block width. The position of

Example 1.

```
10 POKE 86,10 : REM START AT COLUMN # 10
20 POKE 87,10 : REM ON LINE # 10
30 POKE 88,8 : REM BLOCK WIDTH 8 CHARACTERS
40 POKE 89,5 : REM BLOCK HEIGHT 5 CHARACTERS
50 POKE 0,42 : REM USE STAR CHARACTERS FOR BLOCK
60 SYS(30470) : REM CALL SUBROUTINE
```

Example 2.

```
10 POKE 86,10 : REM START AT COLUMN # 10
20 POKE 87,10 : REM ON LINE # 10
30 POKE 88,8 : REM BLOCK WIDTH 8 CHARACTERS
40 POKE 89,5 : REM BLOCK HEIGHT 5 CHARACTERS
50 SYS(30510) : REM CALL SUBROUTINE
```

Example 3.

```
10 POKE 86,10 : REM TOP LEFT CORNER AT COLUMN # 10
20 POKE 87,5 : REM ON LINE # 5
30 POKE 88,20 : REM BORDER WIDTH 20 CHARACTERS
40 POKE 89,15 : REM BORDER HEIGHT 15 CHARACTERS
50 SYS(30090) : REM CALL SUBROUTINE
```

the top-left corner of the block is determined by two variables — column number and line number.

The width of the block can be any integer value with a minimum of 1 and a maximum of 255 character spaces. The height of the block can be any integer value with a minimum of 1 and a maximum of 255. In practice, of course, the maximum block size will be the whole screen. A variable allows the character used to fill the block to be defined in the Basic calling program. The variable locations required by the routine are as follows:

- 86. column number of block start — top left-hand corner.
- 87. screen line number of block start — top-left corner.
- 88. width of block
- 89. height of block.
- 00. ASCII code value of character used in block.

The routine is called from a Basic program with the command:
SYS(30470)

Some example applications for this function:

- To give background characters in graphics
- To highlight data displayed in block area.
- If the character used is a space, this function can be used to erase blocks of the screen.

Example 1 shows a Basic program

by Nick Hampshire

which uses this routine. Listing 3 is the reverse field block of screen.

INVT will reverse the field of all characters within a given block of screen area. This routine is very similar to the routine for filling a block of the screen with a specified character. Instead of putting a character into each memory location in the block, the current contents are read, an exclusive "or" operation performed on it and the result stored in the same location.

The position of the top-left of the block is determined by two variables — column number and line number. The width of the block can be any integer value with a minimum of 1 and a maximum of 255 character spaces. The height of the block can be any integer value with a minimum of 1 and a maximum of 255, though in practice, the maximum size of the reverse-field area is the whole screen. The variable locations required by the routine are as follows:

- 86. column number of reverse block start top-left corner.
 - 87. screen line number of reverse block start.
 - 88. width of reverse block area.
 - 89. height of reverse block area.
- The routine is called from a Basic program with the command:

SYS (30510)

Some example applications for this function:

- To highlight specific sets of data.
- By repeating calling this function with a program loop on the same text area a flashing message can be generated, ideal for error and warning signs.

Example 2 shows a Basic program which uses this routine.

BORD will draw a thin line border around a specified area of the screen. The position of the top-left corner of the border can be any integer value with a minimum of 1 and a maximum of 255 character spaces.

The height of the border can be any integer value with a minimum of 1 and a



maximum of 255. In practice, the maximum size of the border is around the outside edge of the screen. The variable locations required by the small routine are as follows:

- 86..... column number of border start top-left corner.
- 87..... screen line number of border start.
- 88..... width of border.
- 89..... height of border.

The routine is called from a Basic program with the command:
SYS (30090)

Some example applications for this function:

- Enhance the screen appearance by putting a border around the screen edge.
- To identify associated data items by dividing the screen into sub-screen areas using borders to isolate each area.
- To isolate graphical displays from text, etc.

Example 3 is a Basic program which uses routine. All the programs in this series of articles are taken from *Pet graphics* by Nick Hampshire. This book is published by Computabits Ltd price £10.

Listing 1.

```

0066 7400 ;*****
0067 7400 ;* ROUTINE TO CALCULATE SCREEN ADDRESS
0068 7400 ;* FROM VALUES FOR COLUMN AND LINE
0069 7400 ;* COLUMN IN $56, LINE IN $57
0070 7400 ;* ADDRESS RETURNED IN $54 AND $55.
0071 7400 ;* THIS ROUTINE IS ONLY CALLED BY OTHER
0072 7400 ;* ROUTINES IN THE PACKAGE, DO NOT
0073 7400 ;* USE BY ITSELF IT WILL CAUSE PET
0074 7400 ;* TO CRASH SINCE REGISTERS ARE NOT
0075 7400 ;* SAVED ON STACK.
0076 7400 ;* ERROR FLAG IN LOCATION $01
0077 7400 ;*****
0078 7400 ;
0079 7400 A9 00 ADR1 LDA #$00
0080 7402 85 01 STA T9
0081 7404 A5 56 LDA T3
0082 7406 30 33 ADR2 BMI ERROR1 ;COLUMN < 0 ?
0083 7408 C9 28 CMP #$28
0084 740A B0 3A BCS ERROR2 ;COLUMN > 40 ?
0085 740C A5 57 LDA T4
0086 740E 30 41 BMI ERROR3 ;LINE < 0 ?
0087 7410 C9 19 CMP #$19
0088 7412 B0 48 BCS ERROR4 ;LINE > 25 ?
0089 7414 A9 00 LDA #$00
0090 7416 85 54 STA T1
0091 7418 85 55 STA T2
0092 741A A5 57 LDA T4
0093 741C F0 0F BEQ COLUMN ;LINE = 0
0094 741E AA TAX
0095 741F 18 LINE CLC
0096 7420 A5 54 LDA T1
0097 7422 69 28 ADC #$28 ;ADD 40 TO ADDRESS
0098 7424 85 54 STA T1
0099 7426 90 02 BCC LINE2
0100 7428 E6 55 INC T2
0101 742A CA LINE2 DEX
0102 742B D0 F2 BNE LINE ;ANOTHER LINE ? DO AGAIN
0103 742D 18 COLUMN CLC
0104 742E A5 54 LDA T1
0105 7430 65 56 ADC T3 ;ADD COLUMN # TO ADDRESS
0106 7432 85 54 STA T1
0107 7434 A5 55 LDA T2
0108 7436 69 80 ADC #$80 ;ADD SCREEN STARTING ADDRESS
0109 7438 85 55 STA T2
0110 743A 60 RTS
0111 743B ;
0112 743B ;
0113 743B ;
0114 743B A9 01 ERROR1 LDA #$01 ;SET ERROR FLAG
0115 743D 85 01 STA T9 ;STORE IN 01
0116 743F A9 00 LDA #$00
0117 7441 85 56 STA T3 ;SET COLUMN TO 0
0118 7443 4C 06 74 JMP ADR2 ;CALCULATE ADDRESS
0119 7446 A9 02 ERROR2 LDA #$02
0120 7448 85 01 STA T9
0121 744A A9 27 LDA #$27 ;SET COLUMN TO 40
0122 744C 85 56 STA T3
0123 744E 4C 06 74 JMP ADR2
0124 7451 A9 03 ERROR3 LDA #$03
0125 7453 85 01 STA T9
0126 7455 A9 00 LDA #$00 ;SET LINE TO 0
0127 7457 85 57 STA T4
0128 7459 4C 06 74 JMP ADR2
0129 745C A9 04 ERROR4 LDA #$04
0130 745E 85 01 STA T9
0131 7460 A9 18 LDA #$18 ;SET LINE TO 25
0132 7462 85 57 STA T4
0133 7464 4C 06 74 JMP ADR2
0134 7467 ;
0135 7467 ;

```

Listing 2.

```

0644 7706 ;*****
0645 7706 ;* FILL A BLOCK OF THE SCREEN WITH A
0646 7706 ;* SPECIFIED CHARACTER. CHARACTER

```

(continued on next page)

io systems Ltd.

VERY HIGH RESOLUTION FOR NASCOM 2

380 x 220 individually addressable points

FEATURES:

- fully bit mapped from dynamic RAM
- software controlled
- software supplied for point-plot, line-draw, — block-shading and display control
- mixed text and graphics
- real time plotting
- display size variable to suit memory available

Price **£55** + 15% VAT (post free)

EPROM PROGRAMMER

FEATURES:

- programs: 3-rail : 2708, 2716
- and single rail : 2758, 2508
- 2716, 2516
- 2732, 2532
- EPROM type selected by plug-in modules — 3 modules supplied with simple wiring diagrams for all EPROM types
- driven from NASCOM 1 or 2 PIO
- powered from NASCOM and transformer (supplied)
- software supplied for READ/PROGRAM/VERIFY
- ** CAN BE USED WITH OTHER MACHINES WITH 2 PARALLEL PORTS

Price **£63** + 15% VAT (post free)

Both products built and fully tested supplied with comprehensive documentation and full instruction for simple installation. Send SAE for free data sheets

AVAILABLE NOW direct from:

NASCOM GRAPHICS

6 Laleham Ave., Mill Hill
London NW7 3HL tel. 01-959 0106

• Circle No. 185

Meet people on your wave length immediately though **RAPPORT**, the intelligent person's introduction service.

All ages, nationwide. Send stamp and age for details:

RAPPORT, Dept RB,
P.O. Box 94, Oxford

• Circle No. 186

STOKE on TRENT

for
TUSCAN
and
TANGERINE
and
VIDEO GENIE + SOFTWARE
and
BOOKS

MICRO-PRINT Ltd.,
59, Church Street, Stoke on Trent.
(0782) 48348. Barclaycard and Access

• Circle No. 187

EPROM Erasure at low prices.

Chiptech ultraviolet erasers have been designed primarily for economy in situations that have a low throughput.

Although low cost, they are also the fastest and most efficient erasers of their size.

All models are fitted with 600-hour UV tubes, safety interlocks and housed in gold anodised aluminium casings.

PE 14 6 chips £56.00
PE 14T 6 chips £76.58



prices exclude delivery and VAT

PE 24T 9 chips
£111.22



For larger systems users, model PE 24T has a double tube construction and automatic shut-off with 60 minute timer.



Chiptech Limited

Chiptech Limited.
Tewin Court, Welwyn Garden City,
Herts. AL7 1AU
Tel (07073) 32140. Telex 8953451

• Circle No. 188

(continued from previous page)

```

0647 7706 ; * STORED IN $00, TOP LEFT COORDINATES
0648 7706 ; * IN $56 (COL) AND $57 (LINE), HEIGHT
0649 7706 ; * OF BLOCK IN $59, WIDTH IN $58
0650 7706 ; * ROUTINE CALLED BY - SYS(30470)
0651 7706 ; *****
0652 7706 ;
0653 7706 ;
0654 7706 48 BLOCK PHA
0655 7707 98 TYA
0656 7708 48 PHA
0657 7709 8A TXA
0658 770A 48 PHA
0659 770B 20 00 74 JSR ADR1
0660 770E A6 59 LDX T6
0661 7710 A4 58 BLOCK1 LDY T5 ;FILL LINE WITH
0662 7712 89 DEY ;CHARACTER
0663 7713 A5 00 BLOCK2 LDA T8
0664 7715 91 54 STA (T1),Y
0665 7717 88 DEY
0666 7718 10 F9 BPL BLOCK2
0667 771A 18 CLC
0668 771B A5 54 LDA T1 ;CALCULATE START OF
0669 771D 69 28 ADC #$28 ;NEXT LINE
0670 771F 85 54 STA T1
0671 7721 90 02 BCC BLOCK3
0672 7723 E6 55 INC T2
0673 7725 CA BLOCK3 DEX
0674 7726 D0 E8 BNE BLOCK1
0675 7728 68 PLA
0676 7729 AA TAX
0677 772A 68 PLA
0678 772B A8 TAY
0679 772C 68 PLA
0680 772D 60 RTS
0681 772E

```

Listing 3.

```

0683 772E *****
0684 772E ; * INVERT A BLOCK OF THE SCREEN
0685 772E ; * TOP LEFT COORDINATES IN $56 (COL)
0686 772E ; * AND $57 (LINE), HEIGHT OF BLOCK
0687 772E ; * IN $59, WIDTH IN $58
0688 772E ; * ROUTINE CALLED BY - SYS(30510)
0689 772E ; *****
0690 772E ;
0691 772E ;
0692 772E 48 INVT PHA
0693 772F 98 TYA
0694 7730 48 PHA
0695 7731 8A TXA
0696 7732 48 PHA
0697 7733 20 00 74 JSR ADR1
0698 7736 A6 59 LDX T6
0699 7738 A4 58 INVT1 LDY T5
0700 773A 88 DEY
0701 773B B1 54 INVT2 LDA (T1),Y ;READ SCREEN CHARACTER
0702 773D 49 80 EOR #$80 ;INVERT IT
0703 773F 91 54 STA (T1),Y ;AND REPLACE ON SCREEN
0704 7741 88 DEY
0705 7742 10 F7 BPL INVT2
0706 7744 18 CLC
0707 7745 A5 54 LDA T1
0708 7747 69 28 ADC #$28
0709 7749 85 54 STA T1
0710 774B 90 02 BCC INVT3
0711 774D E6 55 INC T2
0712 774F CA INVT3 DEX
0713 7750 D0 E6 BNE INVT1
0714 7752 68 PLA
0715 7753 AA TAX
0716 7754 68 PLA
0717 7755 A8 TAY
0718 7756 68 PLA
0719 7757 60 RTS
0720 7758

```

Listing 4.

```

0373 758A *****
0374 758A ; * DRAW A BORDER OF ANY SIZE AND ANY
0375 758A ; * LOCATION. TOP LEFT COORDINATES ARE
0376 758A ; * COLUMN IN $56, AND LINE IN $57
0377 758A ; * WIDTH IN $58 AND HEIGHT IN $59
0378 758A ; * ROUTINE CALLED BY - SYS(30090)
0379 758A ; *****
0380 758A ;
0381 758A ;

```




```

0382 758A 48      BORD PHA
0383 758B 98      TYA
0384 758C 48      PHA
0385 758D 8A      TXA
0386 758E 48      PHA
0387 758F 20 00 74 JSR ADR1      ;TOP LEFT ADDRESS
0388 7592 A5 54    LDA T1        ;SAVE TOP LEFT ADDRESS
0389 7594 85 56    STA T3        ;IN $56 AND $57
0390 7596 A5 55    LDA T2
0391 7598 85 57    STA T4
0392 759A A9 64    LDA #*64
0393 759C 85 00    STA T8
0394 759E 20 FA 75 JSR HBORD     ;DRAW TOP HORIZONTAL
0395 75A1 18      CLC
0396 75A2 A5 54    LDA T1        ;FOR VERTICAL LINES
0397 75A4 69 29    ADC #*29     ;TOP ADDRESS = TOP
0398 75A6 85 54    STA T1        ;ADDRESS + 40.
0399 75A8 85 56    STA T3
0400 75AA A5 55    LDA T2
0401 75AC 69 00    ADC #*00
0402 75AE 85 55    STA T2
0403 75B0 85 57    STA T4
0404 75B2 A9 65    LDA #*65
0405 75B4 85 00    STA T8
0406 75B6 20 04 76 JSR VBORD     ;DRAW LEFT VERTICAL
0407 75B9 18      CLC
0408 75BA A5 56    LDA T3        ;TOP VERTICAL ADDRESS
0409 75BC 65 58    ADC T5       ;= TOP VERTICAL + WIDTH
0410 75BE 85 54    STA T1
0411 75C0 C6 54    DEC T1
0412 75C2 A5 57    LDA T4
0413 75C4 69 00    ADC #*00
0414 75C6 85 55    STA T2
0415 75C8 A9 67    LDA #*67
0416 75CA 85 00    STA T8
0417 75CC 20 04 76 JSR VBORD     ;DRAW RIGHT VERTICAL
0418 75CF A5 56    LDA T3
0419 75D1 85 54    STA T1
0420 75D3 A5 57    LDA T4
0421 75D5 85 55    STA T2
0422 75D7 A6 59    LDX T6       ;BOTTOM LEFT ADDRESS
0423 75D9 C6 54    DEC T1
0424 75DB CA      DEX
0425 75DC CA      DEX
0426 75DD 18      CLC          ;CALCULATED
0427 75DE A5 54    LDA T1
0428 75E0 69 28    ADC #*28     ;ADD 40 TO ADDRESS
0429 75E2 85 54    STA T1       ;EQUAL TO BOTTOM LEFT
0430 75E4 A5 55    LDA T2
0431 75E6 69 00    ADC #*00
0432 75E8 85 55    STA T2
0433 75EA CA      DEX          ;DO AGAIN UNTIL HEIGHT
0434 75EB D0 F0    BNE BORD1    ;IN X REG =0
0435 75ED A9 63    LDA #*63
0436 75EF 85 00    STA T8
0437 75F1 20 FA 75 JSR HBORD     ;DRAW BOTTOM HORIZONTAL
0438 75F4 68      PLA
0439 75F5 AA      TAX
0440 75F6 68      PLA
0441 75F7 A8      TAY
0442 75F8 68      PLA
0443 75F9 60      RTS
0444 75FA A4 58    HBORD LDY T5     ;LINE LENGTH
0445 75FC A5 00    HBORD1 LDA T8     ;CHARACTER FOR LINE
0446 75FE 91 54    STA <T1>,Y   ;DISPLAY AT ADDRESS,Y
0447 7600 88      DEY
0448 7601 D0 F9    BNE HBORD1   ;END OF LINE?
0449 7603 60      RTS
0450 7604 A0 00    VBORD LDY #*00
0451 7606 A6 59    LDX T6
0452 7608 CA      DEX
0453 7609 CA      DEX
0454 760A A5 00    VBORD1 LDA T8
0455 760C 91 54    STA <T1>,Y
0456 760E 18      CLC
0457 760F A5 54    LDA T1       ;LOCATION FOR NEXT
0458 7611 69 28    ADC #*28     ;CHARACTER
0459 7613 85 54    STA T1
0460 7615 A5 55    LDA T2
0461 7617 69 00    ADC #*00
0462 7619 85 55    STA T2
0463 761B CA      DEX
0464 761C D0 EC    BNE VBORD1   ;END OF LINE?
0465 761E 60      RTS
0466 761F

```

Listing 5.

10 REM *****

20 REM *BASIC LOADER FOR MACHINE CODE

30 REM *GRAPHICS ROUTINES

(continued on next page)

TANDY TRS 80 FULL SALES & SERVICE IN BRADFORD

Printers	£
Microline 80	336.00
Microline 83	768.00
Epson MX80	360.00
Expansion	
Interface 32K	283.00
Teac Disk Drive	236.00
Twin Teac	440.00

DISKETTES

5 1/4" High quality diskettes	£19.20
8" High quality diskettes	£24.95

WE BUY AND SELL SECOND
HAND TRS-80
All prices exclusive of VAT

815

**BRIARWOOD COMPUTER
SERVICES LIMITED**

Briarwood House, Preston Street,
Bradford, West Yorkshire, BD7 1NS.
Tel: (0274) 306018

• Circle No. 189

avrohurst LTD.

- Systems Analysis & Programming
 - QUANTITY SURVEYING SYSTEMS
 - Payroll, Accounting & Invoicing
 - Hardware and Software sales
- Enquiries

Avrohurst Ltd., 57, High St.,
Ingatstone, Essex. CM4 0AT
Tel: Ingatstone 4022

• Circle No. 190

LINCOLNSHIRE APPLE DISTRIBUTORS

Stocks of Apples and most accessories Texas, Qume & Paper Tiger Printers 8" Discs, Corvus Disks for Apples.

SOFTWARE

Financial Planning Databases Mailing
Visicalc Accounts Word Processing.
Also the well known "Estate Computer Systems" Estate Agents Package in use throughout the U.K.

ESTATE COMPUTER SYSTEMS
30 Carre St., Sleaford, Lincs.
Tel: (0529-305637)

• Circle No. 191

UNIVERSITY OF MANCHESTER MICROCOMPUTER ADVISORY SERVICE

Week-end residential courses on
microcomputing

**MICROCOMPUTER
PROGRAMMING FOR
BUSINESS APPLICATIONS**
An introductory course in BASIC
24th-26th July, 1981

**MICROCOMPUTER
APPLICATIONS IN A SMALL
BUSINESS**
An examination of the
application of a microcomputer
in the management of a small
business
2nd-4th October, 1981

**AN INTRODUCTION TO
BUSINESS PROGRAMMING
IN PASCAL**
Intended for people with some
knowledge of programming who
would like to learn to use the
structured language Pascal
27th-29th November, 1981

For full details contact:

Dr. David Jackson,
University of Manchester
Research Consultancy Service
Oxford Road
Manchester M13 9PL
Tel. 061-273 3333 Ext. 3206

• Circle No. 192

VIDEO GENIE Upgrade Kits

Additional 16K Kit (20 mins to fit)	49.95
	16K Kit (Fitted) 74.95
<i>(Incl. Securicor Return)</i>	
Tab & Clear Keys Kit (As on latest models)	3.45
Lower Case Character Conv. Kit	43.75
Cassette Play Back Level Control Kit	2.95
Software Control of Page and Video Cut Buttons Kit	14.95
All Kits easily fitted or fitted for you at £5 per mod. + Return Carriage	

UHF TV/VDU (Switchage) Inc Free Sound Mod for V6 Sound Kit only	74.95 9.95
---	---------------

Repair & Advice Service for Superboards & V Genie
14p BRINGS YOU CATALOGUE
ALL PRICES INC VAT & P&P EXCEPT WHERE
STATED

ARC ELECTRONICS (WAKEFIELD)
54 HERON DR. SANDAL, WAKEFIELD, W.YORKS.
Tel. WAKEFIELD 253145

• Circle No. 193

(continued from previous page)

```

40 REM *****
100 DATA 31243 : REM CURSOR CONTROL
110 DATA 48,98,48,8A,48
120 DATA A9,13,20,D8,E3,A5,54,F0,09
130 DATA A9,11,20,D8,E3,C6,54,D0,F7
140 DATA A5,55,F0,09,A9,1D,20,D8,E3,C6,55,D0,F7
150 DATA 68,AA,68,A8,68,60
200 DATA 29696
210 DATA A9,00,85,01,A5,56,30,33,C9,28,B0,3A
220 DATA A5,57,30,41,C9,19,B0,48,A9,00,85,54
230 DATA 85,55,A5,57,F0,0F,AA,18,A5,54,69,28
240 DATA 85,54,90,02,E6,55,CA,D0,F2,18,A5,54
250 DATA 65,56,85,54,A5,55,69,80,85,55,60
260 DATA A9,01,85,01,A9,00,85,56,4C,06,74
270 DATA A9,02,85,01,A9,27,85,56,4C,06,74
280 DATA A9,03,85,01,A9,00,85,57,4C,06,74
290 DATA A9,04,85,01,A9,18,85,57,4C,06,74
300 DATA 30029
310 DATA 48,98,58,8A,48,20,00,74,A4,58,A5,00
320 DATA 91,54,88,D0,F9,68,AA,68,A8,68,60
400 DATA 30052
410 DATA 48,98,48,8A,48,20,00,74,A0,00,A6,58
420 DATA A5,00,91,54,18,A5,54,69,28,85,54
430 DATA A5,55,69,00,85,55,CA,D0,EC,68,AA,68
440 DATA A8,68,60
500 DATA 30470
510 DATA 48,98,48,8A,48,20,00,74,A6,59,A4,58,88
520 DATA A5,00,91,54,88,10,F9,18,A5,54,69,28
530 DATA 85,54,90,02,E6,55,CA,D0,E8,68,AA,68
540 DATA A8,68,60
600 DATA 30510
610 DATA 48,98,48,8A,48,20,00,74,A6,59,A4,58,88
620 DATA B1,54,49,80,91,54,88,10,F7,18,A5,54,69,28
630 DATA 85,54,90,02,E6,55,CA,D0,E6,68,AA,68
640 DATA A8,68,60
700 DATA 30090
710 DATA 48,98,48,8A,48,20,00,74,A5,54,85,56
720 DATA A5,55,85,57,A9,64,85,00,20,FA,75,18
730 DATA A5,54,69,29,85,54,85,56,A5,55,69,00
740 DATA 85,55,85,57,A9,65,85,00,20,04,76
750 DATA 18,A5,56,65,58,85,54,C6,54,A5,57,69,00
760 DATA 85,55,A9,67,85,00,20,04,76,A5,56,85,54
770 DATA A5,57,85,55,A6,59,C6,54,CA,18,A5,54
780 DATA 69,28,85,54,A5,55,69,00,85,55,CA,D0,F0
790 DATA A9,63,85,00,20,FA,75,68,AA,68,A8,68,60
800 DATA A4,58,A5,00,91,54,88,D0,F9,60
810 DATA A0,00,A6,59,CA,CA,A5,00,91,54,18,A5,54
820 DATA 69,28,85,54,A5,55,69,00,85,55,CA,D0,EC,68
5000 POKE 48,0:POKE49,112
5010 POKE 52,0:POKE53,112:CLR
9000 DATA*
9010 READL
9020 READA$
9030 C=LEN(A$)
9040 IFA$="*"THEN9140
9050 IFC<10RC>2THEN9130
9060 A=ASC(A$)-48
9070 B=ASC(RIGHT$(A$,1))-48
9080 N=B+7*(B>9)-(C=2)*(16*(A+7*(A>9)))
9090 IFN<00RN>255THEN9130
9100 POKEL,N
9110 L=L+1
9120 GOTO9020
9130 IFC=5THENL=VAL(A$):GOTO9020
9140 END

```


How a bubble-sort can test code efficiency

WE HAVE recently been involved at Teesside Polytechnic in software development for a character-recognition project involving the use of a hand-print terminal — see Barker 1981. This device acts as an intelligent peripheral which can be attached to a host mainframe, mini- or microcomputer system. Its mode of operation is such that characters may be printed on a flat, pressure-sensitive writing surface to which an appropriately-designed data-capture document has been attached.

Each character written on the document is recognised and its position deduced. This information is transmitted as a three-byte code to the host computer. The code consists of notional row and column numbers, which reflect the position of the

As both Pascal and assembler programming facilities are available for the Pet, we felt it worthwhile to investigate the relative improvements likely to be gained by re-writing the applications code in one or other of these languages.

To make a comparison of the language systems, we wrote a series of three programs. Each was designed to sort an array of positive integer numbers into

by Philip Barker

order using a bubble-sort technique similar to that described by Knuth. The overall strategy embodied in each program was as follows:

1. Generate 200 random numbers.
2. Initialise a timer.
3. Sort numbers using the bubble-sort.
4. Deactivate the timer.
5. Print out the sort time.

The exact details of program implementation depend on the particular language system employed which will be described later. Fundamental to the comparison is the bubble-sort embedded in the third step of the sequence of operations. For each of the languages used, this was coded directly from Knuth's algorithm which is reproduced in table 1.

For our applications, the records R_1 through R_n correspond to the element positions of the array to be sorted. Similarly, the keys — K_1 through K_n — correspond to the values stored at the different array positions.

The bubble-sort algorithm was implemented in both Basic and Pascal. Listings of the programs are shown in figures 2 and 3. In each case, an array of randomly-selected positive integers is generated by invoking an appropriate function procedure — RND in Basic and Random in Pascal.

Once the array of test values has been generated, the code responsible for performing the sort is timed. Timing is achieved by means of the internal real-time clock of the microcomputer. From Basic, this may be interrogated by

(continued on next page)

Algorithm BubbleSort	
Records R_1, \dots, R_n are rearranged in place; after sorting is complete their keys will be in order $K_1 \leq \dots \leq K_n$	
B1.	Initialise BOUND Set BOUND \leftarrow N. BOUND is the highest index for which the record is not known to be in its final position
B2.	Loop on j Set $t \leftarrow 0$. Perform step B3 for $j = 1, 2, \dots, \text{BOUND}-1$, and then go to Step B4.
B3.	Compare/Exchange $R_j : R_{j+1}$ If $K_j > K_{j+1}$ interchange $R_j \leftarrow R_{j+1}$ and set $t \leftarrow j$.
B4.	Any exchanges? If $t = 0$, the algorithm terminates. Otherwise set BOUND $\leftarrow t$ and return to Step B2.

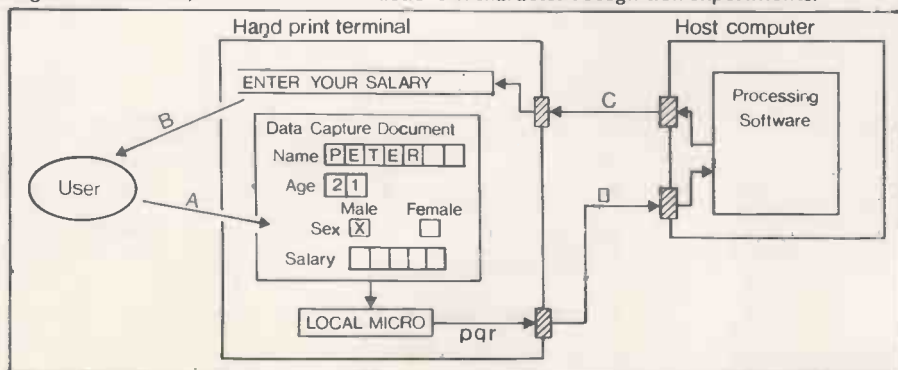
Table 1.

character, and the ASCII value of the character itself.

Software in the host computer can be used to validate this data and process it in various ways appropriate to the application. The arrangement of terminal and host computer is shown schematically in figure 1.

Developing applications software in Basic for use in the host computer is straightforward. However, with Basic, the speed with which the user is able to enter data is severely constrained by software. In view of this, we thought it important to be able to develop programs capable of supporting faster real-time response than could be achieved via the Basic interpreter provided with the microcomputer being used, a Commodore Pet — see Commodore 1979.

Figure 1. Terminal, host and user interactions in character-recognition experiments.



WESTERN

Western Computers Limited



The BEST APPLE payroll

PAYROLL-80

runs under CP/M

Takes care of TAX, N.I. and PENSIONS for you. Creates PAYSLEIPS and MANAGEMENT REPORTS.

DEALER ENQUIRIES WELCOME
PLEASE CONTACT US FOR DETAILS

Blackpool Airport,
Blackpool, Lancs.

Phone Blackpool 404676/42660

• Circle No. 194

Vets for Pets

Anita Electronic Services (London) Ltd. are specialists in the repair and service of Commodore Pets.

We offer a fast on-site service, or alternatively repairs can be carried-out at our workshops should you wish to bring in your Pet. Pet maintenance contracts are available at very competitive prices. Trade inquiries welcomed.

For further information tel. or write to: —

JOHN MEADE
ANITA ELECTRONIC SERVICES
15 CLERKENWELL CLOSE, LONDON EC1
01-253 2444

* We also specialise in the repair of all makes of office equipment.

• Circle No. 195

TRS-80 System

All items stocked, Barclaycard, Access & American Express are welcome, or apply for your own RADIO SHACK Charge Card. U.K. Delivery by Securicor. Direct and Personal Exports.

RADIO SHACK LTD.
188 Broadhurst Gardens,
London NW6 3AY.

Tel: 01-624 7174 Telex 23718

• Circle No. 196



ALGOL-60 Z80-CP/M, PDP11, PDP8

A family of high level languages from RHA (Minisystems) Ltd. ALGOL-60, the language from which PASCAL is derived. A mature implementation with comprehensive operating system and machine code interfaces. SYSTEJ-ALGOL, the subset of Algol-60 in which all the compilers are written. Compiled code is shorter, execution faster. Z80 based CP/M systems including TRS80 RML Algol-60, includes the option of 32 bit integers instead of floating point. About 7 times faster than TRS80 level II BASIC, speed comparable with Microsoft Fortran. Document £10, system £99 + VAT. System-Algol £50 + VAT, free leaflet. PDP11 WITH RT-11, RSTS, RSX or IAS and PDP8 with OS/8 or stand alone. Complete package including both compilers in machine readable source form ... £250 + VAT consultant. 83, Gidley Way, Horspath, Oxford OX9 1TQ (08677) 3625

• Circle No. 197

MZ80K SOFTWARE ON CASSETTE BUSINESS PROGRAMMES

HOTEL: A COMPLETE HOTEL PROGRAMME: REGISTER, MAILING LIST, ETC. FROM £70
STOCK: LISTING, CONTROL, INVENTORY: WHOLESALE - RETAIL ETC.
GENERAL BUSINESS MAILING LISTS ACCOUNTS ETC. FROM £40
PERSONALIZED SOFTWARE OUR SPECIALTY
ALL PROGRAMMES TAILORED TO YOUR OWN REQUIREMENTS - GIVE US A CALL - WE'LL GIVE YOU A QUOTE
GAMES: A RANGE OF GAMES WITH FULL GRAPHICS AND SOUND EFFECTS: - LATEST
SUPERGOLF: A FULL 18 HOLE COURSE FOR £6.00
MOON RESCUE: TRIPLE GAME + GRAPHICS £7.00
APHROS SOFTWARE, DEPT (A)
WESTFIELD HOUSE, 8, ARTHUR ROAD, CLIFTONVILLE, MARGATE KENT
PHONE: (0843) 291578

• Circle No. 198

J C A SOFTWARE PET SURGERY/HOTEL BOOKINGS SOFTWARE

(16/32k PET cassettes) £75
SURGERY BOOKINGS (1-4 doctors)
Trace by doctor/patient name or time.
HOTEL ROOM BOOKINGS (5-150 rooms) £65
Traces guests/rooms/accts. Displays menus.
TAXI BOOKINGS (5-150 taxis) £55
Traces drivers/cars/accts and fares.
STOCK CONTROL (500-700 items) £45
Insert/amend. Display purchase orders.

J C A TRAINING

Morning & evening BASIC & COBOL courses.
Groups of 2-8. Write for details.
All prices include VAT & P&P.
Send chs/post to:-

JANE COATES ASSOCIATES LTD
28 St. Mark's Road, Maidenhead, Berks. SL6 6DE

• Circle No. 199

NASCOM 1&2 MUSIC BOARD

*Extremely simple to program in basic or machine code.
*Generates notes over an 8 octave range.
*Driven from most parallel output ports.
*Plugs into Hi-Fi for full sound.
*Sustains notes with no CPU overhead.
*Complete with full documentation and programming examples.

£22.80 (1kit), £24.50 (assembled and tested).
Multiple boards may be used to great effect!
REPLACEMENT NASCOM INTERCONNECTING CABLE WITH MUSIC BOARD HEADER CONNECTORS - £4.99.

SOFTWARE FOR INSTANT ENJOYMENT - 'MUSIC MAKER' -
Comprehensive music only program, can handle multiple channels, (16k min.) - £6.00.

All prices inclusive, p&tp 65 pence per order, S.A.E. for details

BBF ENGINEERING

Dept. 5, 82 Buckingham Drive, Luton, Beds.
Luton (0582) 35930

• Circle No. 200

```

10 DIM X%(200)
20 FOR I = 1 TO 200
30 X%(I) = RND(1)*200
40 NEXT I
50 B = 200 : KS = TI
60 T = 0
70 FOR J = 1 TO B-1
80 IF X%(J) > X%(J+1) THEN 110
90 Z% = X%(J) : X%(J) = X%(J+1) : X%(J+1) = Z%
100 T = J
110 NEXT J
120 IF T = 0 THEN 140
130 B = T : GOTO 60
140 PRINT "TIME";INT((TI-KS)/60); "SECONDS"

```

Figure 2. Bubble-sort in Basic.

(continued from previous page)
references to the system variable TI. The difference between the values of this variable before and after the sort enables the sorting time to be calculated.

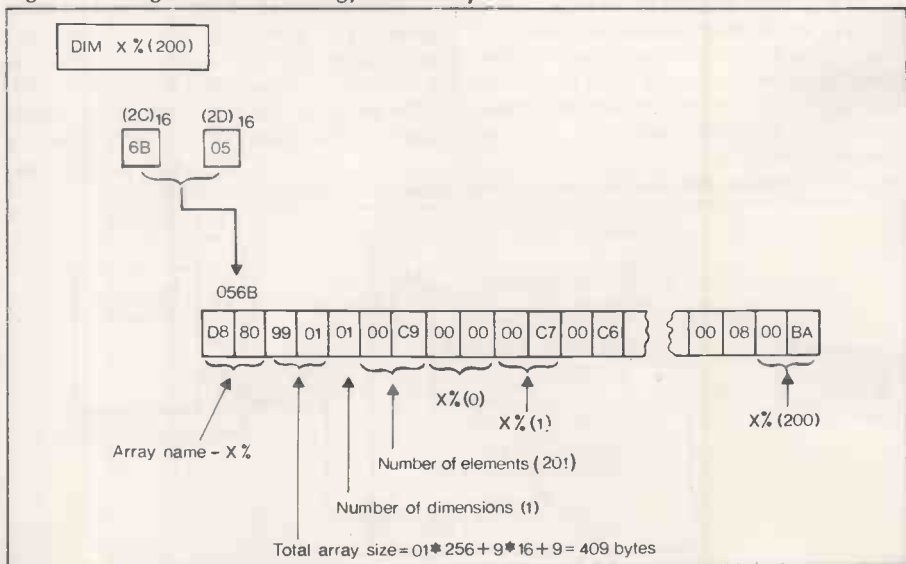
A similar approach is used in the Pascal program: the procedure Settime is used to initialise the real time clock to zero; subsequently, the routines Minutes and Seconds are used to obtain the elapsed time for the sort. Each of the programs was run with sample sizes of 10, 20, 30, 50, 100, 150, and 200 integers. In all cases, the Pascal programs executed far more rapidly than the Basic version. The sort times are presented in figure 8.

To assess the likely improvements gained by using an assembler sort routine, we used a Basic program similar to that shown in figure 4. It acts as a main routine which, after setting up the array to be sorted, invokes an assembly language subroutine whose code is stored at memory locations 6144, decimal address, through 6339. On terminating, the sort routine passes control back to the Basic program which prints out the time required for sorting.

The results of running the program under conditions similar to those used for the high-level languages are presented in figure 8. The substantial improvement in sorting times which results from the use of assembled code is immediately apparent.

To design and implement the assembler

Figure 5. Storage-allocation strategy for an array.



version of the routine, you need to understand:

- The way in which the Basic interpreter stores a source program.
- The storage allocation strategy for integer-array variables.
- The hardware architecture of the Pet microcomputer — in particular, its memory structure and the register arrangement of the MCS6502 processor chip.

Details of the first two points are contained in the Pet Users' Manual while the third point is covered in the MOS Microcomputer Family Hardware Manual and other related microcomputer text books.

Within a Basic program, integer arrays are stored in this general format:
array header element 1 element 2
element 3 element n
in a contiguous section of memory. Each

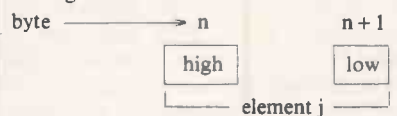
```

10 VAR I,J,B,T,Z : INTEGER;
20 X : ARRAY[1..200] OF INTEGER;
30 BEGIN
40 FOR I := 1 TO 200 DO X[I] := RANDOM;
50 B := 200; SETTIME := (0,0,0);
60 REPEAT
70 T := 0;
80 FOR J := 1 TO B-1 DO
90 IF X[J] < X[J+1]
100 THEN BEGIN
110 Z := X[J]; X[J] := X[J+1];
120 X[J+1] := Z;
130 T := J
140 END;
150 B := T
160 UNTIL T = 0;
170 WRITE('TIME');
180 I := MINUTES*60 + SECONDS;
190 WRITE(I);
200 Writeln('SECONDS');
210 FOR I := 1 TO 200 DO WRITE(X[I])
220 END.

```

Figure 3. Bubble-sort in Pascal.

array element, in turn is represented by two adjacent bytes according to the arrangement:



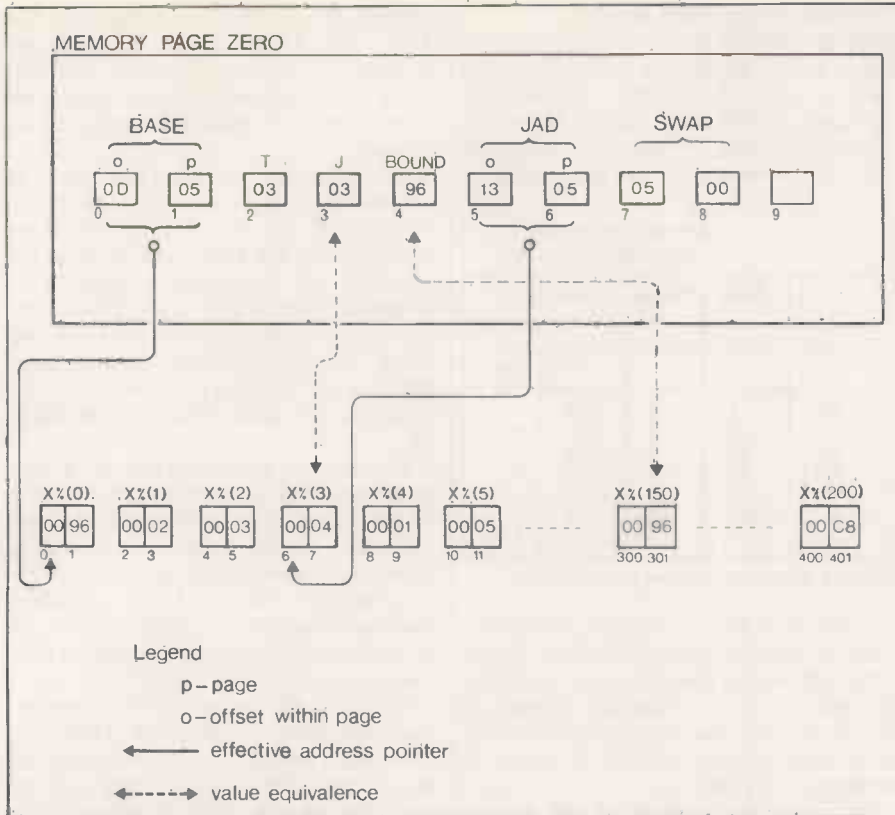


Figure 6. Data structures for the assembler sort routine.

Thus, a value of 1025 decimal would be stored as **04 01** and a value of 199 would be held in the form **00 C7**. The left-most bit of byte *n* is used to reflect the sign of the number positive or negative, so that a value such as -522 would be stored as **FD F6**. The position at which arrays are stored within the source text of the program is given by the address contained in zero page locations (45)₁₀ and (44)₁₀.

The former specifies the memory page and the latter the off-set within the page at which the storage for arrays commences. Similarly, zero-page locations (47)₁₀ and (46)₁₀ point to the section of memory at which array storage ends and unallocated storage commences. These values are useful in helping to decide where to site an assembler routine and the location of the array to be sorted.

The exact details contained in the array header that precedes the elements will depend on its dimension specification. For a one-dimensional array of the type being used for the bubble-sort — see figure 4 — the arrangement is similar to that shown in figure 5. Notice that the array contains a zeroth element which in this program is not used for storing a value to be sorted. Instead, this location functions as a global variable used by the calling routine to pass across to the assembler subroutine the value of the number of elements it is required to sort.

The overall strategy for the machine code sort is:

1. Set up working storage areas.
2. Perform initialisation operations
 - 2.1 Save zero-page environment of Basic

- 2.2 Set base address of array to be sorted
- 2.3 Initialise Bound, J and T.
3. Perform the sort
 - 3.1 Generate the address of array element J
 - 3.2 Compare elements J and J + 1
 - (a) high bytes
 - (b) low bytes, if necessary
 - 3.3 Swap elements J and J + 1, if necessary
 - (a) high bytes
 - (b) low bytes.
4. Restore the zero-page environment of Basic.
5. Return control to the Basic program.

The working storage areas are locations of memory used by the assembler routine while it is performing the sort. For efficiency, they are located in the first 10 bytes of memory page zero. However, because these locations may have some significance to the Basic interpreter, their contents are transferred to a save area local to the assembler routine. At the end

```

10 DIM X%(200)
20 FOR I = 1 TO 200
30 X%(I) = RND(1)*200
40 NEXT I
50 FOR I = 1 TO 200 : PRINT X%(I) : NEXT I
60 PRINT " "
70 PRINT PEEK(45) + 256*PEEK(44) + 7
80 PRINT PEEK(47) + 256*PEEK(46)
90 X%(0) = 150 : KS = TI
100 SYS(6144) : REM INVOKE SORT ROUTINE
110 PRINT "TIME": (TI-KS)/60; " SECONDS"
120 FOR I = 1 TO 200 : PRINT X%(I) : NEXT I
    
```

Figure 4.

of the sorting operation, these 10 zero-page locations are restored to their original values before passing control to the Basic program. Two subroutines, Save and Restor, are used to handle these operations.

The significance of the zero-page
(continued on next page)

D. RAM:

Set of 8: 4116 — 200ns
(add 50p for P&P) **£12.00**

Exclusive:
We are manufacturers of the DRC modules (Dynamic Ram Controllers) which plug into the MPU socket and expand RAM in seconds by 16K, 32K, 48K or more — low cost, removable and neat (£67.00 for 32K).

Also the RRS modules (RAM/ROM simulators) which link your computer to the system you are developing, add RAM from 4K to 32K or, loaded by your computer, work as ROM/RAM in the developed system. Just imagine the possibilities with your software power!

More information, literature and orders:

Audio Computers
87 BOURNEMOUTH PARK ROAD,
SOUTHEND ON SEA, ESSEX. TEL: (0702) 613081
CALLERS WELCOME.

• Circle No. 201



27 HIGH STREET, EGHAM, SURREY.
Telephone: Egham (0784) 36996

MICROBYTE LTD.

MICROPROCESSOR SYSTEMS DESIGN & SOFTWARE

- Announcing the Model 832 EPROM programmer
- Programs/verifies 2708/TMS 2716/2516/2532/2732 and 2732A
- Connects via RS232 to any suitable terminal/processor
- 9 simple single letter commands to read or program EPROM, change data, verify, determine status, find specific data, dump memory/EPROM contents and load directly from HEX files.
- Automatic baud rate selection between 110 and 19K2
- 1 year guarantee
- £250 per unit
- Complete Intel 8048/9 source program to EPROM development systems with assembler and simulator for £2150

• Circle No. 202

Fast Fourier Transform

for the PET and Apple

A fast and accurate machine code implementation interfacing to BASIC and Pascal. £125.

Details:

STRUCTURED SOFTWARE

25 Handley Court, Riversdale Road, Liverpool. L19 3QS.

Please specify CBM(PET) or Apple.

• Circle No. 203

ZX80/81

USER PORT MODULE

Start using your ZX80 in control applications (Robotics, Household systems, Model trains, etc.) £29 inc. p&P.

- ready built and tested
 - plugs into ZX80
 - sample control programs supplied on C12 cassette
 - gives 8 input and 8 output lines
 - applications and software booklet included
- Please state which system you require
cheque with order to:

J.M.J. INTERFACES

Old School House, Rettendon Tumpike,
Battlesbridge, WICKFORD, Essex.

• Circle No. 204

SHOP WINDOW

Computers for Business

We are **ESSEX** dealers for
IMS 5000/8000
Equinox 200/300

Our CPM software packages include
• Bookkeeping * Incomplete Records
• Business Desk (Integrated Accounts/
Invoicing)
• Mailing Systems
• Wordstar/Mailmerge/Datatar

We also write personalised
software

for more details contact
Criterion Business Systems Ltd.
3-11 Grenfell Avenue, Hornchurch, Essex.
Tele. Hornchurch 72995/6 or 01-989 8177

CCTA APPROVED

Complete
Systems
from around
£22 p.w.

• Circle No. 205

A top quality DISASSEMBLER ACORN ATOM

Fast — versatile — easy to use.
Lays bare all the secrets of ROM and RAM — even
unlistable and uncopyable programs!

Ultra-fast m/c code search for strings of characters or
bytes + other unique features. 3½k.

£9.95 incl.
R. V. HUNT

DEPT PC7
61 BROOMFIELD AVE.
LONDON, N13 4JR

• Circle No. 206

Floppy Disc File

Easy reference filing system for your
flexible computer discs, files 20 discs per
binder. File sheets retail 4 discs, have
reinforced binder edge and file reference
tab. Leaves punched for 2 and 3 hole
binders. Also available for 8" discs, files
10 discs per binder. Please state size
when ordering.

Binder complete with 5 leaves
£4.95 + VAT
Pack of 5 leaves only £1.55 + VAT

LEICESTER COMPUTER CENTRE LTD.

267 Regent Road, Leicester, LE1 6YF.
Tel: 0533 556268

• Circle No. 207

APPLE MUSIC MAKER

Use alone or write your own programs with
musical interludes on any size APPLE II. Covers
3 full octaves (37 notes), allowing 3 tempos and
3 note lengths. Optional graphic display.
Supplied on cassette with instructions and
demonstration. £9.95

Other programs (S = Sorcerer, A = Apple, T = TRS-80
lev2)

Spy Satellite (A, T)	£ 4.95
Chancellor (A, T)	£ 5.95
Temple of Apshei (T)	£16.95
Morlock's Tower (T)	£11.95
Breakout (T, S)	£ 6.95
Starbase Hyperion (S)	£13.95
Martian Invaders (S)	£11.95
Screen Editor (S)	£ 8.95
Wilderness Campaign (A)	£10.95
Dungeon Campaign (A)	£10.95
Game of Life (A) Board Games	£ 4.95
Skirmish (A) — for 2 players	£ 4.95
Triangle (A) — for 1 or 2 players	£ 3.95
Books for the TRS-80	
Supermap	£ 7.95
The Book Vol 1 & 2 each	£ 8.95

All goods post free. Cheque/PO to:

SAPPHIRE SOFTWARE LTD

P.O. Box 244 Milton Keynes MK14 7BQ

• Circle No. 208

(continued from previous page)

locations used in the sort are as follows:
Swap is the swap area used when the
values contained in two consecutive
elements of the array are to be inter-
changed; Bound, T and J perform the
same functions as indicated in the bubble-

Sample Size (N)	Basic	Pascal	Assembler	
	random	random	random	worst case
10	1	<1	0.03	0.03
20	4	1	0.07	0.07
30	10	2	0.08	0.12
50	32	7	0.22	0.27
100	124	29	0.78	1.02
150	286	68	1.58	2.25
200	548	116	2.87	4.00

Figure 8. Results of sorting experiments.

sort algorithm described earlier; JAD is the
memory address of the Jth element of the
array and Base is the address of its zeroth
element — both in off-set/page format. A
sketch showing the relationship between
these items and the array to be sorted is
presented in figure 6.

To obtain the address of the zeroth
element of the array, the address of the
array header — see figure 5 — has to be
incremented by 7. However, since the
array header may be split over a page
boundary this condition has to be checked
and the page number incremented
accordingly. This situation is illustrated in
figure 9.

Once the address of the base location of
the array has been computed, it is an easy
matter to calculate the address of the first
byte allocated to any given element of the
array. This is obtained by multiplying the
value of J by 2 using an arithmetic shift-
level instruction and adding the address of
the zeroth element, Base. As usual, care
must be taken to check for page-boundary
crossings when this addition is performed.

The strategy for performing the
comparison is reasonably straightforward
once the address of the Jth element —

address N — has been computed. The
high-value bytes of the numbers are
compared — byte N : byte N+2. If byte
N+2 is less than byte N, the numbers are
in order and the remaining operations are
skipped.

Otherwise, the low-value bytes must be
compared — byte N+1 : byte N+3.
Depending on the results of these
comparisons, the swap code is or is not
executed. If the elements need to be
swapped, bytes N and N+2 are
interchanged along with bytes N+1 and
N+3. To achieve this, the zero-page swap
area is used. The data flow involved in the
swapping operation is illustrated in figure
10.

The numbers associated with the arrows
in figure 10 indicate the order in which
data bytes are moved between the registers
and other storage locations. This data
flow is not intended to be optimal.

A detailed listing of the assembly-
language program is shown in figure 7. To
produce the machine-code routine, a dis-
cussed, two-pass assembler was used.
Given a disc file containing the assembly-
language source code, the assembler
produced a second disc file containing the
object code produced as a result of the
assembly process. This object-code file

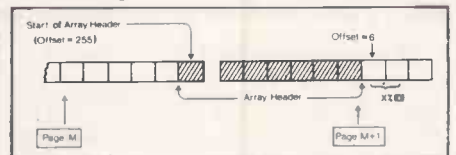


Figure 9.

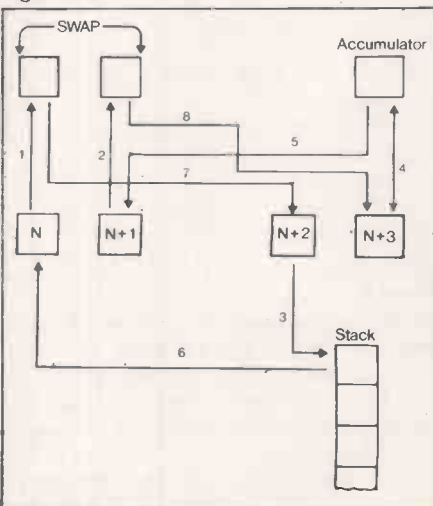
could be loaded into the Pet memory
using the loader program provided with
the assembler-development package.
Once loaded, the relevant section of
memory — (1800)₁₆ through (18C4)₁₆ —
could be dumped on to a cassette tape for
subsequent use by means of the Pet
terminal interface monitor.

The sorting times observed when
different sample sizes are sorted into
descending order by programs written in
Basic, Pascal and assembler are shown in
figure 8. The "random" qualifier
indicates that the sort times refer to
randomly-generated array elements. For
the assembler results, the "worst case"
qualifier refers to measurements made
using an array of positive consecutive
integers — 1 through N — so that the sort
routine has to perform the maximum
possible number of comparisons and
interchanges. The results indicate that
Pascal is about four times faster than
Basic. Similarly, assembler is between 30
and 200 times faster depending on the
sample size.

Although the results in figure 8 indicate
the substantially-greater efficiency of the
machine-code routine, I must emphasise
the limitations of the comparison. In
several ways, the conditions under which
the experiments were performed favour
the machine-code program. In particular:

- The use of positive integers for the tests
limits the applicability of the assembler routine.

Figure 10.





It assumes positive values for the array elements and hence does not test the sign bits of the numbers when the high-value bytes of array elements are compared.

- As it is written, the assembler routine could not be used to sort arrays having more than 256 elements.

Neither the Basic nor the Pascal programs suffer from these limitations. However, one of the major attractions of writing programs in assembler language stems from the facilities it provides for taking advantage of special features that cannot be handled in a high-level language — in this case, pre-knowledge of the size and nature of the data set to be sorted. Should the need ever arise, it would be an easy matter to extend the assembler routine to accommodate the limitations outlined — with a consequent increase in sort time.

Additional instructions could be inserted to test the sign bits of the elements compared, with a skip to Noswap if the sign bit of byte N is set and that of byte N+2 is unset. Alternatively, since negative integers would always sort high in the routine — that is, towards low index values — the routine could be used as it stands with additional code being added to locate any transition between negative and positive element values and, if necessary, implement appropriate block data moves to order the values.

The best strategy would obviously depend on a more detailed analysis of the relevant optimisation calculations. The array size limitation could be overcome by partitioning the array to be sorted into P sub-arrays — each having less than 256 elements — sorting each into order and

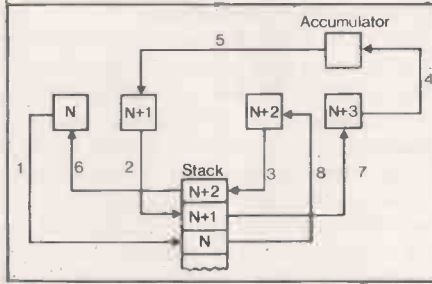


Figure 11.

then performing a P-way merge to produce the final sorted array. Depending on the way in which such extensions are implemented, there would be only minimal departure from the values in figure 8.

It is worth making one final point about the assembler program listed in figure 7. The data flow involved in swapping array elements was not optimised in any way to make the element-interchange highly efficient. Greater use of the stack could have been made, thereby removing the need to use two bytes of zero page memory — Swap and Swap + 1. However, it is unlikely that any major improvement in execution time would be observed.

Indeed, the swap code listed in figure 7 — memory locations 1869 through 1888 — requires only 72 machine cycles compared with 76 cycles for equivalent code based on the use of the stack. These observations are confirmed by measurement of the sort times — figures 11 and 12.

Sorting based upon the use of the stack alone — using 200 numbers under worse case conditions — requires 4.08 seconds.

(continued on next page)

Figure 12.

Number of Machine Cycles	Assembler Code
	SWAPUM NOP
	LDY #0
3	LDA (JAD),Y ; LOAD N
2	PHA ; PUSH ON STACK
5	INY ; INCREMENT Y REGISTER
3	LDA (JAD),Y ; LOAD N+1
2	PHA ; PUSH ON STACK
5	INY ; INCREMENT Y REGISTER
3	LDA (JAD),Y ; LOAD N+2
2	PHA ; PUSH ON STACK
5	INY ; INCREMENT Y REGISTER
2	LDA (JAD),Y ; LOAD N+3
2	DEY ; DECREMENT Y REGISTER
5	DEY ; DECREMENT Y REGISTER
2	STA (JAD),Y ; STORE IN N+1
2	DEY ; DECREMENT Y REGISTER
4	PLA ; PULL OFF STACK
5	STA (JAD),Y ; STORE IN N
2	INY ; INCREMENT Y REGISTER
2	INY ; INCREMENT Y REGISTER
2	INY ; INCREMENT Y REGISTER
4	PLA ; PULL OFF STACK
5	STA (JAD),Y ; STORE IN N+3
2	DEY ; DECREMENT Y REGISTER
4	PLA ; PULL OFF STACK
5	STA (JAD),Y ; STORE IN N+2
	LDA J ; LOAD J VALUE
	STA T ; STORE IN T
	NOSWAP NOP
	INC J ; INCREMENT J VALUE

76 cycles

Business Systems Systems Development

Programs designed and written for North Star and CP/M computer systems

Consultancy

- Feasibility studies
- Independent advice
- Project management
- Single source supply of complete systems.

We specialise in accounting, order processing, invoicing and stock control systems.

McMillan Computing Services
3 Titebarn Grove
Calcot, Reading
Tel: 0734 414751

• Circle No. 209

BASIC

Learn how to write computer programs for micro/mini computers using BASIC language. For further details of our 4 week correspondence course ring 051-227 5622/3 or write to us at

March Associates Limited,
21-23 OLD HALL STREET, LIVERPOOL, L3 9BT.

• Circle No. 210

An International Bank is looking for a technically orientated, preferably mini or micro experienced, person to join a small team being formed in an existing data processing department. The task of the team is to encourage personal computing in the group and the job would include assessment and recommendation of available machines and software and some programming. Career progression into other areas of systems development is possible for the right person.

PLEASE REPLY TO
BOX NO 103, PRACTICAL COMPUTING, ROOM
L311, QUADRANT HOUSE, THE QUADRANT,
SUTTON, SURREY.

• Circle No. 211

EXIDY SORCERER

48K

PRICE REDUCED

NOW ONLY £695 + VAT

Dealer for

Bristol and South West

ELECTROPRINT (Mr. Tasker)

5 Kingsdown Parade • Bristol 6 • 292375

• Circle No. 212

ZX81 ZX80 ACORN ATOM!

The monthly magazine INTERFACE gives you a number of ready-to-run programs for each computer in each issue, plus a host of hints and tips. Large s.a.e. for free copy.

INTERFACE 44 Earls Court Road,
London, W8 6EJ

• Circle No. 213

CUBEMEISTER

Superb magic cube solving aid from
ALPHABYTA.

- Displays all 6 faces at once
 - Backtracks to correct mistakes
 - Any position saved on cassette
 - Powerful "Macro" facility
- TRS-80 LII cassettes

£10 inc.

Cheque with order to:

ALPHABYTA

38 Fylingdales, Thatcham Moor, Newbury
Berks. RG13 4LB.

• Circle No. 214

BEFORE YOU BUY..... **SUPERBRAIN**

standard and complete APL systems



**Atari
Pearman
Limited**

APL SPECIALISTS
□ BOOKS □ SOFTWARE
□ CONSULTANCY □ COURSES

MAPLE HOUSE MORTLAKE CRE8
CHESTER

• Circle No. 215

BROKEN COMPUTERS MENDED

We can mend your
ZX80, NASCOM, VIDEO GENIE, etc.

Prices from **£7.50** plus p & p.

For further details please contact

BYRD ASSOCIATES
43 ASHBURNHAM ROAD, BEDFORD.

24-hour answerphone service on
Bedford (0234) 214785

• Circle No. 216

(continued from previous page)

This value is the average of six measurements for which the standard deviation was 0.005. The corresponding average sorting time based on the use of zero-page memory for swapping was 3.99 seconds with a standard deviation of 0.01. In view of these findings, we conclude that the sort times for the assembler version of the sort routine would be difficult to improve without further detailed analysis based on further optimisation studies.

References

Commodore Business Machines Ltd, CBM 3032N

professional computer users' manual. Publication 320856-3, June 1979.

Barker, P G, Experiments with a hand-print terminal, Interactive Systems Group Working Paper, February 1981.

Knuth D E, pages 106-108, in volume 3 of Fundamentals of computer programming — sorting and searching, Addison Wesley Publishing Co, ISBN 0-201-03803-X, 1973.

MOS Technology Inc, MCS6500 microcomputer family hardware manual. Publication 6500-10A, January 1976.

Camp R C, Smay T A and Triska C J, Microprocessor systems engineering, Matrix Publishers Inc, Portland, Oregon, ISBN 0-916460-26-6, 1979.

Zaks R, Programming the 6502, Sybex Inc, ISBN 0-89588-009-1, 1978.

Commodore Business Machines Limited, Assembler development system users' manual. Publication GD001, September 1979.

Figure 7. Sort routine in assembler.

```

0001 0000                                .OPT MEM
0002 0000 00 00                        BASE .DBYTE $0
0003 0002 00                            T .BYTE $0
0004 0003 00                            J .BYTE $0
0005 0004 00                            BOUND .BYTE $0
0006 0005 00 00                        JAD .DBYTE $0 ; SET UP BASE ADDRESS
0007 0007 00 00                        SWAP .DBYTE $0 ; OF ARRAY
0008 0009                                *=$1800 ; SKIP AROUND DATA
0009 1800 EA                            INIT NOP
0010 1801 EA                            NOP
0011 1802 4C OF 18                      JMP GO
0012 1805                                SAVE *=$+10
0013 180F                                XPTR = $2C
0014 180F 20 AC 18                      GO JSR SAVEUM ; SAVE ZERO PAGE
0015 1812 A5 2C                        LDA $2C
0016 1814 85 00                        STA BASE ; STORE OFFSET
0017 1816 A5 2D                        LDA $2D
0018 1818 89 01                        STA BASE+1 ; STORE PAGE
0019 181A A5 00                        LDA BASE ; CHANGE BASE OF
0020 181C 18                            CLC ; ARRAY TO POINT
0021 181D 69 07                        ADC # $7 ; TO, X%(0)
0022 181F 85 00                        STA BASE
0023 1821 90 02                        BCC NEXT ; SEE IF NEW PAGE
0024 1823 E6 01                        INC BASE+1 ; INCREASE PAGE NO
0025 1825 EA                            NEXT NOP
0026 1826 A0 08                        B1 LDY # $8 ; LOAD OFFSET
0027 1828 B1 2C                        LDA (XPTR),Y ; LOOK IN X%(0)
0028 182A EA                            NOP ; FOR NUMBER OF ELEMENTS
0029 182B EA                            NOP ; TO BE SORTED
0030 182C 85 04                        STX BOUND ; INITIALISE BOUND
0031 182E A9 01                        B2 LDA # $1 ; INITIALISE J
0032 1830 85 03                        STA J
0033 1832 A9 00                        LDA # $0 ; INITIALISE T
0034 1834 85 02                        STA T ;
0035 1836 EA                            B3 NOP
0036 1837 A5 03                        LDA J ; LOAD J VALUE
0037 1839 A4 01                        LDY BASE+1 ; GET PAGE
0038 183B 18                            CLC
0039 183C 0A                            ASL A ; MULTIPLY BY 2
0040 183D 90 01                        BCC SKIP ; PAGE BOUNDARY?
0041 183F C8                            INY ; INCREMENT PAGE NUM
0042 1840 18                            SKIP CLG
0043 1841 65 00                        ADC BASE ; ADD IN BASE ADDRESS
0044 1843 90 01                        BCC SKIP2 ; PAGE BOUNDARY?
0045 1845 C8                            INY
0046 1846 84 06                        SKIP2 STY JAD+1
0047 1848 85 05                        STA JAD
; JAD NOW CONTAINS THE ADDRESS
; OF THE REQUIRED ELEMENT
;
; NOW COMPARE ELEMENT J WITH
; ELEMENT J+1
0053 184A EA                            NOP
0054 184B A0 00                        LDY # 0
0055 184D B1 05                        LDA (JAD),Y ; TEST FIRST BYTE
0056 184F C8                            INY
0057 1850 C8                            INY
0058 1851 D1 05                        CMP (JAD),Y ; COMPARE
0059 1853 90 0F                        BCC SWAPUM
0060 1855 F0 02                        BEQ EQUAL
0061 1857 80 36                        BCS NOSWAP
0062 1859 88                            DEY
0063 185A B1 05                        EQUAL LDA (JAD),Y ; TEST SECOND BYTE
0064 185D C8                            INY
0065 185D C8                            INY
0066 185E D1 05                        CMP (JAD),Y ; COMPARE
0067 1860 F0 2D                        BEQ NOSWAP
0068 1862 B0 2B                        BCS NOSWAP
;
; NOW PERFORM THE SWAP
0070 1864
0071 1864

```




```

0072 1864 EA          SWAPUM NOP
0073 1865 A0 00      LDY #0
0074 1867 B1 05      LDA (JAD),Y
0075 1869 85 07      STA SWAP
0076 186B C8          INY
0077 186C B1 05      LDA (JAD),Y
0078 186E 85 08      STA SWAP+1
0079 1870 C8          INY
0080 1871 B1 05      LDA (JAD),Y
0081 1873 48          PHA          ; PUSH ONTO STACK
0082 1874 C8          INY
0083 1875 B1 05      LDA (JAD),Y
0084 1877 88          DEY
0085 1878 88          DEY
0086 1879 91 05      STA (JAD),Y
0087 187B 88          DEY
0088 187C 68          PLA          ; PULL FROM STACK
0089 187D 91 05      STA (JAD),Y
0090 187F C8          INY
0091 1880 C8          INY
0092 1881 A5 07      LDA SWAP
0093 1883 91 05      STA (JAD),Y
0094 1885 C8          INY
0095 1886 A5 08      LDA SWAP+1
0096 1888 91 05      STA (JAD),Y
0097 188A A5 03      LDA J          ; LOAD J VALUE
0098 188C 85 02      STA T          ; STORE IN T
0099 188E EA          NOP
0100 188F E6 03      NOSWAP INC J
0101 1891 EA          NOP
0102 1892 A5 03      LDA J
0103 1894 C5 04      CMP BOUND
0104 1896 90 9E      BCC B3
0105 1898 F0 03      BEQ B4
0106 189A 4C A7 18    JMP FINISH
0107 189D A5 02      B4 LDA T
0108 189F F0 06      BEQ FINISH    ; RETURN IF ZERO
0109 18A1 85 04      STA BOUND
0110 18A3 EA          NOP
0111 18A4 4C 2E 18    JMP B2
0112 18A7 20 B8 18    FINISH JSR RESTOR ; RESTORE 0 PAGE
0113 18AA EA          NOP
0114 18AB 60          RTS          ; BACK TO CALLER
0115 18AC          ;
0116 18AC          ; SUBROUTINE TO SAVE FIRST TEN
0117 18AC          ; ZERO PAGE LOCATIONS
0118 18AC EA          SAVEUM NOP
0119 18AD A2 09      LDX #9
0120 18AF B5 00      SAV01 LDA $0,X
0121 18B1 9D 05 18    STA SAVE,X
0122 18B4 CA          DEX
0123 18B5 10 F8      BPL SAV01
0124 18B7 60          RTS
0125 18B8          ;
0126 18B8          ; SUBROUTINE TO RESTORE FIRST TEN
0127 18B8          ; ZERO PAGE LOCATIONS
0128 18B8 EA          RESTOR NOP
0129 18B9 A2 09      LDX #9
0130 18BB BD 05 18    RES01 LDA SAVE,X
0131 18BE 95 00      STA $0,X
0132 18C0 CA          DEX
0133 18C1 10 FB      BPL RES01
0134 18C3 60          RTS
0135 18C4          .END
    
```

ERRORS = 0000

SYMBOL TABLE

SYMBOL	VALUE	SYMBOL	VALUE	SYMBOL	VALUE	SYMBOL	VALUE
B1	1826	B2	182E	B3	1836	BA	189D
BASE	0000	BOUND	0C04	EQUAL	1859	FINISH	19A7
GO	180F	INIT	1800	J	0003	JAD	0005
NEXT	1825	NOSWAP	188F	RES01	18BB	RESTOR	1888
SAV01	18AF	SAVE	1805	SAVEUM	18AC	SKIP	1840
SKIP2	1846	SWAP	0007	SWAPUM	1864	T	0002
XPTR	002C						

END OF ASSEMBLY

video genie

£279 + CARR + VAT

£349 + CARR. + VAT

Please send for VIDEO GENIE system price list.
SOFTWARE * BOOKS * COMPONENTS
***** INTRODUCING *****

THE RANGE OF CAVERN MICRO MODULES

Designed for Z80 based systems, these modules are suitable for Micro-computer expansion and the development of Micro systems.

Each module is 150 x 50 mm. Connections are mini-wrap terminals which can be wire-wrapped, soldered or plugged into sockets.

First in the range are:-

16K dynamic RAM £15.00 + VAT
(supplied without the 4116 chips)

RAM driver £12.50 + VAT
Will drive up to four RAM modules

More will follow shortly.

Good quantity discounts available. Dealer enquiries welcome. Please send for data sheets.

CAVERN ELECTRONICS

94 Stratford Road, Wolverton, MILTON KEYNES
MK12 5LU Telephone: Milton Keynes (0908) 314825

• Circle No. 217

TANDY TRS-80 TEXAS TI-99/4 in Bedfordshire

ELECTRON SYSTEMS
6, PARK ROAD, SANDY
Telephone 0767-81195

• Circle No. 218

MAXELL DISKETTES

(SOFT SECTORED)

MD1 S/S S/D Box of 10 £24.95
MD2 D/S D/D Box of 10 £34.95

SUPERBRAIN 67K RAM 320K £1649
SUPERBRAIN 64K RAM 700K £1990

EPSON DOX MATRIX PRINTER
NEC SPINWRITERS AVAILABLE

CALL NOW!

BRISTOL (0272) 312333 or 313418

NUMBERCRUNCH

289 ALMA VALE ROAD, CLIFTON, BRISTOL
EXCLUSIVE OF VAT (POSTAGE & PACKING FREE)

• Circle No. 219

TANDY COMPUTER CENTER

— FOR BUSINESS AND PLEASURE —
FULL RANGE OF TRS 80 COMPUTERS
DISC DRIVES, SOFTWARE, PRINTERS.
OTHER MAKES ALSO AVAILABLE



EXPERT FRIENDLY ADVICE



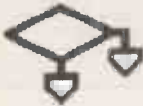
PJ EQUIPMENT
3 BRIDGE STREET (0483)
GUILDFORD, SURREY 504801

• Circle No. 220

SOFTWARE

WE WRITE PROGRAMS TO
FIT YOUR REQUIREMENTS

SPECIALISTS IN PET SOFTWARE



ARMBAM LTD.

KILN LANE

LEIGH

TONBRIDGE

KENT TN11 8RT

HILDENBOROUGH 832130

• Circle No. 221

TRS-80 I, II & III

THE SPOOLER gives your Model I/II/III the same performance edge bigger computers have had for years, with the SPOOLER installed CPU time ordinarily spent waiting for disk and printer operations to complete is made available for useful work. Performs much better and is easier to use than those supplied with NEWDOS/80 and TRSDOS2.0. Installation is simple and requires no changes to your programs. **£45.00**

MODEL II EXTENDED BASIC adds command abbreviations and additional commands for variable/line number cross referencing, re-numbering with block relocation, dynamic dump of variable contents, locate/replace strings and commands in program text and compress your BASIC programs to an absolute minimum — and more! — a must for every programmer. **£87.50**

Other MODEL II Software includes remote data entry, Model II to Model II file transfers, convert "V" to "F" format files, convert Model I Basic to Model II, output simultaneously and separately to parallel and serial printers, true proportional spacing for the Electric Pencil, Structured BASIC, powerful multivariate sort and other BASIC extensions, disk intermediate spoolers etc.

All Model II disks contain DOSFIX, a collection of patches to TRSDOS and BASIC to enhance their usability and function. Includes removing 'break' to CTRL6, disable verify detect (speeds disks by 30%) and change disk stepping rate from 20 to 12 ms — 80% faster!

Most products now available for TRSDOS 2.0 and the Model III.
Prices exclude VAT. Write or call for details.

SYSTEM SOFT

49 DUNVEGAN DRIVE, RISE PARK,
NOTTINGHAM 5 5DX. TEL (0602) 275569

• Circle No. 222



in MIDDLESEX

**APPLE II Europlus 48K
ONLY £695.**

MONAPPLEY GAME
*up to 4 Players
*amazing graphics
*ONLY £18.95

BASF 5.25in Disks — 10 for **£18.95**
Add 15% VAT (P&P FREE)
Send Cheque/P.O. payable to **AUTOCRAT**

264 PRESTON RD. HARROW, MIDDX.
Tel 01 908 3636 or call & see us NOW

• Circle No. 223

BUYERS' GUIDE

The Buyers' Guide is a summary of low-cost computers available in the U.K. It appears every third month; we add new computers and amend existing information, as required, to keep it up-to-date. Systems are listed by manufacturer.

Microcomputers

ACORN COMPUTERS

Systems 1.2.3: 6502-based, 1-8K RAM, COS or DOS, Hex or full keyboard, TV interface, Acorn bus. Personal or scientific use. Reviewed September 1979.

*From £65 for
System 1 kit;
£285 for System
2 kit; £670 for
System 3 kit*

Atom: 6502, 2-12K RAM, up to 40K external memory, full keyboard, Basic in ROM, high-resolution graphics, cassette and TV interface, parallel port, I/O lines. Should eventually be able to link into a ring. Acorn Computers Ltd, 4a Market Hill, Cambridge CB2 3NJ (0223) 312772. Reviewed November 1980.

From £130

AIRAMCO

Mikro 1000: Z-80, 64K RAM, serial and parallel I/O, 12in. P31 display, detachable 117 key keyboard, twin 8in. drives up to 2MB storage, CP/M, S-100. Airamco Ltd, 9 Longford Avenue, Kilwinning Industrial Estate, Kilwinning, Ayrshire. (0294) 57755. **£3,500**



ALAN PEARMAN LTD

Maple: Z-80A, 16-64K RAM, S-100 bus, CP/M, 8in. discs, RS232 serial and parallel. Sold mainly as Micro-APL system. Alan Pearman Ltd, Maple House, Mortlake Crescent, Chester CH3 5UR. (0244) 46024. *From £1,510*

ALPHA MICRO

AM-1010, AM-1051: WD-16, 64K-16MB RAM, S-100, four 8in. up to 90MB hard discs, RS232 up to 20 ports. Alpha Micro, 13 Brunswick Place, London N1 6ED. (01) 250 1616. *From £7,500*

APPLE COMPUTERS

Apple II Plus: 6502, 16-48K RAM, 8K ROM, colour graphics, 5 1/4in. discs, general use. Own bus. Reviewed October 1979. *From £695*

Apple III: 6502A with supporting chips, giving it a superset of 6502 instruction set. 96-128K RAM, colour graphics, integral 5 1/4in., RS232, four 50-pin expansion slots. Microsense, Finway House, Hemel Hempstead, Hertfordshire HP2 7PS. (0442) 48151. *P.O.A.*

ATTACHE

Attache: 8080, 64K RAM, S-100, parallel port, 8in. discs, business system. Friargrove Systems Ltd, 494 Great West Road, Hounslow, Middlesex (01) 572 3784. *From £1,737 to £7,000*

BASF

System 7100: Z-80A, 64K RAM, RS232, 5 1/4in. discs, business systems. MPR, 293 Grays Inn Road, London WC2. (01) 837 6332. *From £4,937*

BILLINGS

BMS: Z-80A, 64K RAM, 8in. 200MB hard discs, business system. Mitech Data Systems, 8 Guildford Road, Woking, Surrey. (04862) 23131. *From £4,295*

B L MICROELECTRONICS

Biproc: Z-80 or TMS9980 kit, 1K RAM, 2K monitor, RS232, cassette, TV. BLM, 1 Willow Way, Loudwater, High Wycombe, Buckinghamshire HP11 1JR. (0494) 443073. *From £150*

BLEASDALE COMPUTER SYSTEMS

UDS: 8080, Z-80, 6809, 32K-1MB, Multibus, CP/M, 5 1/4in., 8in., hard, RS232, four parallel ports, IEEE 488, development system. Bleasdale Computer Systems, Francis House, Francis Street, London SW1. (01) 828 6661. *P.O.A.*

UK101 SOFTWARE ON TAPE

from the guy who wrote "La Passe Temps"

GALACTIC HITCHHIKER (8K) An Adventure, all in machine code. A beauty! (£7.00)

SUPERTREK (8K) Sail boldly through the universe zapping moving Klingons in real time. Superb graphics. (£7.00)

LUNAR LANDER A real challenge. You won't get down in less than three hours. (£3.00)

LE-PASS-TEMPS This is what a computer game SHOULD be like (£3.00)

HANGMAN Excellent graphics... P.E. said so! (£3.00)

STARTREK (8K) The old favourite, beautifully presented. Not real time but great graphics nonetheless (£6.00)

*** NEW ***

CASSETTE HANDLER facilitates named programs/files at Baud Rates from 300 to 12,000, with complete reliability. User transparent - no troublesome POKing even after a reset. (£4.00)

Others available include a BASIC TUROR (8 x 4K programs) at £12.00 and lots more games.

All programs are available for 16x48 or enhanced (32x48) display and compatible all monitor ROMs. Compatible also with enhanced SUPERBOARD. All inclusive prices from

A. KNIGHT (DEPT PC)

28 SIMONSDALE WALK, ORMESBY, CLEVELAND

Tel: (0642) 321266

• Circle No. 224

GAMES FOR THE TRS-80 (16K, L2)

Cassette 1. **SPACE ATTACKERS.** Now you can play this popular arcade game without having to feed it 10p's.

DIGITAL CLOCK. With alarm facility.

Cassette 2. **BREAKWALL** (with sound). Knock the bricks out of the wall by bouncing the ball off your paddle. Sounds easy? - it gets more difficult.

FOUR IN A ROW. A game for two players. try and get four counters in a row. Definitely a thin-king game.

Cassette 3. **SURROUND.** Two lines move (one controlled by you, the other by the computer) getting faster all the time. The first to hit a line loses. (watch out for random obstacles).

FOX AND HOUNDS. You must stop the computer controlled fox from getting to the top of the board.

SIX GAMES FOR THE ZX80(1K)

Pontoon, guess the number, battleships, slot machine (162), maths quiz, maze (162). all on one cassette.

Each cassette cost £3.00 (incl. p&pp), is dual saved and comes with complete instructions from:-

BRAMWELL ENTERPRISES,
87, ANDERSON CRESCENT,
GREAT BARR,
BIRMINGHAM. B43 7ST.

• Circle No. 225

Sinclair ZX81

SOFTWARE

LOW-PRICE SOFTWARE ON CASSETTE

PROGRAM PACK 1 (for 1K ZX81 & 8K ROM ZX80)
Digiclock, 9 lives, Sketchpad, Dice, Catch,
Reaction Test, Gobbler, Patterns
All on one cassette for ONLY £3.50

ZX80 ASSEMBLER (for 16K ZX81 & ZX80)
NEW Machine code assembler, complete with
documentation ONLY £4.00
Send SAE for full list of ZX80(state ROM) &
ZX81 software.

Acorn Atom INVADERS!

This superb game was £12 - now we are offering it at ONLY £9.00. Atom Pinball is now only £4.50, and Fruit Machine is now £4.00. Send for our complete catalogue with new low prices - we have the largest range of ATOM software available.

NEW RELEASE: ATOM DISASSEMBLER, ONLY £4.00
ALL PRICES INCLUSIVE MAIL ORDER ONLY

BUG-BYIE

251 MENLEY ROAD
COVENTRY CV2 1BX

• Circle No. 226



PUT YOUR MICRO TO WORK!

CONTROL MACHINES, ROBOTS, FACTORY OR HOME

Have you ever wanted your MICRO to control a machine for you, or manage your house? If so the MDR 'MICROCOMPUTER CONTROL INTERFACE' will give you isolated channels of OUTPUT (8A @ 250 volts) and switch sensing INPUTS.

Available now for connection to PET USER PORT, RS232 and IEEE488, allowing expansion up to more than 900 channels.

Supplied complete with connecting cables, full data and guarantee from £12.54 per channel. Complete preprogrammed systems or individual components available. Write or phone for details.

MDR (INTERFACES)

Little Bridge House, Dane Hill, Nr. Haywards Heath, Sussex RH17 7JD. Telephone: 0825-790294.

• Circle No. 227

PRICES SLASHED

As our introductory offer the following prices are held firm until 31 August.

£40 off VISICALC	Now £85
£20 off DESKTOP PLAN	Now £55
£15 off PASCAL CARD	Now £284
Games Software	From £8
Educational Software	From £10
Business Software	From £90

Add 15% vat and £1 p&p to above prices.
For full catalogue send to:

ANDERLEE COMPUTING SERVICES

17 ADELPHI CRES., HAYES PARK,
HAYES, MIDDX. UB4 8LY
or telephone 01-841-1507

• Circle No. 228

TRS 80 16K L11 THE FUNCTIONAL BUSINESS SOFTWARE for CASSETTE

BREAKTHROUGH. BRITISH COMPOSED WORD PROCESSOR TYPER IV AT £15.00 INCLUDING MANUAL

YEAR AUDIT/ BANK ACCOUNT

Shows Bank Balance instantly. Shows accumulated expenditure in 36 columns. Balances to date, month & year, from which can draw up a balance sheet. Stores all names & numeric records.

ORDERS PROGRAMME	14.95
SALES LEDGER	21.95
MAILING LIST	9.95

Searches by Name, Town, County & Code No. A powerful reference system can be created using code. Search by name does not require exact spelling to find.

All programs are menu driven needing no operator expertise. Most responses require only single key-strokes. Operator errors correctable.

We believe our software to be unequalled in Functionality & ease of use. Causes great excitement from users. Access software draws congratulations by letter & phone as to its straightforward functional ability. Fascinating Games with high quality graphics, by one of Britain's leading Authors from £5.00

2000 Sheets 11"x9 1/2" Fanfold paper £14.00 + 2.55 p&p. Multi copy forms in stock.
Printers from: Epson MX70 £259.00. OKI 80. £289.00

S.A.E. for catalogue.
ALL SOFTWARE PLUS 75 pence P&P
ALL PRICES PLUS VAT
ACCESS COMPUTERS
2 ROSE YARD, MAIDSTONE, KENT:

• Circle No. 229

BRUTECH ELECTRONICS

BEM: Single-board processor with 6502 and no RAM. Data Precision Equipment, 81 Goldsworth Road, Woking, Surrey GU21 1LJ. (04862) 67420. *From £133*

BYTRONIX MICROCOMPUTERS

Megamicro: 8080/Z-80, 64K RAM, 8in. discs, CP/M. Business and university use. Bytronix, 83 West Street, Farnham, Surrey GU9 7EN. (0252) 726814. *From £6,080*

CANON BUSINESS MACHINES

Canon BX-1/BX-1d: 6800, 64K RAM, 5 1/4in. integral, RS232, V24 ports, business use. Canon Business Machines, Wadden House, Stafford Road, Croydon, Surrey. (01) 680 7700. *From £3,250*

COMMODORE BUSINESS MACHINES

Pet: 6502, 8-32K RAM, IEEE ports, integral 9in. screen, personal and general use. Reviewed August 1979. *From £460*

8000 Series - SuperPet: Upgrade of original Pet. 12in. screen, 5 1/4in. discs, business and general use. Reviewed October 1980. *From £895*

Kim-1: 6502, LED six-digit display, 1K RAM, cassette and Teletype interface, evaluation board for 6502 chip. Commodore Business Machines, 818 Leigh Road, Slough Industrial Estate, Slough, Berkshire. (75) 74111. Reviewed November 1978. *From £99.95*

COMPSHOP

UK101: 6502, 4-8K RAM, TV interface, RS232, full keyboard, single-board, personal use, similar to Ohio Superboard. Compshop, 14 Station Road, New Barnet, Hertfordshire EN5 1QW. (01) 441 2922. Reviewed May 1980. *From £199 for kit*

COMPUCOLOUR

Compucolour II: Z-80, 8-32K RAM, 5 1/4in. integral discs, 13in. colour VDU, RS232. General use. Dyad Developments, The Priory, Great Milton, Oxfordshire OX9 7PB. (08446) 729. Reviewed June 1979. *From £998*

Copernicolor II: 8080A, 8-32K RAM, 5 1/4in., 8in. and Winchesters available, VDU, RS232 bus, standard ASCII keyboard with optional keyboards available, graphics 128 by 128, Basic, assembler, Fortran. Based on Compucolour II, wide range of software. General use. Copernicus Ltd, 7 Wey Hill, Haselmere, Surrey. (0428) 52888. *From £1,200*

COMPUCORP

655-675: Z-80, 60K RAM own OS but will run CP/M with modifications, RS232, IEEE and others optional. 1-4 5 1/4in. discs, 16by80 VDU. Business use. Barnet House, 120 High Street, Edgware, Middlesex. (01) 952 7860. *From £2,595 to £4,750*

COMPUTER CENTRE

Minikit: Z-80, 16K RAM, serial and parallel, 5¼in., CP/M, S-100. *From £800*
Maxikit: Z-80, 16K RAM, serial and parallel, 8in., CP/M S-100. *From £911*
 Computer Centre, 9 De la Beche Street, Swansea SA1 3EX.

COMPUTERMART LTD

Computermart 2000 range: Z-80A, single/multiple, 16-256K, CP/M, S-100 bus, graphics, 8in. single-density double-sided, 180MB hard disc, general/business use. Computermart, 60 St. Faiths Lane, Norwich, Norfolk. Norwich 615089. *From £6,000*

COMPUTHINK

Act System 800: 6502, 48K RAM, full keyboard, graphics, 5¼ or 8in. discs, 12in. VDU integral. Business system. Act, 66-68 Hagley Road, Edgbaston, Birmingham B16 8PF. (021) 455 8686. Reviewed February 1980. *From £4,000*

CROMEMCO

Single Card Computer: Z-80, S-100, 1K RAM, 20mA/RS232. *From £273*
 OEM and industrial use.

Z2: Z-80, 31A power supply, motherboard, 21 sockets, serious hobbyist and OEM use. Reviewed February 1979. *From £573*

Z2-H: Z-80A, 64-512K RAM, S-100 bus, CDOS, 10MB formatted fixed disc, two 5¼in. discs, hard discs up to 70MB. *From £5,373*

System 2: Z-80A, 64-512K RAM, S-100 21 slots, CP/M, VDU, two 5¼in. discs, hard discs up to 70MB. Multi-channel interface available. General/business use. *From £2,095 to £6,408 for seven users*

System 3: Z-80A, 64-512K RAM, S-100, CP/M, two or four 8in. discs, hard discs up to 70MB, general/business use. Datron Microcentre, 2 Abbeydale Road, Sheffield S7 1FD. (0742) 585490. Microcentre, 30 Dundas Street, Edinburgh EH3 6JN (031) 556 7354. Comart, PO Box 2, St Neots, Huntingdon, Cambridgeshire PE19 4NY. (0480) 215005. *From £3,568 to £8,304 for seven users*

DATA APPLICATIONS

DAI Personal Computer: 8080, 8-48K RAM, colour graphics, 20 Eurocard industrial interface modules, RS232, industrial use. Data Applications, 168 Dyer Street, Cirencester, Gloucestershire GL7 2PF. (0285) 2588. Reviewed February 1981. *From £998*

DIGITAL DATA ELECTRONICS

SPC/1: 8085, 32-48K RAM, own OS, COMAL, Assembler and Pascal, graphics, up to three 5¼in. drives, up to four 8in. drives, 10MB Winchester, up to four 20MB cartridge, many ports. DDE, Clark House, Pump Lane, Hayes, Middlesex. 01-573 8991. *From £1,995*

DIGITAL MICROSYSTEMS

DSC-3: Z-80, 64K RAM, CP/M, 8in. discs, hard discs up to 28MB, RS232/V24, business and general use. *From £3,445*

DSC-4: Z-80, 128-512K RAM, CP/M, 8in. discs, hard discs up to 28MB, RS232, RS422, business and general use. *From £3,995*

Hex-29: AMD 2900 16-bit, 64K-1,024K RAM, Hex bus, 8in. discs, hard discs up to 28MB. Eight to 32 ports, RS232. Modata, 30 St Johns Road, Tunbridge Wells, Kent TN4 9NT. (0892) 41555. *From £6,445*



DYSON & MEMOREX

WE STOCK
 THE BEST IN FLOPPIES,
 CARTRIDGES, W.P. SUPPLIES
 AND STORAGE, BACKED
 UP WITH NATIONWIDE
 SERVICE...
 CALL US ON 0934 416392
 ASK FOR DEPARTMENT D

DRG
BUSINESS
MACHINES

• Circle No. 230

D. RAM: Set of 8: 4116-200 ns £12.00

(add 50p for P&P)

We are manufacturers of the DRC MODULES (Dynamic Ram Controllers) which plug into the MPU socket and expand RAM by 16KB, 32KB, 48KB or more in seconds — very low cost, removable and neat. E.g. 32K expansion for only £67.00 (1 off).

Information and orders:
 87 BOURNEMOUTH PARK ROAD
 SOUTHEON ON SEA, ESSEX.

Tel: (0702) 613081
 PERSONAL CALLERS WELCOME

• Circle No. 231

BIG EARS

SPEECH
 INPUT
 FOR
 YOUR
 COMPUTER!



BIG EARS opens the door to direct man-machine communication. The system comprises analogue frequency separation filters, preamps and signal conversion, together with a quality microphone and extensive software.

Words, in any language, are stored as "voice-prints" by simply repeating them a few times in "learn" mode. Using keyword selection techniques, large vocabularies can be constructed.

Use BIG EARS as a front end for any application: data enquiry, robot control, starwars — the possibilities are unlimited...

BUILT, TESTED & GUARANTEED ONLY £49!

PRICE INCLUDES POSTAGE & PACKING PLEASE ADD VAT AT 15%
 PLEASE STATE COMPUTER: UK101, SUPERBOARD, NASCOM2,
 PET, TRS80, ETC.

MICROGRAPHICS

Colour Conversion for
 UK101/NASCOM 1 & 2/ Superboard. *KIT £45*
 (Modulator included) *BUILT £60*

COLOUR MODULATOR

RGB in, PAL/UHF out *KIT £12*
BUILT £18

Please add VAT at 15% to all prices
 Barclay/Access orders accepted on telephone

WILLIAM STUART SYSTEMS Ltd Dower House, Billericay Road, Herongate, Brentwood, Essex CM13 3SD. Telephone: Brentwood (0277) 810244

• Circle No. 232

OHIO IN THE NORTH

Computers and Peripherals

FOR:

- * THE HOME
- * SCHOOLS
- * LABORATORIES
- * SHOPS
- * OFFICES

SPECIAL MULTI-USER SYSTEMS FOR COLLEGES

ALL FROM:

C. T. S.

31/ 33 Church Street,
Littleborough, Lancs.

Tel: (0706) 79332/ 74342

• Circle No. 233



"THIS BOOK IS EXCELLENT!"

— Clive Sinclair

'30 PROGRAMS FOR THE SINCLAIR ZX-80-1K' is a unique 112 page book which contains 30 programs all designed to fit into your basic 1K version of the Sinclair ZX-80. IN programs which go far beyond anything that has been published the authors show the unique capabilities of the Sinclair ZX-80. The ZX-80 is more powerful than you ever thought!

BLACKJACK — actually contains a full pack of cards, shuffles them, keeps track of the dealer and player card totals, and the money bet, all within 1K.

MEMORY LEFT — an incredible routine, especially useful as it enables you to know exactly how much memory is left, even during the running of a program. This also illustrates USR routines.

DR. ZX-80 — a conversational program with the computer as analyst which uses an ingenious method of storage.

GOMUKU — the computer challenges you to this complex Japanese game. Incredibly this program including display of the 7 x 7 board, fits into 1K; it only does so because it uses the display as memory!

Other programs included are **HORSE RACE, LUNAR LANDER** (with moving spaceship), **NOUGHTS & CROSSES, NIM, SIMPLE SIMON, HANGMAN, LIFE, MASTERMIND, PINCH** and 17 others.

As well as the programs, the book illustrates programming techniques you can use in your own programs — space compression, **PEEKs and POKEs, USRs** and so on.

AVAILABLE BY MAIL ORDER ONLY £8.95 plus 50p p&p
MELBOURNE HOUSE PUBLISHERS

Orders to: 131 Trafalgar Road, London SE10.
Correspondence: Glebe Cottage, Glebe House, Station Road, Cheddington, Leighton Buzzard, Bedfordshire LU7.

I enclose £7.45 for each copies of '30 programs for the Sinclair ZX-80. 1K' book. (Orders outside the UK — £7.95).

NAME

ADDRESS

Postcode

• Circle No. 234

FLOPPY DISKS

5 1/4" — VERBATIM DATALIFE	PER TEN
MD525 35/40 TR. — Sn. Sd.	— £21.05
MD550 — 35 — 40 TR. Ds. Sd.	— £29.58
MD577 77TR — Sn. Sd.	— £31.87
MD567 77TR — Ds. Sd.	— £38.99

Available as soft sector (Single Index) or 10 or 16 sector at same price — stipulate when ordering.

All mini-diskettes fitted with hub reinforcing ring.

8" — VERBATIM DATALIFE	PER TEN
FD34-1000 — Sn. Sd.S.D.	— £27.40
26 Sec.	
128 Bytes/S	
FD34-9000 — Sn. Sd.D.D.	— £33.84
Soft sector.	

Most types supplied
Please let us quote your needs.

DISKETTE HEAD CLEANING KITS

5 1/4"	—	£21.58
8"	—	£24.15

HARD DISKS

We offer a refurbishment service for Front-Loading and Top-Loading Disk Cartridges and are an established service company within the computer industry.

NOTE: ALL PRICES INCLUSIVE OF POSTAGE + VAT

Discounts available for large orders.
Details on request.

SPEAKE & CO.

FREEPOST, CRICKHOWELL, POWYS. NP8 1YZ
TELE: 0873 811281

• Circle No. 235

DURANGO

F85: 8085, 64K RAM, own bus and OS, graphics, four RS232 ports, integral 9in. VDU, 9 x 9 printer, keyboard and two 5 1/4in. disc drives. General use. Comp Ancillaries, 64 High Street, Egham, Surrey. (07843) 6455.

From £7,500

DYLE HOUSE

System 2000: Z-80, 64K RAM, dual 8in. discs, own OS, business use. Dyle House, 36 Abbot Way, Wellingborough, Northamptonshire. (0933) 79135.

P.O.A.

DYNABYTE

Dynabyte 5000: Z-80, 32-64K RAM, S-100, CP/M, MP/M, CP/Net, RS232, 5 1/4 or 8in. discs, hard discs up to 96MB, expands to multi-task/user system. Business use. Microtech Ltd, Waterloo Road, Uxbridge, Middlesex, UB8 2YW. (0895) 57780.

From £1,600 to £12,000

EACA

Video Genie EG3003: Z-80, 16-48K RAM, S-100, CP/M, 5 1/4in. discs, RS232, personal and general use. Lowe Electronics, Bentley Bridge, Chesterfield Road, Matlock, Derbyshire DE4 5LE. (0629) 2430. Reviewed February 1980.

From £369

ECS MICROSYSTEMS INC

Aristocrat: Z-80A, 32-180K RAM, 12K PROM, dual 5 1/4in. drives, 946K. Three RS232 and one parallel port, CP/M, wide range of protocols, business and general use. Telecomputing Systems Ltd., Seacourt Tower, Westway, Oxford. (0865) 723621.

From £3,950

EQUINOX

200: Z-80, 64-512 RAM, S-100 bus, CP/M, Omnix, MicroCobol, MVT FAMOS, cartridge disc, six serial and one parallel port, business use.

From £7,500

300: WD-16, 64-256K RAM, S-100 bus, CP/M, Omnix, MicroCobol, MVT FAMOS, cartridge disc drive, six serial ports, business use. Equinox, 16 Anning Street, New Inn Yard, London EC2A 3HB. (01) 729 4460/(01) 739 2387.

From £10,500

EUROCALC

Euroc: 8080, 64K RAM, 8in. discs, 15in. VDU, CP/M, business use. Eurocalc, 55/56 High Holborn, London WC1. (01) 405 3113.

From £8,000

EXIDY

Sorcerer: Z-80, 16-48K RAM, S-100, RS232, CP/M, 5 1/4in. discs. Plug-in ROM pack programs. Liveport, The Ivory Works, St Ives, Cornwall TR26 2HF. (0736) 798157. Reviewed May 1979.

From £749



GNAT

System 10: Z-80, 65K RAM, own bus, CP/M, graphics, 5¼in. discs, RS232, RS449, 12in. VDU, full keyboard, optional IEEE. Business use. Millbank Computers, 98 Lower Richmond Road, London SW16. (01) 788 1083. Reviewed December 1980. *From £2,995*

HAYWOOD

Systems 1000-8000: Z-80, 32-65K RAM, 6000 is S-100, 3000 single-board, CP/M, graphics, 5¼in. discs, three serial and parallel ports. Business, scientific and general use. Haywood Electronics Assoc., 11 Station Approach, Northwood, Middlesex. (01) 428 9831. *From £2,359*

HEATH/ZENITH

H8: Single-board WH8 assembled, 8080, 16K-65K RAM. Heathbus nine slots, cassette interface, nine-digit LED. *From £321*

Z89: Z-80, 16-48K RAM, CP/M, integral 5¼ in. drive, optional dual external, two RS232, full keyboard, 12in. VDU. *From £1,570*

WH-11A: LSI-II, 16-bit, 16-32K RAM, own bus and OS, optional dual 8in. drives, serial and parallel ports. Heath Ltd, 11b Bristol Road, Gloucester GL2 6EE. (0452) 29451. (01) 636 7349. *From £1,250*

HEWART

6800Mk II: 6800 single-board, 1K monitor, 1K user RAM, 1K VDU RAM, 128byte scratchpad, education and home user. S-50 bus. *From £155*

6800S: 6800, 16K monitor, 8K Basic in ROM, graphics, 5¼in. drive. Hewart, 95 Blakelow Road, Macclesfield, Cheshire. (0625) 22030. *From £229*

HEWLETT-PACKARD

85A: 16-32K RAM, 32K ROM, IEEE 488, RS232, graphics, 5¼in. drives, integral 32 by 16 VDU, integral thermal printer, QWERTY and numeric keypad. Scientific use. Hewlett-Packard, King Street Lane, Winnersh, Workingham, Berkshire. (0734) 784774. *From £1,830*

HYTEC MICROSYSTEMS

H-3000: Z-80A, 4MHz, 32-128K RAM, two minifloppy discs, standard I/O, two parallel, three serial ports, single board. *From £2,381-£2,640*

H-4500: Z-80, 64-208K, two minifloppy discs, standard I/O, two parallel, three serial ports, 4MHz option. *From £3,110*

H-7000: Z-80A, 4MHz, 32-128K, two 8in. floppy discs, standard I/O, two parallel, three serial ports. *£3,350*

IMAGE DATA PRODUCTS LTD

Image Data Eight: 6802, 4-40K RAM, 43-way bus, own OS, Basic assembler and editor, viewdata-style graphics, up to four 5¼in. discs, up to 12 RS232 ports. Image Data Products, 1-4 Portland Square, Bristol, BS2 8RR (0272) 40248. *£500-£4,000*

SYSTEMICS LIMITED

21-23 The Bridge
Harrow Middlesex HA3 5BH
(01)422 3276 (24 hours)

HI-RES PROBLEM SOLVER £45

an all purpose hi-res processor, includes upper/lower case, mixed graphics and text, two way window scrolling, user shape definition with rotation, enlargement, slanting, stretching, reflection, inversion and other hi-res functions.

LITERATURE SEARCH £25

a suite of four programs forming a complete magazine article filing system allowing retrieval of references to items by keyword(s) within category.

DISC ORGANISER £15

a program to maintain a list of your discs; print labels and catalog discs automatically.

Many other quality packages include

Club membership	£95
Linear programming	£85
Time recording	£125
Mailing list	£75

Dealer enquiries invited



ASK FOR OUR CATALOGUE
ADD 15% VAT - POST FREE
Access & Barclaycard Welcome

• Circle No. 236

NEW VERSATILITY FOR TRS 80

CP/M from Pickles & Trout now available to give your Tandy Model II access to software worldwide.

This version of CP/M is designed specifically for the Model II and has none of the problems associated with other versions.

Plus 20 utilities to extend and enhance CP/M on the Model II.

Full P & T and digital research documentation, £130 plus VAT.

For more details contact:

TAYLOR MICRO SYSTEMS LTD.
Hamstead Industrial Estate,
Old Walsall Road, Great Barr, Birmingham B42 1DF
Tel: 021 358 2436

• Circle No. 237

NEW

TRS 80 MODEL III

The Model III has arrived in the U.K.

NEW FEATURES AVAILABLE

- *Upper and Lower Case characters (standard)
- *Real Time Clock
- *500 or 1500 Baud Cassette
- *Parallel Printer Interface (standard)
- *Auto Repeat keys
- *Flashing Cursor
- *New Characters, Greek, Japanese Kana
- *Numeric Keypad
- *16, 32 or 48K
- *Room for two D.D. Disc Drives & Interface
- *12" VDU

All in stylish cabinet.
16K ~~£849~~ INCLUSIVE
See Enquiries Delivery 4-6 weeks

N.I.C.
Unit 7, 61 Broad Lane, London N15 4DJ
Daytime 01-808 0377 Evenings 01-889 9736

• Circle No. 238

SHOP WINDOW

SHUGART

MINI FLOPPY DISC DRIVES

** THE LOWEST PRICES ANYWHERE **

SA 400 5 1/4" £185.00

BRAND NEW — 3 MONTH LABOUR & PARTS WARRANTY.

Also available Tandon TM100 — 1 drives

ENCOTEL SYSTEMS LTD
530 PURLEY WAY, CROYDON, S7
01-686 9687

• Circle No. 239

ALL RISKS INSURANCE FOR YOUR COMPUTER Including Transit

FOR

Minimum sum insured £2,000
Minimum premium £10
Excess £10

GO TO
GENERAL MARINE & LIFE INSURANCE BROKERS
36 New Street, The Barbican,
Plymouth, PL1 2NA
TEL (0752) 29892

• Circle No. 240

TOP QUALITY FLOPPIES Verbatim

Ex: Single Side Single Density Diskettes

	Unit Price	Box Price inc. VAT
8"	£2.27	£27.37
5 1/4"	£1.79	£21.90

Always Quote Your Machine Type When Ordering

- Many other Types Available
- We Can Quote for Your Machine
- Quantity Discount For 50+

Please Give Us A Ring



48 HEDLEY STREET, MAIDSTONE, KENT ME14 5AD
Tel. Maidstone 679 595 MAIL ORDER ONLY

• Circle No. 241

FULLY ASSEMBLED & TESTED

Professional ASCII Keyboards

All complete with Metal mounting frames



MODEL KB 771 B 72 Key £59.50
MODEL KB 756 MF 56 Key £39.50

CARTER KEYBOARDS

Accessories supplied with Keyboard only:
DC to DC Converter DC 512 £5.00
(for operation off single 5v supply)

Model 756 MF Only		
Edge Connector	KB 15 P	£1.95
Numeric Key Pad	KB710	£7.50
Plastic Case (Black)	KB705	£12.75

UK Orders add 15% VAT on order total
Overseas Orders add £2.00 p&p.

FULL DATA SHEET ON REQUEST
CITADEL PRODUCTS LIMITED
Department PC, 50 High Street Edgware
Middlesex HA8 7EP Telephone: 01-951 1848

INDUSTRIAL MICROSYSTEMS

Series 5000: Z-80, 16-56K RAM, CP/M, S-100, two or three 5 1/4in. discs, two serial and one parallel port, desk unit, business and general use. *From £1,500*

Series 8000: Z-80, 64-256K RAM, S-100, CP/M, MicroCobol, MVT FAMOS, Omnix, two, three or four 8in. disc drives, two serial and one parallel port, desk unit, business and general use. Equinox, 16 Anning Street, New Inn Yard, London EC2A 3HB. (01) 739 2387/(01) 729 4460. *From £2,500*

INSTAR

Omega: 16-bit, 48-256K RAM, dual floppies, hard discs, up to 12 simultaneous users, business use. *From £7,500*

Asatayd: Z-80, 16-56K RAM, dual floppies, CP/M, S-100 bus, business use, Instar, 61 High Street, Croydon, Surrey CR0 1QD. (01) 680 5330. *From £4,950*

INTERTEC

Superbrain: Z-80, 64K RAM, 256 static RAM, dual Shugart, optional hard disc, CP/M, S-100 bus, business and general use. Encotel, Succombs Hill, Upper Warlingham, Surrey. (820) 5701. Sun, 138 Chalmers Way, North Feltham Trading Estate, North Feltham, Middlesex. (01) 751 6695. KGB, 88 High Street, Slough, Berkshire. (75) 38581. Icarus Computer Systems Ltd, 27 Greenwood Place, London NW5 1NN. 01-485 5574. Reviewed April 1980. *From £1,495*

ITHACA INTERSYSTEMS

Pascal Micro DPS1: Z-80, 64K-1MB RAM, full IEEE S-100 bus, CP/M version 2.2, graphics 8in. and hard discs, RS232, four parallel and two serial ports per S-100 board. Ithaca Intersystems, 58 Crouch Hall Road, London N8 8HG. (01) 341 2447. *From £4,258*

ITT

2020: Built under licence from Apple. See entry under Apple II. ITT, Star House, Mutton Lane, Potters Bar. (77) 51177. *From £827*

KEMITRON ELECTRONICS

UDS 3000: Z-80, 1-64K RAM, Kbus, own OS, CP/M, 8in. and hard discs, ports up to 256. Kemitron Electronics, (0244) 21817. *From £640 to £4,000*

LOGABAX

LX-500: Z-80, 32K RAM, S-100, CP/M dual 5 1/4in. drives, business use. LogAbax Ltd., 1-7 Wesley Avenue, London NW10. (01) 965 0061. *From £3,000*

LSI COMPUTERS

M-One: 8080, 8-16K RAM, own OS, dual Shugart 8in. drives, two serial and one parallel port, 12in. VDU and full keyboard. Business use. *From £5,995 with software package*

M-Two: 8085, 64K RAM and 4K EPROM. Launched in December 1980. LSI Computers, Copse Road, St Johns, Woking, Surrey GU21 1SX. (04862) 23411. *P.O.A.*



LUXOR

ABC 80: Z-80, 16-40K RAM, 12in. VDU, IEEE 488, RS232, 5¼in. drives, loudspeaker, personal and education use. CCS Microsales, 7 The Arcade, Letchworth, Hertfordshire ST6 3ET. (04626) 73301. *From £795*

MICRO V

Microstar: 8085, 64K RAM, three RS232, serial inputs, StarDOS, twin 8in. drives, general use. Data Efficiency Ltd, Maxted Road, Maylands Avenue, Hemel Hempstead, Hertfordshire. (0442) 63561. *From £4,950*

MICROMATION

Z-Plus: Z-80, 64K RAM, S-100 bus, CP/M (3), MP/M two serial and six parallel ports, business use. Rostronics, 115-117 Wandsworth High Street, London SW18 4HY. (01) 874 1171. Reviewed May 1980. *From £3,950 to £8,550*

MICRONEX

MX-100: Z-80A, 64K RAM, S-100 bus, RS232, CP/M, Pixel graphics display system, twin 8in. drives. Micronex, Harford Square, Bristol BS18 8RA. (027) 589 3042. *From £3,485*

MIDWEST SCIENTIFIC INSTRUMENTS

MSI 6800: 6800, 16K-56K RAM, 5¼ or 8in. or hard discs up to 10MB. Systems 1,2,7 and 10. System 7 runs Flex, MSI, DOS and SDOS, RS232. System 10 is System 7 with hard disc. Business use. Strumtech (SEED), Portland House, Coppice Side, Brownhills, Walsall, West Midlands. (279) 4321. Reviewed March 1980. *From £1,100 to £12,000*

MODULAR BUSINESS SYSTEMS

Tutor: 8085, 32-64K RAM, Intel Multibus, CP/M, optional graphics, twin 5¼in. drives or four 8in., two RS232 serial ports. *From £2,500*

Elite: 8085, 32-256K RAM, Intel Multibus, CP/M, 5¼in. to 24MB hard discs, RS232, 24-bit TTL programmable port. Modular Business Systems, 21 Chapel Lane, Yeadon, Leeds LS19 7NX. *From £5,400 to £25,000*

NASCOM

Nascom 1: Z-80, 2-64K RAM, serial and up to 16 parallel ports, 8K Microsoft Basic, 1K monitor in EPROM. Personal use. Reviewed January 1979. *From £125*

Nascom 2: Z-80, 1K RAM expandable to 256 with Nascom System 80 case. Nasbus, 8K Basic, 2K monitor and 2K character generator, low/high-resolution graphics and colour. 5¼in. single or twin floppy discs, RS232, parallel port, Kansas City cassette port. Nascom Microcomputers, 92 Broad Street, Chesham, Buckinghamshire. (02405) 75151. Reviewed April 1980. *From £295*

NATIONAL MULTIPLEX

Pegasus: Z-80, 48K RAM, S-100 bus, 5¼in., 8in. drives, CP/M, 12in. VDU, business use. London Computer Store, 43 Grafton Way, London W1. (01) 388 5721. *From £2,700*

GOOD THINGS FOR 6800 SYSTEM BUILDERS

1. P.C.B.'s, including component list & schematics:—

CSH001 — SWTPC MPB/2 motherboard	£24.20
CSH002 — SWTPC MPA/2 CPU board	£11.50
CSH005 — SWTPC MPL/A parallel interface board	£ 6.60
CSH006 — SWTPC MPS serial interface board	£ 6.60

2. Assembled Boards.

CSH003 — SWTPC MPA/2 CPU, SWTBUG, space for 8k Eprom	£75.00
CSH004 — SWTPC MPA CPU, MIKBUG	£49.50

3. Components

CSH020 — 6800 Chip set: M6800, M6821, M6850, M6810 & M6875	£16.50
CSH021 — Molex connectors, 10 pin male, pack of 10	£2.50
CSH022 — Molex connectors, 10 pin female, pack of 10	£ 3.00
CSH030 MOTOROLA 6800 PROGRAMMING MANUAL, VAT free	£ 6.60

Prices include postage but add VAT at 15% when ordering.

COMPUSENSE LTD.
P.O. BOX 169 LONDON N13 4HT Tel: 01-882 0681

• Circle No. 242

TRS 80 ACCESSORIES

JOYSTICK CONTROLLER — Now you can add arcade-style to your games software instead of fumbling with your keyboard. The CSL Conustik is a high quality joystick with eight directions of movement plus a fire button complete with an interface which plugs into your expansion connector. You also get an operators manual and programming hints plus a cassette of four Level Two Basic programs including Slalom, Racer, Space Wars and Magic Artist. *£34.50 + 50p P&P*

LIGHT PEN — The CSL Photopen connects to your TRS-80 via the cassette recorder and can be used with a second cassette recorder on a Video Gene system. It permits direct communication with your system via the video screen. Complete with operating instructions, programming hints, 9v battery and a cassette of four Level Two Basic programs including three games and a simple subroutine to add Light pen input to your own programs. *£14.99 + 50p P&P*

CSL MICRODATA
4, GREENBARN WAY, BLACKROD,
LANCASHIRE, BL6 5TA
TELEPHONE: 0204 690465

• Circle No. 243

ARTIFICIAL INTELLIGENCE

TUTORIAL AND GAME-PLAYING PACKAGE, FULLY DOCUMENTED FOR YOUR

APPLE II (32K min)

- Send self-addressed stamped envelope for full details, or
- Send £19.50 and receive diskette with visible BASIC programs, including:
 - TRAP THE INVADER, a game for two based on Fox and Hounds;
 - LEARNING INVADER, enables you to teach a whole breed of invaders to play against humans;
 - PLUS programs that explain Artificial Intelligence techniques in the context of game-playing.

LEARNING

COMPUTER
SYSTEMS

37 St Andrews Drive,
Seaford, Sussex

• Circle No. 244

FUNCTIONAL BUSINESS SYSTEMS £2930.00 + VAT

Includes all Hardware, Software & Training. Full integration & automatic update of all ledgers, including stock, Sales Ledger, Purchase Ledger, Mailing Addresses, Invoicing, V.A.T., Statements, Double Entry Journals including Nominal Ledger, A/C Receivable & Payable giving Auto Bank Entries etc; etc.

Superbrain	
32K + 320K Disk	1637.50
64K + 700K Disk	1950.00
Printers	
OKI Microline 80	289.00
Epsom MX-70	259.00
Epsom MX-80 (F/T)	395.00
TEC Starwriter Daisy Wheel	995.00
Software	
Business Programme	975.00
Wordstar	245.00
Mail Merge	65.00
Stationery	
2000 sheets 11"x14" Fanfold Paper	14.00 +
	2.55 p&p
4 copy Carbon Forms Music Ruled	17.28 +
8 ½"x11" 500 Sets	2.55 p&p

ALL PRICES PLUS VAT & CARRIAGE
ACCESS COMPUTERS
2 ROSE YARD, MAIDSTONE, KENT:

• Circle No. 245

APPLE II/ITT 2020

VISCALC BACK-UP £16
A specially formatted disk to enable you to take a back-up copy of your Visicalc master disk.

VISCALC 3.3 UPGRADE SERVICE £18
Your own copy of Visicalc (or Back-Up) converted to work directly on a DOS 3.3 system, and to use DOS 3.3 format disks for storage. Includes warranty cover.

VISCALC 3.2 £90
The original Visicalc program at a competitive price.

VISCALC 3.3 £106
A copy of the standard Visicalc disk upgraded for you to DOS 3.3. Includes all documentation and our own replacement warranty.

VISCALC UTILITIES £32
Enables you to selectively access formulae and/or portions of a Visicalc worksheet; and to display these (without truncation) to screen or printer, or re-arrange them for further use by Visicalc, or re-format them for use by other programs.

RELOCATED INTEGER £16
Run any Integer Basic program without the expense of an Integer card. Includes Mini-Assembler. Specify memory size and whether DOS 3.2 or 3.3.

ALL PRICES FULLY INCLUSIVE

D. J. BOLTON 1 BRANCH RD. PARK STREET.
ST. ALBANS

TEL PARK STREET (0727) 72917

• Circle No. 246

Quality ADC'S and DAC'S for your Apple available at a very reasonable price

We now stock Real World Products' series 2000 analogue to digital and digital to analogue converter cards for the Apple.

These will enable your Apple to monitor and control various types of analogue instrumentation e.g. pressure, temperature, position or acoustic transducers, X-Y plotters and display scopes.

2010 8-bit adjustable 0—+10V full scale buffered voltage output DAC (settling time 20 micro-seconds) £26

2020 8-bit adjustable 0—+10V full scale buffered voltage output DAC (settling time 500 nano-seconds) £27

2030 8-bit adjustable 0—5V full scale unbuffered voltage output DAC (settling time 100 nano-seconds, output resistance 2.5 kilo-ohms) £26

2100 8-bit adjustable 0—2mA full scale current output DAC (settling time 100 nano-seconds) £26

2200 140 micro-second conversion time 8-bit ADC. Provides full 8-bit resolution between any two levels within 0—+5V range £26

Custom interface design and building undertaken at reasonable cost.

All prices inclusive of VAT, postage + packing
Cheques or official orders to

Merton Electronics
8 Rutlish Road, Wimbledon, London, SW19
TEL 01-543 3533

• Circle No. 247

1. Cromenco System 3 microcomputer with 128K memory, 3 Elbit VDU's and Dolphin BD-80P printer **£3000.**

2. Zilog MCZ-1/05 microcomputer, 64K memory **£1500.**

3. Elbit DS1920-X VDU **£500.**

4. Persci 299b disk drives with auto-eject **£1000 each**

Maintenance contracts are available for the above computers.

Telephone 0734 791737

• Circle No. 248

NEWBURY LABORATORIES

7768: CPU board, 4K RAM, cassette and VDU interface, up to 64K RAM, kit only. *From £45*

NewBrain: Z-80A, 2K static RAM plus 4K static or 16K dynamic, RS232 ports, 16-character, LED display, hand-held. Newbury Laboratories, King Street, Odiham, Hampshire. (025) 671 2910. *From £155 for model without LED*

NEWTRONICS

Elf II: Single-board on 1802, 256bytes to 64K RAM, Hex keypad, RS232 I/O and VDU interface, option keyboard, machine code or Tiny Basic, educational. *From £39 for kit*

Explorer 85: 8085, 4-64K RAM, S-100 bus, RS232, VDU interface, 8080 and Z-80 software, hobbyists and OEM use. Newtronics, 255 Archway Road, London N6. (01) 348 3325. *From £299*

NORTH STAR

Horizon: Z-80A, 16-56K RAM, 5¼in. twin drives, S-100 bus, own OS, business, educational or scientific use. Comart, PO Box 2, St Neots, Huntingdon, Cambridgeshire PE19 4NY. (0480) 215005. Equinox, Kleeman House 16 Anning Street, New Inn Yard, London EC2A 3HB. (01) 729 4460. Reviewed April 1979. *From £995 to £2,500*

OHIO SCIENTIFIC

Ohio Superboard and Challenger I: 6502, 8K Basic in ROM, 2K monitor, 4K RAM, full keyboard and VDU interface. Hobbyist use. Reviewed June 1979. *From £160*

Challenger 2: 6502, 48K RAM, dual 8in. drives, serial port, low-cost business use. *From £1,500*

Challenger 3: 6502, Z-80 and 6800, 48-56K RAM, OSI 48-pin bus, serial port for VDU, CP/M, expands to eight users, 10, 20 and 75MB hard disc, business use. *From £2,300*

Challenger 4: Similar to Challenger I but 64 by 32 display, colour and sound option. U-Microcomputers, Winstanley Industrial Estate, Long Lane, Warrington, Cheshire WA2 8PR (0925) 54117/8. CTS (0706) 79332. Millbank, 98 Lower Richmond Road, London SW16. (01) 788 1083. Reviewed September 1979. Mutek, Quarry Hill, Bath, Wiltshire. (0225) 743289. *From £450*

PANASONIC

Panasonic: 8085, 56K RAM, full keyboard, integral 24 by 80 VDU, integral twin 5¼ or 8in. floppy drives. Three RS232, business use. Panasonic Business Systems, 9 Connaught Street, London W2. (01) 261 3121. Reviewed June 1979. *From £4,150*

PROCESSOR TECHNOLOGY

Sol: 8080, 16K RAM, S-100 bus, 5¼in. drives, VDU integral, business system. Comart, PO Box 2, St Neots, Huntingdon, Cambridgeshire PE19 4NY. (0480) 215005. Reviewed July 1979. *From £1,750*

RAIR

Black Box: 8085, 32-256K RAM, dual mini-floppy discs, eight programmable serial ports, RS232, CP/M, hard discs to 10MB, general and business use. Rair, 30-32 Neal Street, London WC2H 9PS. (01) 836 4663. Reviewed November 1979 and August 1980. *From £2,300*



RCA

Cosmac: 1802 micro with Hex pad and TV interface. Machine-code programming with Tiny Basic option. **HL Audio**, 255 Archway Road, London N6 5BS. (01) 348 3325. *From £79 for kit*

RESEARCH MACHINES

380-Z: Z-80, 4-56K RAM, RS232, CP/M, twin 5¼ or 8in. discs, high-resolution graphics. Sold principally to higher and secondary education. Reviewed December 1978. *From £830 to £3,500*

280-Z: Board version of 380-Z. Research Machines, PO Box 75, Mill Street, Oxford. (0865) 49791. *From £722 for 4K version*

ROCKWELL

Aim-65: 6502, 1-4K RAM, full keyboard, RS232, discs, hobby use, Portable Microsystems, Forby House, 18 Market Place, Brackley, Northamptonshire NN13 5SF. (0280) 702017. Reviewed July 1979. *From £250*

SALMON ELECTRONICS

Archives: Z-80 at 4MHz, CP/M, S-100, serial and parallel I/O, 12in. display, 5¼in., 8in. or 19MB hard disc or 8in. Winchester, 104 keys including 23 configured for Wordstar. Salmon Electronics, PO Box 26, Croft-on-Tees, Darlington (0325) 721368. *£3,400*

SATTCO AB

Databoard 4680: Z-80, 16-64K RAM, own bus, full-colour graphics, 5¼in., 8in. and hard discs up to 10MB, 64 interface units. General use. Microsystems Technology, PO Box 5, Knutsford, Cheshire, WA16 9DU. (0565) 52911. *P.O.A.*

SD SYSTEMS INC

SBC-100: Z-80, 1-48K, S-100 bus, Basic in 8K ROM, four ROM sockets, optional 5¼in. drives, RS232 serial and parallel, single-board. Reviewed January 1981. *From £155*

SD-100/200: Z-80, 64-256K RAM, 8K PROM, S-100 bus, RS232, CP/M, 12in. VDU, twin 8in. drives, business, industrial and general use. Airamco, Unit A2, 9 Longford Avenue, Kilwinning Industrial Estate, Kilwinning, Ayrshire KA13 6EX. (0294) 65533. Barcellos, Kimberley House, Vaughan Way, Leicester. (0533) 26584. *From £3,750*

SEN ELECTRONICS

Organiser: Intel 8085, 64K RAM, multi-user Basic, 8in. drives or 20MB hard discs, three RS232, business use. SEN, 5 London Street, Chertsey, Surrey KT16 8AP. (09328) 66744. *From £7,500*

SGS-ATES

Nanocomputer: Z-80, 6-64K RAM, Gamma bus, 2K NC-2 monitor in ROM, Basic as option, RS232, cassette interface, Hex keypad. Midwich, Hewitt House, Northgate Street, Bury St Edmonds, Suffolk, IP33 1HQ. Reviewed October 1979. *From £350*

ZX80 ACORN ATOM!

The monthly magazine **INTERFACE** gives at least six complete programs for each computer, plus hints and tips.

Large s.a.e. for free copy.

INTERFACE 44 EARLS COURT ROAD,
LONDON W8 6EJ.

• Circle No. 249

TRS 80 ACCESSORIES

JOYSTICK CONTROLLER — Now you can add arcade-style to your games software. Instead of fumbling with your keyboard, The CSL Compustik is a high quality joystick with eight directions of movement plus a fire button complete with an interface which plugs into your expansion connector. You also get an operators manual and programming hints plus a cassette of four Level Two Basic programs including Slalom, Racer, Space Wars and Magic Artist. £34.50 + 50p P&P

LIGHT PEN — The CSL Photopen connects easily to your TRS-80 via the cassette recorder and can be used with a second cassette recorder on a Video Genie system. It permits direct communication with your system via the video screen. Complete with operating instructions, programming hints, 9v battery and a cassette of four Level Two Basic programs including three games and a simple subroutine to add Light Pen input to your own programs. £14.99 + 50p P&P

CSL MICRODATA
4, GREENBARN WAY, BLACKROD,
LANCASHIRE, BL6 5TA TELEPHONE: 0204 694265

• Circle No. 250

MAINS BORNE INTERFERENCE

Protect your
small computer
system or terminal
with the BLL Mains
Interference Suppressor
only £20 inc VAT, p&p from



**BEYTS
LOGIC** LIMITED

Planer Building
Windmill Road
Sunbury, Middx.
(09327) 86262

• Circle No. 251

MICRO ADS
are accepted from private readers only, pre-paid and in writing, 20p per word, minimum charge £2.
Please make cheques payable to Practical Computing and send to Room L311, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

ZX-80 For Sale. As new condition, with power supply. £74.00 o.n.o. Tel: Senghenydd (0222) 831246.

PET 2001 8K — As new £350 o.n.o. will part exchange for a CBM Disk Drive 2040. Westend 01-493 5015.

2716's (5v MOTOROLA) £4.40. 4 off £17.20.
2732's to order. IN4148 50 £1.25. 100 £2.00.
BC107/8/9 plastic 8.5p. VAT is included. P&P 40p under £10 (Cash with order). Mail order only at present. Wessex Components, 17 Crispstead Lane, Winchester.

ZX81 AND ZX80 SOFTWARE available on cassette. Prices from £2.00. Send s.a.e. for catalogue to: Rose Cassettes, 148 Widney Lane, Solihull, West Midlands B91 3LH.

SHOP WINDOW

TRS-80 MACHINE CODE Monitor (L2, 16K) (From and to BASIC, Cursor Control Modify, HEX/ASCII, 128-byte blocks, 10 Breakpoints, System tapes, Printer Driver etc etc) £14.95 incl. (With User's Manual) or £1 for Manual only. (Refundable when Monitor bought). Koveos, 207 Cranbury Rd, Reading, Berks, RG3 2XA.

WANTED: Superbrain 64K or similar CP/M Computer — Mr. Arnold 794-1194.

TRS-80 Level II 16K Green screen, new ROM, cassette recorder, with £200 + software and books. £500. Telephone Rugeley 088 94 3997. Staffordshire.

SUPERPRINT 800 MST Impact Matrix Printer. Many features including graphics, Tractor/Friction Feed, RS232/Parallel. £200. Ring V. Yelland, 01-531 0716 after 6 p.m. (Walthamstow).

ZXMULTIPLE Line-Statemets easy, useful programming trick saves memory, runs faster. Details £1 inc. postage from: Tim Humphries, 16 Coniston Road, Sutton Coldfield, W. Midlands.

US APPLE II Plus, disk drive, 3.3 DOS, TV, transformer, manuals — £1200. 0865-725229.

GENUINE CBM Voice Synthesiser for Sale. Offers around £250, please. Blackburn (0254) 22085).

ZX80 & ZX81. Join ZX Guaranteed. All games/programs guaranteed to work. £5/Year. Frustrated National ZX80 Club people are welcome. Bobker, 29 Chadderton Drive, Unsworth, Bury, Lancs.

8K PET with integral cassette deck. 6 months old. £300. Tel: 0272-292685.

SHARP MZ80K, 36K, games, toolkit, manuals, v.g.c. £425 o.n.o. Phone Chester 672332 after 6 p.m.

ZX80/81 Re-number in Basic, Space Attack, Nought/Crosses, all 1K. £1.50 + SAE. Micro-Aid, 25 Fore St., Praze, Camborne, Cornwall.

RUBIK CUBE Unscrambler. Displays step-by-step solution from any start condition. BASIC listing £3, flow charts and description £2. Wray, 32 Church Green, Totternhoe, Dunstable, Beds.

70 (4K) SUPERBOARD programmes on cassette; Bombers, Moonlander, Avalanche, Taxmen, Connect-4, Simon, Reaction tester, Pairs, Hangman, Mastermind. With instructions for cheap sound output and 2MHz conversion. All for only £3. G. Amson, 43 Junction Road, Leek, Staffordshire.

SUPERBOARD II, 32 x 48 Display, Cegmon, 8K RAM, 50Hz Mod, 7A P.S.U., Cassette Recorder, Space Invaders, Chess etc. All manuals. Bargain at £190 o.n.o. 01-651 1744.

PROGRAPH-BOARD for UK101 and Superboard. Gives 128 user defined characters + ASCII Standard. Kit £39.50, built & tested £47.00. Includes demotape & instructions. Also software for UK101/C1E. Patience, Mancala, Othello, 8K — £2 each. Invaders, Fruitmachine, Solitaire 4K, £2 for two. Hardware — Resistors LP. DIL Sockets. Pins/Pence:— 8/8p, 14/90p, 16/10p, 18/13p, 24/19p, 40/25p. S.A.E. for full details. Exclusive of V.A.T. Please add 20 P&P on orders under £2.00. Keith Purkiss, 4 Asby Road, Asby Workington, CA14 4RR.

VIDEO GENIE 16K. Many books, over 30 game programs £300. 01-571 1705 (Southall).

DISK PROGRAMS (PET/TRS80): List 50p Grant, 250 Widney Lane, Solihull, W. Midlands.

SHARP ELECTRONICS

MZ-80K: Z-80, 16-48K RAM, 10in. integral VDU, integral cassette, loudspeaker, 5¼in. disc optional, general use. *From £480*

PC-1211: Pocket computer. Programmable in Basic with cassette interface. Sharp Electronics, Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE. (061) 205 2333. Reviewed July 1980. *From £85*

PC-3200: Z-80, attractive package for business use with separate keyboard and computer unit, printer, display and twin 5¼in. drives. Software now available on-line and conversion for CP/M being developed. *From £3,500*

SINCLAIR RESEARCH

MK-14: 8060, 256bytes user memory to which ¼K RAM can be added, Hex pad, cassette interface, seven-digit LED, single-board. Reviewed May 1979. *From £39*

ZX-80: Z-80A, 1-16K RAM, 4K Basic in ROM, cassette and TV interface, touch-sensitive keyboard, educational use. 22 graphics. Sinclair Research, 6 Kings Parade, Cambridge CB2 1SN. (0223) 311488/312919. Reviewed July 1980. *From £79 for kit*

ZX-81: Z-80A 1-16K RAM, 8K Basic in ROM, cassette and TV interface, printer soon available, touch-sensitive keyboard, education and games use. Animated-display facility. Two modes; fast with screen blinking, slow without. Reviewed June 1981. *From £49 for kit*

SINTROM ELECTRONICS

Periflex 630/48: Z-80A, 32-48K RAM, S-100, CP/M, twin Micropolis 5¼in. discs, two serial and three parallel ports. *From £1,995*

Periflex 1024/64: Z-80, 64K, S-100, CP/M, dual 8in. discs, two serial and three parallel. Sintrom Electronics, Arkwright Road, Reading, Berkshire RG2 0LS (0734) 85464. *From £2,750*

SIRTON COMPUTERS

Midas Range: Z-80, from 8K RAM, S-100 or IEEE bus, CP/M, MP/M, graphics, up to four 5¼in. or 8in. drives, hard disc, RS232, 8-bit parallel, IEEE 488. Sirton Computers, 76 Godstone Road, Kenley, Surrey CR2 5AA. 01-668 0761. *£785-£2,150*

SMOKE SIGNAL

Chieftain 511-821: 6800/6809, 32-64K RAM, S-50 bus, Flex DOS68/68d/69 dual 5¼in., 8in., dual RS232, video board, wide range of options, general use. Windrush Micro Designs, Gaymers Way, North Walsham, Norfolk. (069) 245189. *From £1,807*

SOLID STATE TECHNOLOGY

Athena: 8085, integral dual mini-floppies and mini-cassette, and matrix printer, can be expanded with 10 micros beyond CPU. Memory to 1.2GB. Claims performance similar to DEC PDP-11/34. Butel-Comco, 50 Oxford Street, Southampton, Hampshire SO1 1DL. (0703) 39890. *From £3,000*

SORD COMPUTER SYSTEMS INC

M200 Range: Z-80A, 64K RAM, S-100 bus, Sord OS, graphics, 5¼ 8in. or hard discs, two RS232, integral 80 x 24 VDU. Business use. Midas Computer Services Ltd, 2 High Street, Steyning, Sussex (0903) 814523. *From £1,850 to £6,950*



SOUTHWEST TECHNICAL PRODUCTS

C/09: 6800, 56K RAM, Flex OS, 5¼in. 8in. or 15MB hard discs, business, educational and scientific packages.

S/09: 6800, 128K RAM-380K RAM. Uniflex OS, support up to 16 users in foreground and background mode. Southwest Technical Products, 38 Dover Street, London W1X 3RB. (01) 491 7507. *From £3,000 to £10,000*

SPENCER JOHNSTON LTD

SJL 8000: Z-80A, 64-208K RAM, integrated database system to user specifications, 8in. discs to 4MB Winchester to 80MB. Sun Computer Services, 60 Broad Lane, Hampton, Middlesex. (01) 979 9824. *From £8,000*

SYNERTEC

Sym-1: 6502, 4K-64K RAM, port-expansion kit, TV interface, Kim software, hobbyist use. Newbear, 40 Bartholomew Street, Newbury, Berkshire. (0635) 30505. *From £160*

TANDBERG DATA

TDV Series: 8080A, 32-64K RAM, Intel bus, 4K Basic discs system in ROM, one plus three 8in. discs, or 2.5MB disc cartridge, eight ports, semi-graphics, CP/M version available, educational use. Tandberg Data, 81 Kirkstall Road, Leeds, LS3 1HR. (0532) 35111. *From £4,000*

TANDY CORPORATION

Model 1: Z-80, 4-48K RAM, RS232, Level I and Level II Basic in ROM, separate keyboard and 12in. VDU, small business and personal use. Reviewed November 1978. *From £349*

Model 2: Z-80, 64K RAM, integral 8in. disc, integral 12in. VDU, detachable keyboard, CP/M serial and parallel ports, Level III Basic, business use. Tandy, TRS-80 Division, Bilston Road, Wednesbury, West Midlands, WS10 7JN. (021) 556 6101. Reviewed March 1980. *From £1,995*

Model 3: Z-80, 4-48K RAM, 12in. display, integral unit with slots for two 5¼in. drives, 65-key keyboard, 12-key data pad, printer interface, compatible with Model 1 software. *From £499*

TANGERINE COMPUTER SYSTEMS

Microtan 65: 6502, 1-48K RAM, Tanbus, IEEE 488, Tanbug in ROM (1K), Pixel graphics, 5¼in. discs, 32 I/O lines and three serial ports, from single-board upwards. Tangerine Computer Systems, Forehill, Ely, Cambridgeshire. (0353) 3633. *From £69*

TECHNALOGICS

TECS: 6800, 56K RAM, Basic and Prestel terminal software, RS232, two cassette ports, two parallel ports, 5¼in. discs. Technalogics, Windmill Works, Station Road, Swinton, Manchester M27 2BU. (061) 793 6323. Reviewed November 1979. *From £895 for kit*

TERODEC MICROCOMPUTER SYSTEMS

TMZ-80: Z-80, 64K RAM, CP/M, MP/M, CP/Net, twin 8in., up to 32MB hard discs, multi-user business use. Terodec, 17 The Gallop, Yately, Camberley, Surrey. (0252) 874790. *From £3,000*

SUPERBOARD 2 PLUS cegmon plus 5 amp PSU, modified display 32x48, Space Invaders, chess, and other software. 8K RAM £175 Tel. Farnborough, Kent 0689 50885

5 OLIVETTI TELETYPES, upper/lower case 10 CPS, Tape punch/reader, current loop I/F one working two require attention two for spares 0268 551448 or 01 286 0512

TRS-80 LEVEL II 16K, VDU C/Recorder. Manuals, Tapes, little used. £380 o.n.o. 053-183-364 (Herrefs) after 6 p.m.

TRS 80 II 16K, C/recorder, Manuals, Games etc. £325 o.n.o. Susan Abbott, Bristol 32291 (office hours).

ZX80 16K French Vocabulary Tests 410 Words. Plus dictionary feature. Only £3.50 cassette, £2.50 listing. S. Pirie, 30 Devonshire Road, Aberdeen.

8K SUPERBOARD II, with Cegmon, good P.S.G., 1½ MHZ, 300/600 Baud, bus expander, metal cased, ready to go. £250. Phone East Kilbride (035 52) 37384.

ZX80 plus 3K RAM extension, leads, manual, etc. £50. Phone 0487 842319 evenings. (Cambridgeshire).

ZX81 1K SOFTWARE — cassette of four games (Blip, Lander, Sketch, I-Ching) with documentation only £3.00. No. Rushton, 123 Roughwood Drive, Northwood, Kirkby, Merseyside L33 9UG.

TRITON L.51, in professional VDU Terminal, large K/brd, 4K Basic 4K RAM £250 o.n.o. Tel: 0293-24375.

NORTH STAR Horizon 32K 1 single density drive: — ADM3A VDU & Numeric Pad — £1,500 or offers. Luton (0582) 38792.

BUSINESS SOFTWARE for PET 8032/3040. Top quality word processing and records management programs and manuals for sale. Reason upgrade. Cost £500. Genuine bargain at £300. Tel: 01-998 8675 (Eves.).

TELETYPE ASR33 sound proof cover. Good condition £100. Tel: Tonbridge 364 837.

ZX80/81 INVADERS The famous pub game. ZX80/81 Galaxy Wars Startrek in 'Real Time'. These M/C code routines give continuous non-flicker display on ZX80 and fast animation even when using ZX81 slow mode, at least 4K RAM required. Specify which machine. £5 each listing (or send blank cassette). J. Edmunds, 29 Chestnut Ave., Grays, Essex.

ZX81 GAMES. Four super games on cassette, £3.00. (Plus additional free game and other info) or SAE List/Details. Bobker, 29 Chadderton Drive, Unsworth, Bury, Lancs.

ZX80 16K SOFTWARE. 2 programs on cassette. — Jason and the Argonauts (exciting interactive adventure game). — Air Raid (uses arinated graphics M/C subroutine). Send £5 to John Mason, 6 Main Street, Calverton, Notts. NG14 6FQ.

SHARPS MZ80K PROGRAMS. Hangman for 2 players, or play your Comput or with animal, or 4 in a row, all on cass. £5.50 for 3 or £2.50 each, inc. P&P. Mr J. Bosco, 5 Arncliffe Crescent, Morley, Leeds LS27 9DU. Tel: (0532) 520398.

ZX80 2K LISTINGS, Fruits spin, Missing number Mathematical tug-of-war, Jail breaker, Hangman £3.00 From: S. Rowe, 5 The Croft, Clevedon, Avon.

FOR SALE Sony KV1400 TV complete with Keen Computers' modifications for colour and all plug in boards ready for use with Apple computer. Can also be used as video monitor. £450.00 + VAT.

TRS80 LEVEL II 16K Complete with leads, tapes £289 o.n.o. Nick 01-318 5009 Evenings.

TRS-80 16K Level 2, green vdu, keyboard with numeric pad, cassette recorder, manuals, cassettes, programs. Five months old, boxed as new. £395. Worcester 357304.

SHARP MZ80 Printer + Interface £500. Never used must clear. Tel: Southend-on-Sea 230338.

SUPERBOARD II: psu, UHF mod, twice normal speed, plus tapes, hardly used £190 o.n.o. 021-429 1150.

GENIE/TRS80 graphics programmes. Any two £6. Hangman/Solitaire/3D Noughts & Crosses/One-check/Mastermind/Blackjack/Queen/A-nim-ate/Reverse. B. Coupe, 20 Lewiston Road, Derby.

2K DIS-ASSEMBLER Nascóm 1. Decodes all B-Bug/NAS-SYS Restarts. £5 cassette. Includes relocation loader. SAE for details. Tipping, 3 Cliffe Villas, Longfield Road, Todmorden, Lancs.

EPSON MX80 F/T, MX100, Anadex Printers, ADM 3A, ADM 3A+, Televideo 912C, 920C, 950 VDUs, PET, Apple, Tand and Superbrain. Sale and maintenance service at lowest prices. Tel: A. W. Computer Engineering Co. on 01-751 2196.

APPLE 48K Disc 3.3 9" B&W Monitor over £900.00 of software inc. Visicalc, word processor, utilities games £1400 o.n.o. may split. Charles 01-405 3113 Eve. 01-883 0874. Guarantee possible.

INFOMAST Database 48K Apple + /Disk £30 or exchange with DOC. Many functions. A. Hill, 71 Madeley Road, London W5. 997 2703.

TRS-80 L2 16K, CPU, VDU & Cassette, Soundbox, Books, Listings & Software. £375. Tel: Wellingborough (0933) 681166.

SCOPEX 25MHz Oscilloscope (almost new) £280, Wang Triple 8 inch floppy disc drive unit complete with driver boards & power supply £400. Tel: Milton Keynes (0908) 605070.

GAMBYTES 1,2,3: Basic Programming Games. In Basic. 1-50p, 3-£1. Peace, 25 Birches Lane, South Wingfield, Derbyshire.

ITT 2020 - 48K, with disc drive, controller and large quantity of software for sale. Computer £550, disc drive £320 - software free if both purchased. Tel: 01-863 6240 after 6 p.m.

SUPERBRAIN OWNER with 12 years D.P. experience offers consultancy, analysis or programming. Will work from home or travel. Fixed price or daily rate. Tel: 0532 854282.

APPLE II EUROPLUS 48K, Disk Drive and controller, Paper Tiger Printer and controller, RF Modulator and Phillips TV set as VDU. Paper for printer, some disks and miscellaneous literature. Used for a few demonstrations only, for £2200 or £70 p.m. London and Cambridge area. Might consider split. Tel: Comberton (022 026) 2422. Business hours, evenings and weekends.

SHARP MZ-80K, 20K, for sale due to travel. Warranty and programs. 01-951 3242. Bijan (Even).

TRS-80 PRINTING SERVICE. Now you can have printouts without owning a printer - promptly! Programmes listed: 1p per line (Basic); 2p per line (system). Word processing (letters, reports, etc.): 30p first page, 10p each copy. Cheques and tapes to: S. Thirsk, 8 Roxburgh Place, Heaton, Newcastle Upon Tyne.

TEXAS ELECTRONIC INSTRUMENTS (TEI)

PT-208/PT-212: 8080, Z-80, 8085, 32-60K RAM, S-100, CP/M, 5¼in., 8in. and hard discs, three RS232 and three 8-bit ports, integral VDU, business use. Abacus Data-type, 62 New Cavendish Street, London W1. (01) 580 8841. Reviewed January 1980.

TEXAS INSTRUMENTS

TI-99/4: 990 16-bit, 16K RAM, Basic in 26K ROM, high-resolution, colour graphics, up to three 5¼in. discs, joystick, cassette and other ports, RS232, personal use. Texas Instruments Ltd., Manton Lane, Bedford, MK41 7PU. (0234) 67466. Reviewed August 1980.

TRANSAM COMPONENTS

Triton: 8080, 32K RAM, CP/M, 1K TB10S in ROM, up to three 5¼in. discs, or four 8in., serial and parallel ports. Reviewed December 1979.

Tuscan: Z-80, 8-64K RAM, S-100 bus, CP/M, RS232, TV and cassette interface, from single-board, personal use to full business system. Transam, 59 Theobalds Road, London WC1. (01) 405 5240.

ULBRICH AUTOMATION

Powerhouse II: Z-80, 16-32K RAM, RS232, 5in. internal VDU, integral mini-cassette, 2K monitor, IEEE, 14K Basic DOS, OEM users. Powerhouse Microprocessors, 5 Alexander Road, Hemel Hempstead, Hertfordshire HP2 5BS. (0442) 42002.

VECTOR GRAPHIC

MZ: Z-80, 48K-64K RAM, CP/M, 5¼in. discs, optional graphics, serial and parallel ports. Business and general use. Almarc Data Systems, 906 Woodborough Road, Nottingham (0602) 625035. Reviewed October 1980.

WESTERN DIGITAL

Pascal Microengine: MCP1600, executes P-code directly, 64K RAM, own bus, 5¼in., 8in. or hard discs up to 18MB, two RS232, two parallel ports. Pronto Electronics Systems, 466-478 Cranbrook Road, Gants Hill, Ilford, Essex IG2 6LE. (01) 554 6222.

ZENTEC

ZMS-70: 8080A-1, 32/64K RAM, up to 12K ROM, dual integral 5¼in. discs, 600MB, RS232, integral 15in. VDU, 16 function keys. Zigal Dynamics Ltd., Bank Chambers, 13 High Street, Chesham, Buckinghamshire. (02405) 75681.

ZILOG

MCZ Series: Z-80, 64K RAM, RIO OS, Zilog bus, optional graphics, 8in. discs, and hard discs, four RS232, one parallel, stand-alone or networking. Zilog (U.K.) Ltd, Babbage House, King Street, Maidenhead, Berkshire. (0628) 36131.

EXPLORER-85 COMPLETE BUSINESS SYSTEM AT A FANTASTIC PRICE



**64K COMPUTER — VDU —
TWO 8" DRIVES —
PRINTER — CP/M 2.2 —
EXTENDED MBASIC**

£2900.00

*All you need to run your business
We can supply software to suit your particular requirements*

EXPLORER-85 COMPUTER Kits Start at £85

8085A cpu — S100 Based System Designed for maximum Flexibility

**PROBABLY THE MOST EXPANDABLE KIT ON THE MARKET TODAY.
A COMPUTER FOR YOUR REQUIREMENTS TODAY AND TOMORROW BE IT BEGINNERS KIT:
OEM CONTROLLER: OR FULL DISC DRIVE SYSTEM
EXPLORER-85 NOT THE CHEAPEST, JUST THE BEST**

8085A cpu — S100 slots (expandable to 6) — Powerful 2k Monitor — 4K RAM (expandable to 64K) — 8k Microsoft Basic — Speed 3.1MHz — 4,8bit I/O Ports — 1,6bit, I/O Port — 14bit Binary counter — All programmable — Stand alone Keyboard Terminal — 64/32 characters 16 lines — upper & lower case — Full cursor control — Power supply unit — **NO EXTRAS NEEDED**

4K system complet kit £327: Assembled Uncased £402: Assembled & Cased £502

16K system complet kit £410: Assembled Uncased £485: Assembled & Cased £585

Limited Budget? You can purchase explorer 85 in sub kits starting from £85 for the Motherboard Level 'A'.

EXPAND YOUR SYSTEM WITH 8" DRIVES

8" Control Data Corp Professional Drive
* LSI Controller * Write protect * Single or Double density * Capacity 400K Bytes (SD) 800K Bytes (DD) unformatted * Access time 25ns. Price £350

DISC CONTROLLER I/O 5100 CARD
Controls up to 4 Drives * 1771 ALSI (SD) floppy disc controller * On board data separator (IBM compatible) * 2716 PROM socket included for use in custom applications * On board crystal controlled * On board I/O baud rate * Two serial I/O ports * Autoboot to disc system when system reset * Generators to 9600 baud * Double sided PC board (glass epoxy). Price £150

DISC DRIVE CABINET WITH POWER SUPPLY
De Luxe steel cabinet to house single drive with power supply unit to ensure maximum reliability and stability. Price £79

DRIVE CABLE SET UP FOR TWO DRIVES

Price £19

64K 'SJ64K' S100 DYNAMIC RAM CARD

We offer you ... Hidden refresh ... fast performance ... lower power consumption ... latched data outputs ... 200ns 4116 RAM's ... on board crystal ... 8K bank selectable ... fully socketed ... solder mask on both side of the board. Designed for 8080, 8085 and Z80 bus signals ... works in Explorer/85, Tuscan, Horizon Sol, as well as all other well-designed S100 computers.

Kit	W/T	Kit	W/T
16K	£149	48K	£239
32K	£194	64K	£284
	£214	16K upgrade kits	£304
			£45

SOFTWARE

CP/M 1.4 £75 — CP/M 2.2 £98.00
Microsoft extended MBasic £155

Now-Break Through The 64K Micro-Memory Limit! 'SS16K'

Bank Selectable 16K Static RAM
Don't buy any more antique RAMs (RAM without bank select) — now there's Netronics's new SS16K board featuring a universal software bank select system. SS16K is capable of addressing 2,048 different banks. With SS16K boards you can add memory beyond the 64K limit, or expand to a multi-terminal system.

LOOK AT THESE FEATURES:

- 300 NS, low power 2114's
- Software Bank Selector — Universal decoder works with Cromeco Alpha Micro, Netronics, most other systems, or your design Onboard dip switches: Bank Select Enable; Reset Enable; Reset Disable; Port Address; Port Data.
- All Inputs And Outputs meet the proposed IEEE standards for the S-100 bus.
- 4.0 MHz Operation.
- Schmitt Trigger Buffer on all signals for maximum noise immunity.
- Addressable On 16k Boundaries, 0.64k, dip switch selectable.
- Phantom Option, dip switch selectable.
- PWR/MWRITE Option, dip switch selectable.
- LED Indicator to display status.
- Glass Epoxy PC Board with gold-plated contacts and double-sided solder mask.
- Fully Socketed. • Four Separate Regulators for maximum stability.
- £149 Kit: Assembled & Tested £175.

THE ELF11 IF YOU REALLY WANT TO UNDERSTAND COMPUTERS THEN ELF11 for YOU



Basic Specification
RCA COSMAC 1802 cpu — ¼K RAM expandable to 64K — DAM — Interrupt — 16 registers — Fully Decoded Hex Keypad — Dual 7 segment display — Crystal clock — Onboard regulation — 1861 Graphic Chip — 5 slot expansion bus — Double sided plated through PC Board.

ELF11 is ideal for Beginners — Engineers — Industry — Scientific and Educational purposes

SPECIAL OFFER £49.95

You will LEARN to program in Machine code and really understand computers, from there you can expand it to meet your requirements upto 64K RAM working in Basic level 111

Suggested Starters Pack:— ELF11 kit + RF Modulator + T. Pitmans Short Course for £56.70

ELF11 EXPANSION. We carry a full range of expansion kits — HARDWARE — FIRMWARE — SOFTWARE —

MANUALS. Send S.A.E. for brochures.

NOW AVAILABLE — FULL BASIC LEVEL 111 + RPN Maths package COMING VERY SHORTLY — EPROM BURNER

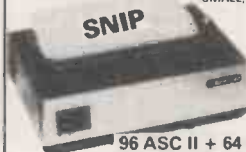
10" MONITOR £79.95

IDEAL FOR APPLE NASCOM
U.K. 101, ETC.

Designed for monitoring computers, closed circuit TV and Video Tape Recorders
10" black and white video monitor
10 MHz band width
High quality metallic cabinet
• Dimensions: 9" x 9" x 9 1/2"
Trade Enquiries Welcome

Oki Microline 80

SMALL, LIGHT QUIET MATRIX PRINTER



UNBEATABLE
VALUE AT
£299

40, 80 or 132 cols.
6 or 8 lines per inch.
96 ASC II + 64 graphics character set
with Centronics compatible interface
(Serial Interface £75 extra)

Centronics 737 LETTER QUALITY PRINTER AT ONLY £399



• Dot Matrix: 7 x 9 • Paper Handling: 3 way • Pitch: 5, 10 or 18 characters per inch • Speed: 80 characters per second proportional/50 characters per second monospaced • Line Length: 40, 80 or 132 characters • Standard Interface: Parallel (Serial version £429)

SEND SAE FOR COMPREHENSIVE BROCHURE

Please add VAT to all prices. P&P extra. Please make cheques and postal orders payable to NEWTRONICS or phone your order quoting BARCLAYCARD, ACCESS number.

We are open for demonstrations and Sales. Monday-Saturday 9.30 a.m.-6.30 p.m. Near Highgate Underground on main A1 into London.

Newtronics



255 ARCHWAY ROAD,
LONDON, N.6 TEL: 01-348 3325

• Circle No. 291

nascom

.... Computing for everyone

Nascom products, designed and built in Britain, are now backed by Lucas one of Britain's foremost industrial companies. This is a vindication of the innovative design of the Nascom computer and an assurance of its future.

NASCOM-1

Kit Price **£125 + VAT**
Built Price **£140 + VAT**



12" x 8" PCB carrying 5L SI MOS packages, 16 1K MOS memory packages and 33 TTL packages. There is on board interface for UHF or unmodulated video and cassette or teletype. The 4K memory block is assigned to the operating system, video display and EPROM option socket, leaving a 1K user RAM complete with keyboard.

NASCOM 2



Kit includes all parts to build CPU board which has resident 8K microsoft BASIC and 2K NAS-SYS 1 monitor for machine code programming. Included with kit is a fully assembled LICON QWERTY SOLID STATE KEYBOARD specially designed to exploit the potential of the NAS-SYS monitor. Other interfaces include video to monitor or domestic TV, Kansas City standard cassette interface (300/1200 baud) or RS232/20mA teletype interface.

In addition to full character generator graphics ROM is provided to give BASIC on board graphics capability. System uses Z80A which gives selectability between 2 or 4 MHz.

Nascom 2 Kit Price **£225 + VAT**

Power supply—3 amp. Suitable for powering of basic Nascom 1 or 2 and memory expansion.

£32.50 + VAT

RAMBOARD

SERIES B ramboard gives user option of 16K DYNAMIC RAM. This board can be arranged in page mode to allow use of up to 4 with NASCOM 2. Boards are fully buffered but PAGE MODE facility is an optional extra. This card can be used at 4MHz without wait state.

16K **£120 + VAT**

Lucas Logic

Nascom Microcomputers
Division of Lucas Logic Limited
Welton Road Wedgcock Industrial Estate Warwick CV34 5PZ
Tel: 0926 497733 Telex: 312333

NASCOM IMP PLAIN PAPER PRINTER



The Nascom IMP (Impact Matrix Printer) features:

- 60 lines per minute ● 80 characters per line ● Bi-directional printing
- 10 line print buffer ● Automatic CR/LF ● 96 characters ASCII set (includes upper/lower case, \$, £)
- Accepts 8 1/2" paper (pressure feed)
- Accepts 9 1/2" paper (tractor feed) ● Tractor/pressure feed ● Baud rate from 110 to 9600 ● External signal for optional synchronisation of baud rate ● Serial RS232 interface.

£325 + VAT

NASCOM FIRMWARE

CPU card can accommodate either 8K of static memory or 8 2708 EPROMS. This allows for inclusion of standard firmware on board. **ASSEMBLER** Version 2.0 of ZEAP (Z80 Editor Assembler Package) offers in 4K features found normally only in far larger programs.

A comprehensive line editor is provided in addition to an assembler operating in standard Z80 mnemonics. Direct assembly to memory allows immediate program execution. ZEAP can take advantage of special features of NAS-SYS, which was itself developed on this assembler. Supplied on tape at **£30.00 plus VAT** or in 4 x 2708 EPROMs at **£50.00 plus VAT**.

DISASSEMBLER The NAS-DIS 3K disassembler reverses the effect of assemblers such as ZEAP by turning machine code into assembler program, automatically labelling and cross-referencing to produce a complete program listing, saving hours of tedious hand disassembly when program analysis is required. Supplied in 3 x 2708 EPROMs at **£37.50 plus VAT**.

DIAGNOSTIC PACKAGE NAS-DEBUG is a 1K addition to NAS-DIS which provides remarkable facilities for error elimination, including a full register display which may be edited by the cursor. An unusual feature is the provision for examination of the program *in assembler* as the machine single-steps through it. A second video page may be assigned to allow work on programs which use the screen. A very powerful assembler-based system for program development could be realised on a NASCOM-2 with appropriate external memory by fitting the 8 ROMs containing ZEAP, NAS-DIS and NAS-DEBUG into the sockets on the computer board. This system would function immediately on switching on, without needing programs to be loaded from tape. Supplied in a 2708 EPROM at **£15.00 plus VAT** and must be operated with NAS-DIS.

NAS-SYS 3. THE NEW OPERATING SYSTEM FOR NASCOM 2. Supplied in 1 x 2716 EPROM.

NAS-SYS 3 is the latest in the current series of Nascom monitors and includes features such as adjustable keyboard repeat and cursor speed, full interrupt handling and a number of powerful routines and commands making this probably the most comprehensive 2K monitor ever written for a microcomputer. **£40.00 plus VAT**.

TO BE INTRODUCED

	Price
Programmable graphics cob ur board	TBA
Twin floppy disk unit, double sided, double density with NASDOS or CPM 2.2	TBA

WATCH IT!

Nascom products fully assembled and packaged in the near future!

Please send SAE for list of distributors.

Son of Hexadecimal Kid

Samson Synapse has been picked up by a press gang from the spacecraft Green Tangerine on account of his prowess at Astro-Pinball. Having just blasted Neptune's moon Triton out of their path, he has set course for Omega Solaris and can now relax in the uncluttered interstellar flight corridors.

"Right", said Samson with the ship safely locked on auto-pilot, "all that excitement has given me an appetite. I could eat a horse".

"Horse"? queried Rom. "Please explain".

"It means I'm hungry. I want some food".

"Please explain food".

Samson suspected his leg was being pulled, but he could not detect sarcasm in the cybernoid's even voice. "Food is what gives you energy", he began warily.

"Ah", said Rom, "electricity". He plugged an extension flex into a wall socket and started unrolling it.

"No. No. I mean something to eat, something I can chew, ingest, digest".

"I think he refers to a biochemical process", suggested Ram. "Beings of his type derive their motive power from the breakdown of organic hydrocarbons".

A horrible thought dawned on Samson; "Haven't you got anything edible on the whole ship"?

"Well, Prestel has an Arcturan cuttlefish bone to sharpen his beak", offered Rom.

"And there's a Chinese Takeaway near Delta Parvonis, but we've already passed that", added Ram.

"I'm going to starve", wailed Samson piteously.

"Leave it to me", cut in Prestel. He hopped into his cage and began turning the exercise wheel back and forth, like a thief testing a combination lock. A holographic image of strange shapes and hieroglyphics surrounded him as he did so. He twiddled his wheel some more, working his way through the index pages to the classified refreshment frames. Moments later a red-and-white cardboard box somewhat battered in transmission, plopped on to the floor of the cage.

"There you are", he said with pride, "Kentucky Fried Klingon. Any subscriber can dial some up, if they know the right number".

"Mm good", said Samson when he finished, licking his fingers appreciatively.

They landed on Blotto, seventh planet of the giant red sun Omega Solaris, three temporal units early amid a hubbub of mutual congratulation. The crew stayed on board to supervise the unloading as the half-baked ideas were pumped out to replenish the dangerously-depleted supply of the Intergalactic Think Tank which had its headquarters on this planet.

That left Samson at a loose end. He had been paid well for his efforts and was now the possessor of a huge wad of Blottonian Gigaflops, but he had no real idea how to spend them. With time hanging on his hands he wandered around the amusement arcades,

notching up phenomenal scores at Astro-Pinball and raising a few eyebrows by his performance at N-dimensional Hyperchess. He even paid a visit to Blotto's notorious infra-red-light district, but was too timid to sample any of the wares on display, which for a boy of 12 was just as well.

Eventually he mooched back to the ship. "Bored, eh"? was Ram's reaction. "You're set loose in the entertainment centre of the entire galaxy with a fistful of Blottonian Gigaflops and you complain of boredom. I can see I'm going to have to teach you how to enjoy yourself. Just you wait: our unloading will be finished in a few hours. Then we'll really hit the town in style. By the way, where have you been staying"?

"At the YMCA".

"No wonder you're depressed. That crowd of dossers and space hoboos would give anyone the creeps. Listen. I'll tell you what we'll do. First we clean up — then we head straight for the bar at the Intergalactic Hotel. When we've warmed up with a little jungle juice under our belts, we'll take us along to watch the tournament. I bet you don't even know what day it is tomorrow".

Samson confessed his ignorance.

Well, tomorrow's the Vernal Equinox here on Blotto, and tonight's a bit special. Since it takes about 19 of your Earth-years to come round, they grow quite excited about it — kind of carnival atmosphere. At midnight they'll hold the head-butting ceremony. All the young studs in town will climb into the ring and run at each other head-to-head. The winner is the last one left standing. He'll be crowned Spring King".

Samson looked shocked. Ram waved an antenna dismissively.

"It's a vestige of a primitive ritual they had before computerisation. I did it myself one year — got to the semi-final. They called me "battering" Ram. Normally we bring the disposable diapers on the Green Tangerine which they use as padding round their heads, so I guess this time it could get a mite noisy. So long as we arrive in time to catch the quarter-final round we shouldn't miss much of the fun. When it's over things really go wild".

Samson almost imagined a wink on Ram's impassive front panel.

So it was that Samson found himself, only a few hours, standing in a packed crowd of assorted life-forms on the steeply-raked terracing of the Stadium of Light with a half-drunk can of Solarian Punch in one hand shouting enthusiastically at the barbaric spectacle beneath.

Prostrate bodies, felled in earlier rounds, lay littered across the floor of the arena. Two of the survivors were lined up like sprinters at either end of the stadium ready to dash full tilt at one another. This was the needle match. These two were the favourites. At the near end was the local lad, an inhabitant of the neighbouring star system of Altair, who sported a fine pair of antlers and rejoiced in the name of Mighty Micro.

Even at this distance Samson could see that his face was streaked with gashes from earlier bouts. At the far end, built like a tank, was a 40-tonne military cybernoid of the Behemoth class hailing from a planet called Poughkeepsie in the Greater Magellanic Cloud.

The crowd were right behind their own man. Every time the Behemoth moved they hissed, and a great cheer of support erupted into the night when the game Altairan, though dwarfed by his opponent, took off his tracksuit and waved.

A gunshot sounded and the words "They're off" flashed up on the electronic scoreboard. The two gladiators rushed headlong at each other. There was a jarring crunch as skull met steel, distinctly audible above the breathless hush of the spectators. A moment later its echo was drowned by a great roar. Amazingly the skinny Altairan had triumphed: the metal monster keeled over sideways and thudded unconscious to the ground. Samson, carried away by the spring fever, cheered himself hoarse.

The final bout resulted, as expected, in victory for the local hero. He thus won the contest outright and was led to the champion's pedestal from where, dazed and groggy but triumphant, he raised his arms in salute to the crowd — before being borne off shoulder-high into the streets.

Then the festivities really began. In true Blottonian style the frenetic revelry continued unabated till dawn. The roadways were full of dancers and there were wild goings-on as an incredible variety of different beings drowned their inhibitions in the fire-water for which Blotto was justly famous.

Samson's recollection of the subsequent events of that night was very hazy. Suffice it to say that he woke up with a very thick head in a sidestreet of the Blottonian capital. His money was all gone. He never found out whether he had lost it, spent it or simply had his pocket picked. Next to him in the gutter lay his Binary Tree. Its pot was smashed but some soil still clung to its roots.

Where does he go from here?

Enlightenment next month.

C — cassette
D — disc

Our list of software is *FREE*. Our illustrated catalogue costs £1 but contains discount vouchers!

APPLE

- ATTACK FORCE (C)** A GREAT NEW ARCADE-STYLE GRAPHIC GAME FROM COMPUTHINGS £9
(THE ONLY COMPUTER GAME THAT ENABLES YOU TO RECREATE WORLD WAR II LAND OPERATIONS)
- OPERATION APOCALYPSE (D)** £28
- TORPEDO FIRE (D)** SUPERB 3D GRAPHIC SUBMARINE SIMULATION £28
- CARGELS & CUTTHROATS! (D)** THE FIRST FUN BUT ACCURATE BUSINESS SIMULATION GAME £22
- WARP FACTOR (D)** HAS TO BE THE BEST SPACE SIMULATION AVAILABLE! £28
- SPACE EGGS (D)** SUPERB COLOUR GRAPHICS—CRACK THE EGGS—SHOOT THE MONSTERS! £18
- SNOGGLE (D)** FANTASTIC GRAPHICS — CHASE THE GHOSTS ROUND THE MAZE £16
- ALIEN TYPHONE (D)** GALAXIANS BUT TWICE AS MANY! TWICE AS FAST! £15
A SUPERB TOOL. YOUR PROGRAMS BECOME INCREDIBLY FASTER IN EXECUTION!
- BASIC COMPILER (D)** £142
- TABS (D)** SUPERB RANGE OF SOFTWARE MODULES — ALL THE STANDARD BUSINESS PROGRAMS AND ONLY £99 + VAT each!
(CALL IN FOR A DEMONSTRATION!)
- TIME LORD (D)** EXCITING SPACE STRATEGY GAME £18

HARDWARE

- VERSA-WRITER — MAGIC GRAPHICS EASILY £125 + VAT
- EPSON MX 80FT — MARVELLOUS VALUE PRINTER £400 + VAT
- VIDEO GENIE 16K £289 + VAT
- 16K UPGRADE (12 MONTH GUARANTEE!) £17 inc. VAT
- APPLE II FROM STOCK

TRS 80

- BANK ROBBERY (C)** SMASHING GRAPHICS — CAN YOU ROB THE BANK AND ESCAPE? £9
EXCELLENT ARCADE STYLE GRAPHICS — MOVE YOUR BALLON THROUGH THE MAZE — IT SOUNDS EASY BUT IT ISN'T! WITH SOUND!
- BALLOON (C)** £7
- DARKSTAR (C)** WHEN YOU'VE GOT RID OF THOSE ALIENS — EVERYTHING STARTS TO GO WRONG! INCREDIBLY GOOD GRAPHICS & SOUND! £12
COULD YOU KEEP CONTROL OF ALL THOSE PLANES? FIND OUT FOR ONLY
- AIR TRAFFIC CONTROLLER (C)** £7
- DAM BUSTERS (C)** A SUPERB GRAPHIC RE-CREATION OF THE FAMOUS W.W. II RAID £8
OUR FAMOUS ADVENTURE RE-CREATED FOR TRS80 —
- WIZARD'S MOUNTAIN (C)** DIFFICULT BUT NOT IMPOSSIBLE. YOU'LL ENJOY THIS ONE! £9
- METEOR MISSION II (C)** £10
- COSMIC INVADERS (C)** £10
- SUPER NOVA (C)** £10
- ATTACK FORCE (C)** £10
- GALAXY INVASION (C)** £10
- ZORK (D)** THE MINDBLOWING ADVENTURE! £22
- HELLFIRE WARRIOR (D)** TEMPLE OF APSHAI SEQUEL £22
- MZ 80K** GAMES PACK 1 £8
GAMES PACK 2 £8

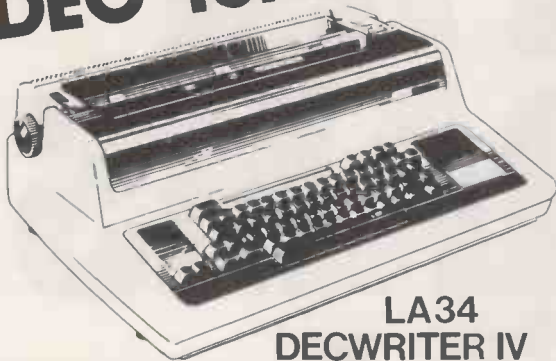
MAIL ORDER
146 DRIFSBURY YARD
LONDON W.1.
TEL: 01-637 2108

RETAIL SHOP (MON-SAT 9.30/5.30)

BROOK STREET
LONDON W.1.

NEW: HIRE SERVICE FOR APPLE & VIDEO GENIE!!!

Wilkes Computing for DEC[®] Terminals



LA34
DECWRITER IV

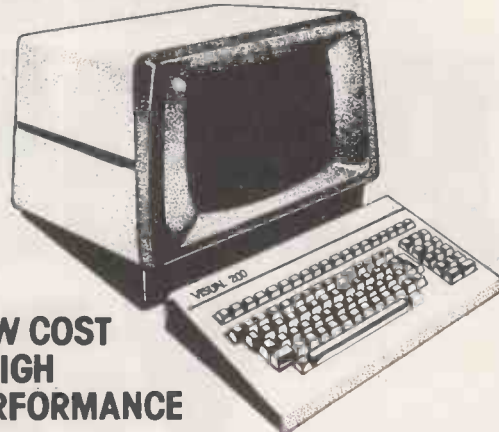
- Desk Top ● 30 cps
- Full 128 ASC11 Character Set
- 4 Character pitches
- 6 different line spacings
- Left and right margins
- Optional forms control
- **LOW PRICE**

© Digital Equipment Company Ltd.

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU
Tel. (0272) 25921 Telex. 449205

Wilkes Computing Announce The VISUAL 200



LOW COST - HIGH PERFORMANCE

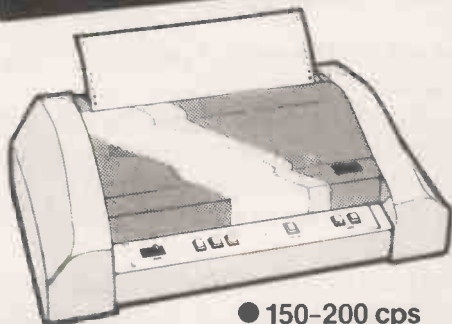
- Detachable keyboard
- Numerical pad
- Upper & lower case
- Editing
- Smooth scroll
- Cursor addressing
- Printer port
- Many more standard features and options
- Switchable emulations
DEC VT52
Hazeltine 1500
Lear Siegler ADM3A
ADDS 520

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU
Tel. (0272) 25921 Telex. 449205

Wilkes Computing Present

the Anadex DP9500



- 150-200 cps
- Bi directional smart printing
- 132-176 columns ● Complete forms control
- Horizontal and vertical tabs
- Double width printing ● 9 wire print head
- High density graphics ● Up to 9600 Baud

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU
Tel. (0272) 25921 Telex. 449205

Wilkes Computing Announce

DIABLO 630[®]

DAISY WHEEL PRINTER



- Automatic bi-directional printing
- Up to 40 cps (32 cps average)
- Interchangeable metal/plastic print wheels
- RS232-c or 20 mA interface
- Word processing options
- Optional tractors ● Optional cut sheet feeder

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU
Tel. (0272) 25921 Telex. 449205

● Circle No. 294

ALL THE PROGRAMS YOU'LL EVER NEED. FOR £260.^{+VAT}

Say goodbye to the costs and frustrations associated with writing software: The Last One[®] will be available very soon.

More comprehensive and advanced than anything else in existence, The Last One[®] is a computer program that writes computer programs. Programs that work first time, every time.

By asking you questions in *genuinely* plain English about what you want your program to do, The Last One[®] uses those answers to generate a totally bug-free program in BASIC, ready to put to immediate use.

What's more, with The Last One[®], you can change or modify your programs as often as you wish. Without effort, fuss or any additional cost. So as your requirements change, your programs can too.

In fact, it's the end of programming as you know it.

And if, because of the difficulties and costs of buying, writing and customising software, you've put off purchasing a computer system up to now, you need delay no longer.

The Last One[®] will be available very soon from better computer outlets. To place your order, take this ad into your local dealer and ask him for further details. Or in case of difficulty, please write to us direct.

THE LAST ONE[®]

YOU'LL NEVER NEED BUY ANOTHER PROGRAM.
D.J. 'A' Systems Ltd., Ilminster, Somerset, TA19 9BQ, England
Telephone: 04605-4117. Telex: 46338 ANYTYR G.

• Circle No. 295

The quality of the new

SCRIPTA

daisywheel printer is astonishingly good



-and so's the price from CPS

A lot is written about the quality of daisywheel printers, but how many people would be prepared to use one to make up an advertisement? **This paragraph was actually printed on a SCRIPTA RO daisywheel printer for reproduction in this advertisement.

Manufactured in West Germany by world renowned Olympia International.

The SCRIPTA RO (receive only) model and the SCRIPTA KSR model which incorporates a full electronic typewriter keyboard, including auto corrector facility.

Both models are available with IEEE, RS232 Serial and Parallel Interfaces. So if you have a COMMODORE, APPLE, TANDY, SUPERBRAIN, NORTHSTAR HORIZON, CROMENCO, SORCERER, SHARP, 380Z etc. etc. CPS have a SCRIPTA printer for you.

****Will your printer pass the CPS underline test?**

There is a choice of several different daisywheel type styles and both printers use low cost carbon ribbon cassettes.

The equipment comes with a 90 day warranty. CPS offer a full on-site maintenance contract.

You can buy, lease or hire your SCRIPTA from CPS.

Accessories available:

Rutishauser Tractor Feed £175+VAT

Rutishauser Cut Sheet Feed £395+VAT

Contact Nick Ashburner today at:-



CPS (DATA SYSTEMS) LTD

Third Floor, Arden House, 1102 Warwick Road, Acocks Green, Birmingham B27 6BH. Tel: 021-707 3866

A member of the CPS Group.

A quality wordprocessor from CPS is now only ***£2,785+VAT** (CBM 8032, 4040, SCRIPTA RO and WordPro 4) *including FREE Data Desk

• Circle No. 296

**AVAILABLE NOW! for
SUPERBRAIN
and IBM 8" format users**

**Wordstar™
£250 PLUS
VAT**

The screen-orientated, integrated word processing system specifically designed for non-technical personnel.

**Mail Merge™
£75 PLUS
VAT**

The WORDSTAR option file merging tool - can produce personalised letters by combining name and address files with letter text files etc.

For further details contact:

**ICARUS COMPUTER SYSTEMS LTD.,
Deane House, 27 Greenwood Place, London,
NW5 1NN. Tel: 01-485-5574**

Trademarks of Micropro International Corporation.

• Circle No. 297

**SUPERBRAIN
and IBM 8" format users**

AVAILABLE NOW FROM ICARUS

**C.Basic 2
£70 PLUS
VAT**

and

**Pascal/M™
£120 PLUS
VAT**

PASCAL/M is implemented using pseudo machine P-code (portable PASCAL) which optimises instruction execution and code space.

For further details contact:

**ICARUS COMPUTER SYSTEMS LTD.,
Deane House, 27 Greenwood Place, London,
NW5 1NN. Tel: 01-485-5574**

Trademark of Sorcim Corporation.

• Circle No. 299

**HEY!
SUPERBRAIN
USER**

ICARUS can now supply

**Microsoft
BASIC INTERPRETER**

**£155 PLUS
VAT**

and

**Microsoft
BASIC COMPILER**

**£195 PLUS
VAT**

For further details contact:

**ICARUS COMPUTER SYSTEMS LTD.,
Deane House, 27 Greenwood Place, London,
NW5 1NN. Tel: 01-485-5574**

• Circle No. 298

**AVAILABLE NOW! for
SUPERBRAIN
and IBM 8" format users**

**Datastar™ £195 PLUS
VAT**

A powerful data entry, retrieval and update system incorporating data entry verification - edit mask feature to control data field content.

Printout formatting - using existing printed forms in conjunction with MAILMERGE and SUPERSORT.

**Supersort™ £125 PLUS
VAT**

High performance, sort, merge and record selection system. Sort and/or merge up to 32 input files into one output file.

Compatible with Basic, Fortran, Cobol, Assembler and Text Editors.

For further details contact:

**ICARUS COMPUTER SYSTEMS LTD.,
Deane House, 27 Greenwood Place, London,
NW5 1NN. Tel: 01-485-5574**

Trademarks of Micropro International Corporation.

• Circle No. 300

95% OFF

The cost of Financial Modelling

Too good to be true?

This is what the Financial Times said:

Financial modelling made easy

IF MICROMODELLER were a wine you might be forgiven for describing it as presumptuous and definitely non-vintage. As it is a software package, these may be seen as positive advantages.

Micromodeller comes to the market with the claim that it is the software program that will enable non-computer trained managers to do sophisticated financial modelling on a mere Apple microcomputer. It will cost a fraction of using an expensive program on a mini-computer let alone time sharing on a mainframe.

The Micromodeller software program costs just £425. A complete Apple II computer system, complete with video display, floppy disc drives for memory and a printer costs £4,000. By comparison the program for a mini-computer which rivals Micromodeller would cost around £10,000 according to Applied Computer Techniques the publicly quoted company, which is marketing the new program.

ACT believes that Micromodeller will rival Visicalc, the highly successful American software program which can be used on most micro-computers. Visicalc, which enables micro-computers to be used as sophisticated calculators, has itself been a significant driving force behind the success of mini-computers.

Micromodeller, which is considerably more sophisticated, is expected to encourage sales of micro-computers among business users. In the first 12 months, and it was only launched last week, ACT anticipates sales of over 2,500 programs. Many large companies with high financial modelling costs are expected to adopt Micromodeller on Apple computers.

Intelligence (UK) Limited, which wrote Micromodeller, says it has 95 per cent of the facilities offered by other financial modelling packages—including those costing around £10,000. It says the few features it does not offer are those like declining balance depreciation under French law, and third order polynomial regressions which are very seldom used.

The program has colour graphics and it can present information as line graphs, bar charts or pie charts. Instructions are given in English—the program is designed to be used by businessmen rather than by computer programmers.

ACT is claiming that it only takes a couple of hours to learn how to use—with the help of a tutorial guide. At its launch even some of the most jaundiced observers of the computer industry were making some highly favourable predictions for Micromodeller's future.

JASON CRISP

ACT MICROSOFT

5/6 Vicarage Road, Edgbaston,
Birmingham B15 3ES
Tel: 021-454 5341

Twx: 339396

PET is the trademark of Commodore Systems. Apple is the trademark of Apple Computers.

[] Rush me free details of MICRO-MODELLER

Name:

Address:

Postcode:

Credit card holders may order by telephoning 021-455 8585

PC7/81



• Circle No. 301

8" and 5 1/4"
DISKETTES
 from
£15 per 10?

IT'S TRUE!

**Due to our bulk purchasing
 we are able to offer
 high quality products
 at LOW, LOW prices ...**

DISKETTES

5 1/4" DISKETTES

single sided single density soft sector	15.00
single sided double density soft sector	15.00
single sided single density 10 sector	15.00
double sided double density soft sector	22.00
double sided double density 10 sector	22.00
double sided double density 16 sector	22.00
single sided single density soft sector 77 track	24.00
single sided single density 10 sector 77 track	24.00
single sided single density 16 sector 77 track	24.00

8" DISKETTES

single sided single density soft sector	15.00
flippy double sided single density soft sector	30.00
single sided single density 32 sector	19.00
single sided single density 32 sector C.A.	23.00
single sided single density 32 sector Memorex	24.00
single sided single density soft sector C.A.	23.00
double sided double density soft sector	30.00
double sided double density 32 sector	30.00
single sided double density soft sector	23.00
single sided double density 32 sector	23.00
double sided single density soft sector	29.00

Note C.A. denotes Critical Application

**ALL OUR DISKETTES ARE OF
 HIGH QUALITY AND CARRY OUR
 "NO QUIBBLE" GUARANTEE**

**5 1/4" DISKETTES ARE FITTED WITH
 A CENTRE SUPPORT RING**

per 10

APPLE II SOFTWARE ON DISK

Listed below are just a few of
 the software packages
 available.

Full lists on request

ADVENTURES

Alkalabeth	18.25
Micro-Soft Adventure	15.95
The Wizard & the Princess	17.50
Mystery House	13.75

SPACE WAR GAMES

Galactic Revolution	13.75
Galactic Trader	13.75
Galactic Empire	13.75
Tawalas Last Redoubt	15.95

Arcade Action Games

Anti Ballistic Missile	13.75
Apple Galaxian	13.75
Puckman	13.75
Asteroids in Space	11.50
Head On	13.75
Hyper Head On	13.75
Galaxy Wars	13.75
Bill Budes Space Album	20.75
Bill Budes Trilogy of Games	15.95
Hyper Space Wars	15.95
Cyber Strike	20.75
Star Cruiser	13.75
Olympic Decathlon	15.95
Flight Simulator	19.00

TRADITIONAL GAMES

Sargon 11	19.95
Micro-Chess 2.0	13.75
Monty Plays Monopoly	20.95
L. A. Land Monopoly	15.50
Bridge Partner	13.75
Checker King	13.75
Gammon Gambler	13.75

APPLE LANGUAGES

Apple Pilot	95.95
Apple Fortran	109.95
Forth Version 1.7	79.95

Z80 LANGUAGES

Microsoft Basic Compiler	190.00
Fortran	95.95
Cobol	333.00
Assembly Language	65.00

BUSINESS Software

DB Master	90.95
Supertext	75.00
Visicalc	75.00
Desk Top Plan	51.95
Apple Pie	58.55
Applewriter	37.75
Easywriter	140.00

UTILITIES

DOS 3.3 Tool Kit	39.00
Dakins Programming Aids	41.75
Higher Text	19.25
Appletword	30.75
Bill Budes 3D Graphics Tutor	20.50

ACCESSORIES

Protect Your Investment!

- HEAD CLEANING KIT 5 1/4" £16.50 each
- HEAD CLEANING KIT 8" £16.50 each
- LIBRARY BOXES 8" & 5 1/4" £1.70 each

24 HOUR ANSWERING SERVICE 01-402 6103

BARCLAYCARD / ACCESS / AMERICAN EXPRESS
 CARDS WELCOME

ALL PRICES ARE SUBJECT TO VAT @ 15%

UK post, packing & Insurance: library boxes 0.45 per box
 diskettes 1-5 boxes 0.95 per box cleaning kits 0.65 per kit
 diskettes 6+ boxes 0.65 per box software 0.45 per item

GESBURY LTD.
 224 EDGWARE ROAD, LONDON W2 1DN
 Tel. 01-402 6103

ORDER FORM

Please send me

QTY	ITEM	PRICE	VAT	TOTAL

post, packing & insurance _____

I enclose cheque payable to **GESBURY LTD.** for £ _____

NAME _____

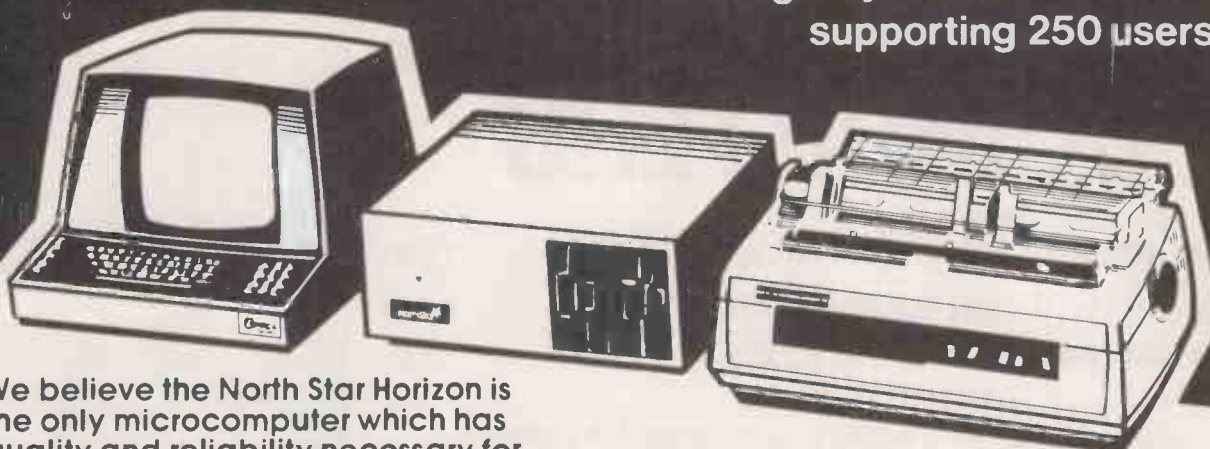
ADDRESS _____

TEL. NO. _____ PC7/81

• Circle No. 302

SIMPLICITY & EFFICIENCY

From a single system to a network supporting 250 users



We believe the North Star Horizon is the only microcomputer which has quality and reliability necessary for the serious small business user. We supply the Horizon with a Hazeltine 1420 terminal and an Epson MX80 Dot Matrix printer or optionally with a Vulca-Craig terminal and Diablo 630 letter quality printer.

ACCOUNTS

Complete accounting software for the above system suitable for the small manufacturing company. It is characterised by extreme ease of use and security of data. It uses only three disks thus preventing all that confusion typical of so many accounts systems. The software is designed to be very fast when interacting with the user. Included in the package are facilities for fast search, ledger inspection, aged debt analysis and management accounting summary. The latter provides a complete breakdown of overhead expenditure and all trading parameters and is an

extremely powerful tool for management accounting in today's small business. Passwords and other safeguards make it virtually impossible to make mistakes one example of which is the back up facility in which it is impossible to accidentally copy from the back up disk to the working disk.

INVENTORY CONTROL

This program links to the accounts system through a special sales module so that sales from stock are automatically entered into the accounts. You can even sell directly from stock generating an invoice on the spot and even inspect your stock whilst in the middle of generating an invoice. The system gives warnings of low stock levels notifying re-order points and will also analyse sales by stock item giving total margins on each item. This extremely powerful system is ideal for companies or shops selling from stock.

ACCOUNTS	£495 + VAT
STOCK CONTROL	£295 + VAT
WORD PROCESSING	£250 + VAT
WORDSTAR + MAILMERGE	£275 + VAT
FORTH FOR NORTH STAR	£95 + VAT
COMMERCIAL FORTH	£112 + VAT
SYSTEMS FROM	£2,800 + VAT

Please send me details of the IA Systems

Name

Address

.....

.....

Company

Position

IA Systems, Cambridge Road,
Orwell, Royston, Hertfordshire.
Tel: 0223 207689

IA Systems (Intelligent Artefacts)
Cambridge Road, Orwell,
Royston, Hertfordshire
0223 207689



PC7/81

MAPLIN for ATARI



AUTHORISED DEALER

The World-beating ATARI PERSONAL COMPUTERS

3 consoles available

Atari 400 with 16K RAM (AF36P) £340

Atari 400 with 32K RAM (AF375) £395

Atari 800 with 16K RAM (AF02C) £625

(expandable to 48K)

All consoles when connected to a standard UK colour (or black and white) TV set can generate the most amazing graphics you've ever seen.

Look at what you get:

- * Background colour, plotting colour, text colour and border colour settable to any one of 16 colours with 8 levels of illuminance!
 - * Video display has upper and lower case characters with true descenders, double and quad size text and inverse video.
 - * 57-Key keyboard (touch type on Atari 400) and four function keys.
 - * Full screen editing and four-way cursor control.
 - * 29 keystroke graphics and plottable points up to 320 x 192 (160 x 96 only with 8K RAM).
 - * 40 character by 24 line display.
 - * Extended graphics control and high speed action using a DMA chip with its own character set.
 - * Player missile graphics.
 - * Four programmable sound generators can be played individually or together and each has 1785 possible sounds playable at any one of eight volume settings, for game sounds or music.
 - * Full software control of pitch, timbre and duration of notes in 4-octave range.
 - * Four joystick or paddle ports, sounds output to TV.
 - * BASIC cartridge and 10K ROM operating system and full documentation.
- Dealer enquiries welcome



Maplin Electronic Supplies Ltd
P.O. Box 3, Rayleigh, Essex.
Tel: Southend (0702) 552911/554155

MORE HARDWARE

Atari 410 Cassette Recorder (AF28F)	£45
Atari 810 Disk Drive (AF06G)	£325
Atari 822 40-column Thermal Printer (AF04E)	£240
Atari 850 Interface (AF29G)	£120
Joystick Controllers (AC37S)	£13.95
Paddle Controllers (AC29G)	£13.95
16K RAM Memory Module (AF08J)	£65

MUCH MORE FOR ATARI COMING SOON

SOFTWARE

Lots and lots of amazing software for Atari available during June 1981.

- ★ Word Processor ★ VISI-CALC
- ★ ADVENTURE GAMES ★ Arcade Games
- ★ Trek Games ★ ASSEMBLER & DISASSEMBLER ★ FORTH ★ Teaching
- ★ 3D GRAPHICS ★ Character Set Generator

SEND S.A.E. NOW FOR OUR LEAFLET XH52G available JUNE

LE STICK

For Atari Computer or Video Game
Replaces standard joystick, but much easier to use. Internal motion detectors sense hand movements. Large pushbutton on top of Stick. Squeeze Stick to freeze motion. A MUST for SPACE INVADERS, STAR RAIDERS & ASTEROIDS.
ONLY £24.95 (AC45Y)

Note: Order codes shown in brackets. Prices firm until August 30th 1981 and include VAT and Postage and Packing. (Errors excluded.)



Atari 400 Console



Atari 800 Console (with cover removed)

SPECIAL PACKAGE OFFER

Disk-based system for £725 with Le Stick
The Atari 400 Console
Special 32K RAM Module
Atari 810 Disk Drive
Disk Operating System
Documentation
Interconnecting Leads
Everything in "Look at what you get" list
Can any other computer on the market offer all this at anything like this price?

VERSAWRITER

12½ x 8in. drawing board. Drawing on board is reproduced on TV via Atari with 32K RAM and Disk Drive. Closed areas may be filled in with one of 3 colours. Text may be added in any one of 4 fonts. Paint brush mode: select size of brush and paint away. Air brush mode: shade in your drawing—colour and density is up to you. Plus many more features. S.a.e. for price and further details.

Demonstrations at our shops from June 9th 1981. See Atari at 284 London Road, Westcliff-on-Sea, Essex. Tel: (0702) 554000 and at 159-161 King St., Hammersmith W6. Tel: 01-748 0926

LONDON COMPUTER CENTRE

Daisy Wheel Printer II Including bi-directional tractor
Excellent print quality – superior to most famous makes

£1095

+ Built in proportional spacing + Look-ahead logic

60 CHARACTERS PER SECOND THE FASTEST DAISY WHEEL PRINTER. FAST, heavy duty commercial DAISY WHEEL printer, with high quality printout, coupled with low noise necessary for office environment. 124 char: upper/lower case. *10/12 chars: per inch giving 126 or 163 columns. * 15 inch wide friction platen. *BOLDING, underline, and host of other features. *Centronics type parallel interface as standard options: serial interface £60 *PET interface £65 * APPLE interface £75.



- ← TRS 80 Model I & II
- ← SUPERBRAIN
- ← APPLE
- ← PET
- ← HORIZON Etc

JAPANESE RELIABILITY DEALER ENQUIRIES INVITED
 OPTIONAL EXTRA SHEET FEEDER £550

Other Daisy Wheel printers

Qume RO £1,550
Qume KSR £1,695
Nec Ro £1,550

90 day on site warranty on qumes included

Epson Mx 100 F/T

The only full 15" width platten dot matrix printer with dual print modes. Correspondence quality and standard Dot matrix **£575**
 Full specification as mx80. F/T, as right



EPSON MX80 FT £395

WITH
DUAL PRINT MODES
 + ROLLER ATTACHMENT
 CORRESPONDENCE QUALITY AND STANDARD
 DOT MATRIX IN ONE LOW COST UNIT

LETTER LIKE PRINT QUALITY

3-WAY PAPER HANDLING

1. Letterheads or A4
2. Fanfold
3. Paper Rolls

LOW NOISE

The quietest dot Matrix Printer

132 COLUMNS PER LINE

Directly replaces big, expensive

printers, eg: Texas 810.

Centronics 700

HIGH RELIABILITY

Precision engineered by Shinshu

Seiki a subsidiary of Seiko Watch

Co. of Japan

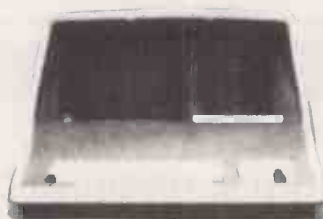
TRS-80 MODEL II



State the art second generation computer. Over 10,000 already sold in USA. 8 slot bus ensures expansion of hard discs & other peripherals. 76 Key professional keyboard, self test on power up, TRSDOS & Level III basic standard. CP/M available as option, making a wide range of accounting, educational, scientific & word processing packages instantly usable.
 Nationwide service through 180 Tandy stores & computer centres.

NOW WITH CP/M 2.24 **£1999**

SUPERBRAIN



350K **£1695**
 700K **£1995** 64K RAM Standard
 1600K **£2595** on all models

NOW with MULTICOLOURED DEDICATED KEYS for MAGIC WAND, the ULTIMATE WORD PROCESSOR

TRS-80 MODEL II FROM £600



NEW LOW PRICES MODEL I

48K system with Dual Disk Drives .. **£1175**

With Epson Printer .. **£1350**

New green screen VDU with rock steady display. Redesigned 32K expansion interface with trouble free operation and two 40 track disc drives.

16K Keyboard with Modulator .. **£382**

16K System: Keyboard, Green Screen &

Cassette .. **£485**

Dual 40 Track Disc Drives & Cables .. **£425**

32K Expansion Interface .. **£299**

VISICALC for TRS-80 MODEL I .. **£52**

Apple 48K £805

Dual 35 track disk drives including integral power supply 3.2/3.3 controller **£650**

As above 80 track drives 655K total with 3.3 controller (equal to 5 Apple drives) **£795**

12" green monitor **£89**

Special LCC System

48K Apple, dual 35 track disk

drives 12" green monitor **£1395**

Double Vision 80 x 24 card **£170**

CPM softcard **£175**

16K Ram (integer) card **£95**

CENTRONICS PARALLEL

CARD **£75**

Serial Printer Communications

Card **£85**

DEALER ENQUIRIES INVITED ON ALL PRODUCTS

43 GRAFTON WAY, LONDON W1P 5LA (Opposite Maples)

Tel: 388 6991/ 2 OPENING HOURS: 11-7 MON-FRI 12-4 SAT

24 hour answer phone: 01-388 5721

INTRODUCING

TWICKENHAM COMPUTER CENTRE LTD



FANTASTIC
OPENING OFFER

15% OFF
MOST ITEMS
UNTIL JUNE 30



With the best microprocessors available

Sample Offers Excluding V.A.T.

Apple 48K Europlus	685.00	Commodore 4022	335.00
Apple Disc + Controller	325.00	North Star Horizon 32K DD	1550.00
Apple Disc only	254.00	North Star Horizon 32K QD	1810.00
VisiCalc	105.00	16K RAM Board	216.00
Pascal Language System	254.00	32K RAM Board	318.00
Z-80 Softcard + CP/M	174.00	TVI-912C V.D.U.	540.00
Commodore 4032/4040	590.00	Epson MX-80FT	350.00
Commodore 8032/8050	760.00	Qume Sprint 5 R0 45	1530.00

**TWICKENHAM
COMPUTER
CENTRE LTD**

**01-892 7896
01-891 1612**

72 Heath Road Twickenham Middlesex TW1 4BW

• Circle No. 306

THE NEW DEAL FOR AUTHORS

A Scheme for marketing software by the authors on a co-operative basis. Copyright is retained by the author.

A license is given to the Company to copy for marketing only.

Authors receive 90% of profits in direct proportion to the value of their sales to total sales.

Guaranteed return to the author of 25% of sale value at time of sale. Balance of distributable profits determined by annual audit subject to scrutiny of trustees appointed by the Members.

CO-OPSOFT LIMITED

TO: CO-OPSOFT LIMITED
10 TRIANGLE SOUTH BRISTOL BS8 1EY

ENCLOSE SAE FOR REPLY

I am interested in the scheme. Please send detailed prospectus.
I enclose a brief description of a programme(s) I may wish to market.
(Indicate when available, approximate selling price and hardware required.)

Name

Address

PC7/81

• Circle No. 307

Wilkes Computing For **DECTM MICROSYSTEMS**



- LSI 11/2 and 11/23 CPU
- 5 Mb or 10Mb Drives
- Multi-user RT-11/TSX

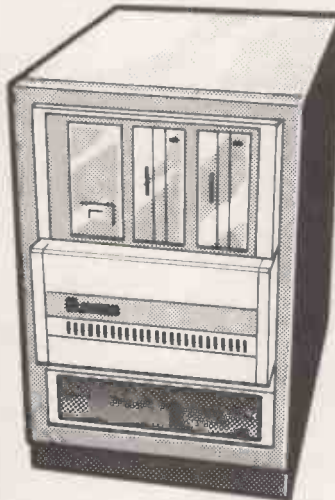
©Digital Equipment Company Ltd.

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU.
Tel: (0272) 25921. Telex 449205.

Wilkes Computing Announce The NEW LSI 11/23 **MICROSYSTEM**

Awarded CCTA contract for Government use.

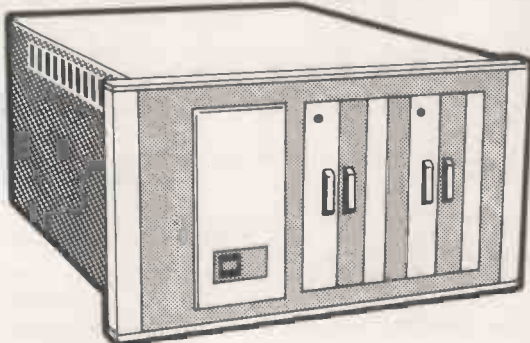


- LSI 11/23 128 Kb
- 32Mb Drive (16Mb+16Mb)
- Cap Microcobol
- Cabinet
- 16 slot back plane

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU.
Tel: (0272) 25921. Telex 449205.

Wilkes Computing Present the **GEMINI MICROSYSTEM**



- LSI 11/2 CPU
- 2.5 M Byte floppy disk
- 16 slot back plane
- Low cost

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU.
Tel: (0272) 25921. Telex 449205.

Wilkes Computing Announce **WORDWRIGHT**

The NEW Word Processing System for LSI 11/2 and 11/23 micro computers awarded CCTA contract for Government use.

- Low Cost Licences available
- Database and report generator facilities available
- Easy to use

Wilkes Computing

Bush House, 72 Prince Street, Bristol BS1 4HU.
Tel: (0272) 25921. Telex 449205.

• Circle No. 308

Attention

MBASIC users

BASKAM

Keyed file management system for Microsoft MBASIC under CP/M. Super-efficient indexing — will save many hours of programming time. You tell BASKAM the key (any length, numeric or alpha.) and it will store the data for you; ask BASKAM to retrieve the data given the key and there it is! Many features include a Universal Index Re-organisation programme that you can use to re-organise any index file that you create. Functions provided are:

OI — Open Index WR — Write Record by key
 WK — Write Key only RK — Read by Key
 RG — Read Generic (by partial key)
 RN — Read Next in key sequence
 DR — Delete Record & key DK — Delete Key only
 Read functions only take 2K, with write, delete 4.5K and with Universal Re-organiser 6K. **£95.00**

SUPERSORT

takes all the bother out of sorting data files, both large and small. Our price is the same as others, but we include *FREE* note on how to call SUPERSORT from interpreted MBASIC programmes. With this you can sort 700 records in less than 2 minutes. **£105.00**

Micro-PICS

is a genuine stock and production control system for any CP/M computer with MBASIC. Uses both BASKAM and SUPERSORT for speed. Full product structure maintenance, orders file, allocations file, etc., etc. Send for details. **£595.00**

DATASTAR data entry system	£160.00
WORDSTAR with MAIL/MERGE	£305.00
MBASIC interpreter	£155.00
MBASIC compiler	£195.00
SPELL-BINDER word processor	£250.00

INTERFACE SOFTWARE PACKAGES

Sales, Purchase, Nominal, Payroll, Stock Control
 All interfacing with each other.

single user	each	£325.00
multi-user	each	£375.00

Formats available:

- a) 8" standard single sided, single density
- b) 5" standard single sided, single density
- b) 5" Superbrain or Signet
- c) 5" d/d, d/s for Horizon or Communicator
- d) 5" Micropolis for Sorcerer or Vector Graphic

Distributors for:

DELTA S-100 systems	from	£2,700
The <i>NEW</i> Signet, 64K, dual 5" floppies from only		£1,299
SORCERER — still the best for word processing.		
Complete with daisy wheel printer & single disc		£2,950
RICOH RP-1600s daisy wheel printer		£1,450

V.A.T. to be added to all prices quoted plus £2.00 p.&p.

BASIC COMPUTING LTD.

251 BRADFORD ROAD, KEIGHLEY, W. YORKS.
 TEL: (0535) 63145

• Circle No. 309

"ATTENTION COMPUTER DEALERS"

Let us be your Exporter/Purchasing Agent in the United States for the following products: —

MICROCOMPUTERS:— Ohio Scientific, Onyx.

PRINTERS:— Okidata, Centronics, NEC, Xerox/Diablo, Anadex, Printerm, Eaton.

TERMINALS:— Micro-term, Televideo, Hazeltine, Zintec, Beehive.

MAG-TAPE:— Alloy engineering cartridge and reel.

FURNITURE:— Printer Stands, CRT Stands, Computer Tables.

MISC:— Blank Floppy Disks, Blank Cartridge and reel mag tape, CRT Cables, etc.

NOTE

IF YOU DON'T SEE YOUR NEEDS, PLEASE CONTACT US WITH YOUR REQUIREMENTS.

SYSTEMS INTERNATIONAL INC
 15920 LUANNE DRIVE
 GAITHERSBURG, MARYLAND
 20760 U.S.A.

Telephone 301-977-0100. Telex 710-828-9703
 Cable Address SYSINTL. GAITHERSBURG MD

• Circle No. 310

THE ONE STOP COMPUTER SHOP

**BUSS
 STOP**

We Supply Systems for Business, Education and Industry —
 And We Support Them With Service and Software!

Commodore

2001-8	£379.00	8032	£895.00	KIM1	£93.00
3008	£398.00	8050	£895.00	KIM3B	£96.95
3016	£495.00	8024	£1160.00	KIM4	£65.00
3032	£625.00	8010	£220.00	Toolkit, SuperChip,	
3022	£383.00	Pet Lead	p18.75	Soundbox, Parallel	
3023	£337.00	IEEE Lead	£23.44	and Serial Interfuses	
3040	£625.00	C2N Cass	£49.50	All Ex-Stock.	

Now on demonstration — The *NEW* PET MODEM, with Supporting Software.

VIDEO GENIE — EG3003 16K RAM, 12K LEVEL II BASIC IN ROM.
 TRS80 Compatible 32K VERSION £280.00
 £37.00

NASCOM — Phone for latest Details/Prices.

Dolphin Printers — The Superb BD80P now 80/132, chrs/line.
 Down to £450.00 While Stocks Last.

The New BD136, The Ultimate Intelligent Matrix Printer — Prints
 at 240 Chrs/Sec. **£1200.00**

RICOH, QUME, NEC Spinwriter etc, Also Available, Please phone
 for Prices.

CONSUMABLES C15's Only £4.00 for 10. 10 Verbatim 5 1/4" Disks
 — 35 Track £19.95 — for CBM 3040. 10 Verbatim 5 1/4" Disks —
 77 Track £36.50 — for CBM 8050.

Wide range of Continuous Stationary in stock — Paper, Labels etc.

SOFTWARE — We Sell Only The Best — Wordpro, Wordcraft,
 OZZ, Communicator, Medicom — and much more! Plus — A Wide
 Range of Books and Manuals for all Machines.

Please phone for carriage charges, all prices + VAT
 Photo Acoustics Ltd, BUSS STOP Computer Division
 255a St. Albans Road, Watford, Herts. (entrance in Judge Street)
 Phone: Watford 40698

58 High Street, Newport Pagnell, Bucks
 Phone: Newport Pagnell 610625

• Circle No. 311

micronetworks introduce

PM1000

CP/M 86

16 bit



A Truly Intelligent Terminal with Full-Page Display That Can Bring The Power of Distributed Processing to Your Computer.

HARDWARE

Display:

128 ASCII character set; upper and lower case alphanumeric and control characters
7 x 9 dot matrix in a 9 x 15 field
15" diagonal tube mounted vertically
Full screen of 5,280 characters (66 lines x 80 characters)
Phosphor P-39 (Green character)
Video attributes - Hi/Lo intensity, blinking, reverse, blank, underline

Diskette Drives:

Two QUME DataTrack Winchester Disks

Keyboard:

Detachable
107 keys, capacitive type with tactile feedback, color coordinated sculptured caps
N-key rollover
Full alphanumeric set
Numeric pad

CPU:

16-bit microprocessor (8086)

Communication Interface:

3 ports: RS232C-half or full duplex
Baud rates are switch or software selectable
Transmission mode - conversational and block

Memory:

2 Kbytes ROM (8K available)
128 Kbytes RAM
Optional: 256K RAM

SOFTWARE

Operating System:

CP/M-86** complete with assembler, text editor, debugging programs, file copy utilities, etc.

Languages:

BASIC (Microsoft)
CIS COBOL (Micro Focus)
Future: PASCAL

Word Processing Program:

Developed by PIICEON, this program enhances the capability of the PM1000. PIICEON Word Processing offers all the major features and is as capable as the dedicated Word Processing systems today. Features included (but not limited to) are: Word wrap, global search and replace, interactive hyphenation, "cut and paste", double column printing with right justification, sort/merge capability and normal move functions.

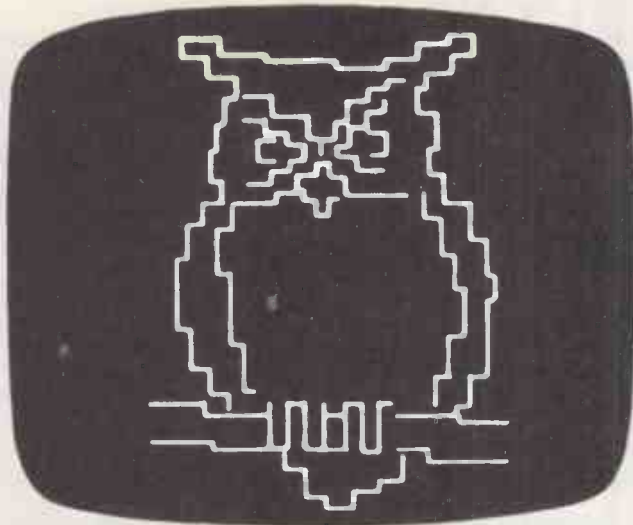
ALL PRICES ON APPLICATION

Visit our showroom at:
MICRO NETWORKS LTD.
60 PALL MALL, LONDON S.W.1
Tel: 01-839 3701

DEALERS' ENQUIRIES INVITED

Specifications and features subject to change.

• Circle No. 312



You lucky Apple II owners— by adding **appletel** you can have the only PO approved computer connection

With Appletel you can link your present Apple II computer direct to Prestel for just £595 plus VAT - which is a major cost saving for a start. Add in these other major advantages and you'll really appreciate what the complete Owl Computer package can do for you!

- ★ Save on telephone bills by storing pages from Prestel on a floppy disc - screen them up on Apple II when you're ready.
- ★ Programme the unit to automatically call up a sequence of pages, and store them for later examination.
- ★ Write your own BASIC programs to process Prestel data as well as send commands to Prestel.
- ★ The full keyboard means you can use Prestel to maximum advantage for sending messages.
- ★ Appletel is now available in colour

For full details on what Appletel can do for you, and the name of your nearest dealer, please phone or write.



Owl Computers

18 Hadham Road, Bishop's Stortford
Herts CM23 2QR
Tel: Bishop's Stortford (0279) 52682

• Circle No. 313

MICRO COMPUTER HARDWARE FROM LEICESTER COMPUTER CENTRE



For Architects, Draughtsmen etc.
DIGI-PLOT WX4671 £850

FLOPPY DISC FILE

Easy reference filing system for your flexible computer discs, files 20 discs per binder. Each file sheet stores 4 discs and disc reference tab. File leaves have reinforced edge, punched for 2 and 3 hole binders. Also available for 8" disc, files 10 discs per binder. Please state size, when ordering.
Binders complete with 5 leaves. £4.95 + VAT
Pack of 5 leaves only £1.55 + VAT

LOWER CASE + PLUS by LAZER SYSTEMS for the Apple II

LOWER CASE CHARACTERS:

Put normal and inverse case characters on the Apple II text screen.

CAPATIBILITY:

The Lower Case + Plus is compatible with word processors and text editors that utilize a lower case adapter to put lower case on the screen.

RESET DISABLE:

You can disable the reset key or control the reset disable with external switching through the expansion socket.

2 CHARACTER SETS:

There are two complete character sets, on board, in the Lazer Systems exclusive character generator. The first set is a word processing set and the second is a HI-RES graphics set. Character set selection is accomplished through the expansion socket.

SOFTWARE:

Standard BASIC software comes on diskette with each Lower Case + Plus, along with a 12 page documentation booklet to show you how to control the fantastic capabilities of this board.

2716 EPROM:

The Lazer Systems character generator is pin for pin compatible with the 2716 EPROM. This will allow you to design your own character set for use with this board. The character font is compatible with Mnt. Hardware's ROM + and other character generator programs to make it easy for you to build your own character set for the 2716 EPROM.

EXPANSION:

The on board expansion socket will let you control the reset key disable and character set selection with either a hardware switch or software control. It will also allow you to have an external character set in RAM that you can control & re-define with software.

£40.00 + VAT

LEICESTER computer centre limited

67 Regent Road, Leicester LE1 6YF. Tel: 0533 556268



• Circle No. 314

COMPUTECH for



COMPUTECH for



COMPUTECH SOFTWARE & HARDWARE IS WIDELY ACCLAIMED - WHY?

Companies like Shell UK Oil, Grindlays Bank, W.H. Smith, government departments and hundreds of firms from multinational corporations to sole traders and small businesses have licensed Computech software. Why?

Thirty years experience of business fifteen years experience of computing and dedication to serving the users' interests economically must be major contributions. By the time this advertisement appears about 1000 business software packages will have been installed and supported by us. Note other features which appeal to our customers - no special equipment, all configurations of Apple systems supported, no extra charge for lifetime support, hot-line service, economical use of hardware resources, program code supplied, modifications allowed, full validation, all accountancy requirements satisfied, all data written to disk and recoverable on demand, very simple operation, emulation of traditional manual methods, comprehensive manuals with sample reports, reliable operation, advisory bulletins and free fixing of bugs, (which is fortunately rare). Reduced licence fee for new versions with extra features. As approved dealers of Apple products and actual manufacturers of compatible hardware we combine the knowledge of hardware and software so essential for the application of microcomputers.

COMPUTECH SOFTWARE AND HARDWARE INCLUDES:

Payroll for 350 employees, 100 departments, all pay periods, printed payslips, approved year end documents, very quick and easy to use, **£375**. **Sales, Purchases and General Ledgers** **£295** each, detailed statements. **Job Costing and Group Consolidation** are amongst many and various applications of the **General Ledger** package, which supports values to totals of one thousand million accurate to a penny! Our **Utilities Disk** available like other packages in 13 sector or 16 sector format, is widely used for reliable, error checking, copying, including single drive, and the renowned **DPATCH** program beloved of programmers for **£20**. We have developed a **Terminal Utilities** package which enables Apple to Apple and Apple to mainframe communications with local processing and storage as well as Apple to host communications from the amazingly low price of **£130**. Our **Graphics Utilities** program for use with the **Microline** and **Epson** families of printers enable the plain paper production on low cost printers of high resolution screen pictures, graphs etc. - free with **Microlines** or **£30** separately. **Keyboard Driver** enables the use of our **Lower Case** adaptor with BASIC programs and **Applewriter Patches** supplied **FREE** with our character generator package (total cost **£50**) is separately available on disk with documents for **£10**. At the same price **CAI** (convert Apple pictures for ITT) makes binary high resolution picture files display properly on the ITT 2020. We sell the famous **Visicalc** for **£125** and have delivered systems using it to do amazing things like production control, shipping accounts and stocks and shares valuations! The versatile **Applewriter** word-processing package at only **£42**, especially employed with our **Lower Case Character Generator** is widely used by people who cannot type to produce word-perfect copy! Experience with Apple systems has led to the design and manufacture of compatible products with enhanced features at very favourable prices to satisfy users' needs. These include the **Diplomat Serial Interface** which has handshaking capability and switchable options (**£80**), the **Diplomat Parallel Interface** which enables the direct use of text and graphics with the **Microline** and **Epson** printers and is a complete 'plug in and go' item with gold-plated edge-connector at **£80** and has optional direct connection for **Centronics 730/737** printers. Our new **Diplomat Communications Card** at **£95** is a sophisticated peripheral especially suitable for Apple to mainframe communications at high speeds in full duplex mode with switch selectable bit rates and other options. The **Lower Case** adaptor is available for Apples (revision 7 and earlier) as well as ITT 2020, complete with diskette software for **£50**. It offers true descenders on screen and the £ sign. We also have an **Optional Character Generator** for the ever popular **Microline M80** at **£15**. This provides £ sign and improved digits and lower case characters with USASCII special symbols. Our price for the **Microline M80**, with graphics, 40, 80 and 132 characters per line, friction, sprocket and teleprinter feed, is only **£345**, amazing for this small, quiet reliable 'look alike' printer. Tractor option is **£40** and **Serial Adaptor** **£80**. The **Microline M82**, bidirectional printer with both parallel and serial input is only **£525**, it can have an optional 2K buffer, while the **Microline M83** full width adjustable tractor 120 cps printer with similar specification is only **£775**. Then for all computer users there is the unique **Micromux** which from **£800** provides up to 16 ports for simultaneous independent serial asynchronous communications! Telephone for data sheets or to arrange a demonstration of for the address of our nearest dealer. Please hurry - the demand for our products has been such that some have been temporarily out of stock. We offer the effective low cost solutions you need. **Prices exclude V.A.T., carriage and packing.**

COMPUTECH SYSTEMS

168, Finchley Road, London NW3 6HP. Tel: 01-794 0202

AGENTS THROUGHOUT THE UK AND OVERSEAS

• Circle No. 315

MAGTRONICS

LTD.

MAGTRONICS LTD.
3 GOLDHURST TERRACE
LONDON NW6 3HX
PHONE 01-624 9847

ELECTRONIC COMPONENTS & COMPUTER SUPPLIES

DISKETTES

UNCONDITIONAL GUARANTEE

5.25"	MINI-DISKETTES 1 SECTOR (SOFT) PET, TRS80, ETC.	SINGLE SIDED PER 10 £16.50
5.25"	MINI-DISKETTE 10 SECTOR	SINGLE SIDED PER 10 £16.50
5.25"	MINI-DISKETTE 16 SECTOR	SINGLE SIDED PER 10 £16.50
5.25"	MINI DISKETTE 1 SECTOR	DOUBLE SIDED PER 10 £24.00
8"	SINGLE SIDED 26 SECTOR	SINGLE DENSITY PER 10 £18.00
8"	SINGLE SIDED 26 SECTOR	DOUBLE DENSITY PER 10 £24.00
8"	DOUBLE SIDED 26 SECTOR	SINGLE DENSITY PER 10 £30.00
8"	DOUBLE SIDED 26 SECTOR	DOUBLE DENSITY PER 10 £30.00

E. PROMS	
1702A	500p
2708	350p
2716 (+5v)	450p
2732	1200p
2532	1200p

MEMORIES	
2102-2L	120p
2114-2L	400p
2114-4L	250p
4116-2L	250p
6810	300p

INTERFACE	
MC1488	80p
MC1489	80p
75451	75p
75452	75p
8128	250p

CPU's	
6502	750p
6800	650p
6802	1100p
8080A	450p
8085A	1100p

SOCKETS L.P.	
8 PIN	9p
14 PIN	10p
16 PIN	11p
24 PIN	22p
28 PIN	30p

ROMS	
74S188	275p
74S189	275p
74S470	650p
74S471	650p
74S472	900p

**C.MOS
SUPPORT DEVICES
TRANSISTORS
DIODES
ALL STOCKED
PHONE
FOR QUOTATION**

**DISK ORDERS ADD 90p AND COMPONENTS ADD 50p P&P.
ADD 15% VAT TO TOTAL.
MANY OTHER TYPES OF HARD & SOFT SECTOR DISKETTES
AVAILABLE. PHONE FOR QUOTATION.
MAGNETIC CARDS, DATA CARTRIDGES, DIGITAL
CASSETTES ARE ALSO STOCKED.
OFFICIAL ORDERS FROM SCHOOLS, COLLEGES,
UNIVERSITIES AND GOVT. BODIES ACCEPTED.**

74LS SERIES	74LS26	22p	74LS76	36p	74LS125	50p	74LS163	1.00p	74LS221	1.20p	74LS279	65p	74LS375	1.20p	
74LS00	14p	74LS27	22p	74LS78	45p	74LS126	50p	74LS164	90p	74LS240	1.75p	74LS280	1.75p	74LS377	1.60p
74LS01	14p	74LS28	22p	74LS83A	70p	74LS132	60p	74LS165	1.00p	74LS241	1.75p	74LS283	90p	74LS378	1.30p
74LS02	15p	74LS30	20p	74LS86	80p	74LS133	40p	74LS166	1.70p	74LS242	1.75p	74LS290	95p	74LS379	1.80p
74LS03	15p	74LS32	26p	74LS88	40p	74LS136	50p	74LS168	1.70p	74LS243	1.75p	74LS293	95p	74LS381	3.80p
74LS04	16p	74LS33	28p	74LS90	40p	74LS138	65p	74LS169	1.70p	74LS244	1.50p	74LS295	1.45p	74LS386	80p
74LS05	22p	74LS37	28p	74LS91	95p	74LS139	70p	74LS170	1.85p	74LS245	2.50p	74LS298	1.45p	74LS390	1.20p
74LS08	20p	74LS40	22p	74LS92	72p	74LS145	110p	74LS173	1.10p	74LS247	1.40p	74LS324	1.85p	74LS393	1.20p
74LS09	22p	74LS42	65p	74LS93	60p	74LS148	1.70p	74LS174	1.00p	74LS248	1.80p	74LS325	3.00p	74LS395	2.00p
74LS10	18p	74LS47	75p	74LS95	100p	74LS151	80p	74LS175	1.00p	74LS249	1.40p	74LS326	3.00p	74LS396	2.00p
74LS11	22p	74LS48	85p	74LS96	110p	74LS153	60p	74LS181	280p	74LS251	1.30p	74LS327	3.00p	74LS398	2.75p
74LS12	25p	74LS49	100p	74LS107	45p	74LS154	1.50p	74LS190	1.00p	74LS253	90p	74LS352	1.80p	74LS399	2.00p
74LS13	40p	74LS54	25p	74LS109	35p	74LS155	65p	74LS191	1.00p	74LS257	90p	74LS353	1.80p	74LS424	4.50p
74LS14	50p	74LS55	25p	74LS112	35p	74LS157	75p	74LS192	1.00p	74LS258	1.20p	74LS365	50p	74LS445	1.85p
74LS15	25p	74LS56	1.50p	74LS113	45p	74LS158	60p	74LS193	1.00p	74LS259	1.60p	74LS366	65p	74LS447	1.85p
74LS20	20p	74LS73	45p	74LS114	45p	74LS159	90p	74LS194	1.00p	74LS260	45p	74LS367	65p	74LS490	1.60p
74LS21	22p	74LS74	28p	74LS122	75p	74LS160	75p	74LS195	1.10p	74LS261	4.25p	74LS368	65p	74LS668	1.05p
74LS22	22p	74LS75	36p	74LS123	75p	74LS161	75p	74LS196	1.20p	74LS266	45p	74LS373	1.55p	74LS669	1.05p
				74LS124	145p	74LS162	1.15p	74LS197	95p	74LS273	1.75p	74LS374	1.80p	74LS670	2.50p

• Circle No. 316

Computer Listing Paper

From Stock at Low Prices!

We can supply any quantity of paper, in any size
for your Mini Computer or Word Processor
from our vast stocks — bulk production means competitive prices

We also supply pre-printed forms to your
own specification — single part or multi-part, OTC & NCR,
and a complete range of continuous self-adhesive labels.

Telephone for prices now:—

01-520 8624

David Richards (Printers & Distributors) Ltd. 61-63 Hoe Street, London E17 4SA.

• Circle No. 317

COLT BUSINESS SYSTEMS

DO NOT ANSWER THE TELEPHONE...

ORDER PREPARATION	30pc SAVING
LEDGER POSTING	40pc SAVING
SALES LEDGER POSTING	AUTOMATIC
INVOICE PREPARATION	
STATEMENT PREPARATION	
STOCK RECORDING AND CONTROL	
AGED DEBTORS	

BUT THEY DO HANDLE MOST THINGS
SYSTEMS

OSCAR

64 Kb Z80 processor 800 000 ch floppy discs VDU 120cps printer

£ 3704

ATTACHÉ

64 Kb Z80 processor 2Mb floppy discs VDU 180cps printer integral desk

£6000

COMPOUND

120Kb Z80 ONYX processor 10Mb WINCHESTER disc 14Mb magnetic tape backup 2VDUs 180cps printer

£10200

Applications Software

ORDER PROCESSING	INVOICING	STOCK CONTROL	BOMP	£1000
SALES LEDGER	£ 500	INCOMPLETE RECORDS		500
PURCHASE LEDGER	500	SUBSCRIPTION ACCOUNTING		3500
NOMINAL LEDGER	500	ADDRESS BOOK MAILING		250
PAYROLL	500	WORD PROCESSING		250

Operating Systems

CP/M

OASIS

MP/M

COLT COMPUTER SYSTEMS
494 Great West Road
Hounslow Middx.

SALES DIRECTOR J.M. PLUMBE FCA Tel 01-572 3784 / 577 2150

• Circle No. 318

PROFESSIONAL SUPERBRAIN SOFTWARE

COMPILERS & UTILITIES

Microfocus CIS COBOL:

- Standard compiler..... £425
- Forms-2 utility £100

NB We are the sole UK distributors of Microfocus products on the SUPERBRAIN.

Microsoft:

- MBASIC interpreter £155
- BASIC 80 compiler £200
- COBOL 80 compiler £390
- FORTRAN 80 compiler £260
- MACRO 80 assembler £ 85

Micropro:

- WORDSTAR (word-processing) ... £230
- Mailing list merge for above £ 65
- DATASTAR (data management) .. £160
- SUPERSORT £130

The Micro Solution Ltd:

- REPORT GENERATOR £100

(this superb data management tool allows you to produce interactively a COBOL program to select records from a file and print them in your layout)

- BSTAM (inter machine transfer).... £ 75

APPLICATIONS SOFTWARE

The Micro Solution Ltd:

- Integrated Accounting System ... £1000
- Stock Control System £400
- Bill of Materials System £400
- Payroll Systems £500

These four modules interlock as required to make a superb total business system.

Half day free training is included in the above price for each module.

The Accounting system includes:

- Sales/Purchase/Nominal Ledgers + VAT
- Final Accounts/Profit & Loss/Bal sheet
- Invoicing
- Open Item or Balance Forward

The Stock Control system includes:

- Order processing/Auto. Reordering
- Picking List production

Others:

- Television Rental system £800
- Estate Agents' system £475
- CP/M Specials (Auto Load etc) ... POA
- SPELLBINDER (word-processing) . £250
- SUPERBIOS(CP/M enhancements).£100
- SUPERVID (video enhancements) . £285

SUPERBRAINS AVAILABLE FROM STOCK,

FROM **£1600** Subject to exchange rate fluctuation

ADD VAT AT STD. RATE TO ALL ABOVE PRICES
POSTAGE AND PACKING WILL BE ADDED
DELIVERY NEXT DAY FOR STOCK ITEMS

** CASH WITH ORDER — DELIVERY FREE

DEALER ENQUIRIES WELCOME



Contact:



Park Farm House
Heythrop
Chipping Norton
OXFORDSHIRE
OX7 5TW

telephone:
CHIPPING NORTON (0608) 3256
ask for: Bill Whaley
or
Bede Dunlop



Apple Turnover.

**New Accounting Programs for Apple.
Of very advanced design.
From Computer Arts.**

**Investigate Apple.
Examine other accounting systems.
Then ask to see a Turnover.**

**Sales Ledger
Purchases Ledger
General Ledger**

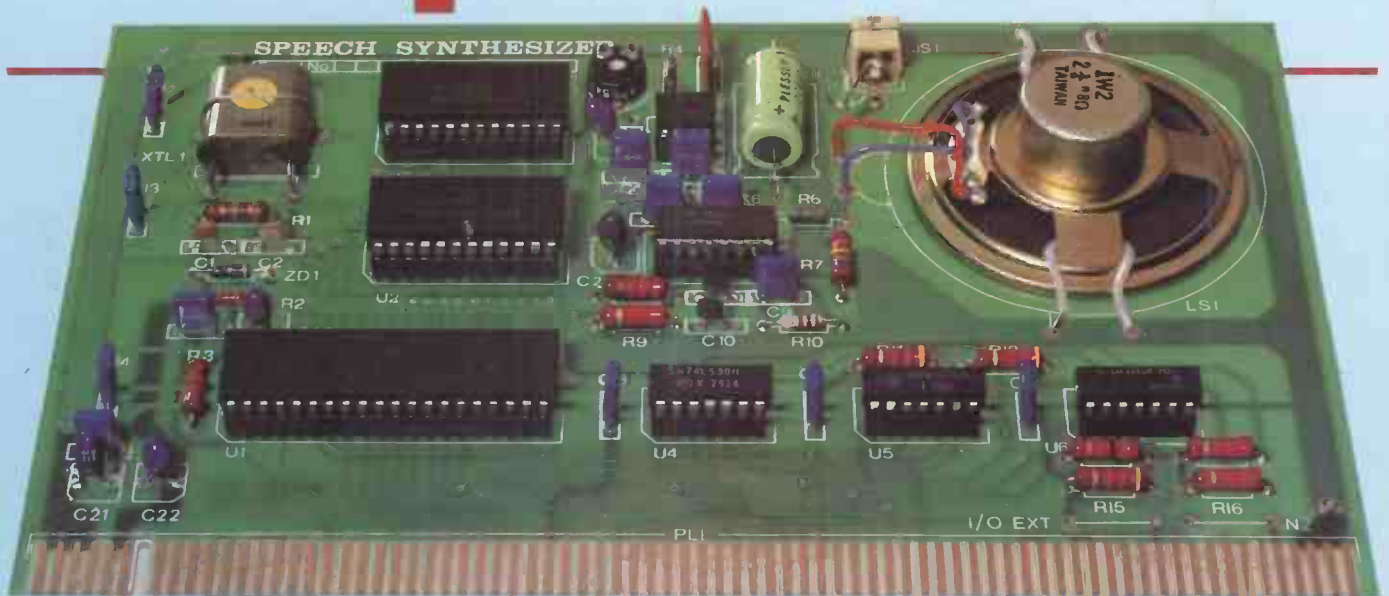
Designed for small and medium size businesses. And for staff who will be using a computer for the first time in their life. We've put a lot of thought into making everything straightforward. With no loss of accountancy standards.

**Treat your staff to an Apple Turnover.
And yourself to the benefits of computer accounting.
You all deserve it.**

**Computer Arts Limited. 11, London Street, Reading, Berkshire. RG1 4PN
Telephone: Reading (0734) 54451.**

Computer Arts provides a full backup service including consultancy, training and permanently manned Customer Service Desk. The Turnover system is available through any Apple dealer. Contact us directly if you have any difficulty getting a demonstration. Price of £444 per ledger includes a full kit containing all the disks needed, disk storage cases, printer stationery, report binders and printed identification labels. Comprehensive instruction book and practice disk minimize need for any special training. No special equipment or extras of any kind needed beyond a standard Apple computer system.

does your computer talk?



For use with Nascom, Pet, Apple, Tandy, UK 101.

The first in our new range of peripheral boards for the popular microcomputers will be a speech synthesizer.

As with all our products it will be fully built and tested.

The main board is 8" x 5", through plated, double sided and fully buffered. We are

using the National Semiconductor 'Digitalker' chip. There is an on-board 2" speaker and audio amplifier.

The speech-board itself is "Nasbus" compatible.

There is a piggy-back board which generates an RS232 interface to any computer with an RS232 serial port.

The board is supplied with

the necessary user software to make insertion into your programs simple. The depth to which you expand your use of the board is your decision.

The "Digitalker" chip has 256 expressions which include words and sub-sounds. These sub-sounds will enable you to expand your vocabulary rapidly and allow you to write

your expressions/responses etc. into your programs using the appropriate code.

The main board and the piggy-back will be available at the end of July 1981 and the interface boards to give compatibility to the Pet, Apple and Tandy will follow sequentially in the following two months.

Arfon Microelectronics is a new company based around the knowledge and proven design success of people who have been at the forefront of the expansion of micros in the UK.

The design group have an interest in many areas involved with microprocessors and future products will not always be specifically computing.

Based in Caernarfon, in a modern 25,000 sq.ft. factory, the company will sell its products throughout Europe. The custom built factory will produce built and tested products to a very high standard.

Not only will the factory produce 'house products' but will also manufacture

Next Proposed Product: a Light Pen in use with the same series of microcomputers. The pen will be properly encased and the whole manufactured for commercial use. The flexibility of input with a light pen and the instantaneous screen addressing makes this product a must for a regular computer user.

Proposed launch Aug/Sept. 1981



products that the design team have generated for outside companies.

Arfon would like to hear from any company with a possible design and/or manufacturing need related to their own business.

For contact with the design team etc. please write to K. Borland at 153 High Street, Potters Bar, Hertfordshire.

For details of the products and to get on our mailing list please fill in the coupon and post to Arfon Microelectronics Limited, Cibyn Industrial Estate, Caernarfon, Gwynedd, Wales.

Name

Address

Telephone

Existing Computer System

Type of user: Hobbist Commercial Industrial

Educational

Mags Read: Practical PCW Comp Today

Comp Weekly Computing

Others

Circle No. 321

NEW!! - 10Mb HARD DISK SYSTEM



UP TO
104Mb ON LINE!
The Morrow Hard Disk
Controller can support as many as
four hard disk drives at either 10Mb,
20Mb, or 26Mb each

Horizon Computer + 64K Ram + 2 Quad Drives (720K) +
Morrow 10Mb Hard Disk + Televideo TVI-912c VDU +
CP/M 2.2 **SPECIAL PACKAGE PRICE £4,595.**

LATEST NORTH STAR COMPATIBLE SYSTEM SUPPORT SOFTWARE FOR NORTH STAR DOS/BASIC AND CP/M

HMSOS - Super fast multi-user operating system for the North Star Horizon computer used with Morrow 10Mb, 20Mb or 26Mb hard disk(s) and tape cartridge backup unit. Can also be used with standard North Star mini-floppy disk drives. **HMSOS** gives you single/multi user compatibility - it configures itself automatically according to your memory set-up and supports up to seven users. It will run existing North Star BASIC programs with little or no modification. It incorporates implicit printer lockout and file lockout from BASIC. Also allows you to load your own assembly language routines from BASIC. The operating system and BASIC are pseudo-reentrant in that only one 16K memory card is required in the address space 0-3FFF. This board holds the operating system and BASIC for all users. Thus one DMB6400 64K board is sufficient for a three-user system with effectively 32K per user!!!

ABRIDGED PRICE LIST HARDWARE

Morrow 10Mb Hard Disk System + CP/M	£1995
Morrow 10Mb Hard Disk Unit (add on)	£1795
Morrow 20Mb Hard Disk System + CP/M	£2595
Morrow 20Mb Hard Disk Unit (add on)	£2395
Morrow 26Mb Hard Disk System + CP/M	£2695
Morrow 26Mb Hard Disk Unit (add on)	£2495
Tape Cartridge Back-up Unit (12.5Mb)	£1875
DMB6400 64K Memory Card + bank switching	£495
DM6400 64K Memory Card, non bank switching	£395
Horizon Computer - 32K RAM, 2 D/D Drives	£1685
Horizon Computer - 32K RAM, 2 Quad Drives	£1965
Televideo TV912c VDU, numerous features	£500
WordStar customised TV1920 VDU	£645
Epson MX80F/T Printer friction + tractor	£395
Anacom 150 Printer, 150cps 9 x 9 matrix 15" +	£795
Anadex DP9500 Printer, 150 cps, graphics 15" +	£895
TEC Starwriter daisy wheel printer, 25cps	£1050
NEC 5510R Spinwriter, letter quality, 55cps	£1495

SOFTWARE

HMSOS - Mini-floppy multi-user system	£175*/£5**
HMSOS - Hard-disk multi-user system	£275*/£15**
COMSTAR - North Star BASIC compiler	£235*/£15**
KDS - North Star BASIC utility suite	£50*/£5**
N*BUS - North Star BASIC global editor	£45*/£5**
MUMPDSPL - Hard disk multi-user spooler	£120*/£5**
CP/M - For North Star Horizon (Vers. 2+)	£95*/£18**
STARLNK 1 - Hard disk/mini-floppy CP/M	£125*/£5**
STARLNK 2 - Multi-user version STARLNK 1	£275*/£5**
MBASIC-80 Interpreter	£155*/£18**
MBASIC-80 Compiler	£195*/£18**
FORTRAN-80 Compiler	£205*/£18**
MACRO-80 Macro Assembler	£80*/£12**
WordStar - Word processing package	£185*/£25**
MailMerge - WordStar Overlay Option	£55*/£15**
DataStar - Data entry, retrieval Sys	£145*/£25**
SuperSort 1 - File sort utility	£95*/£20**
CIS COBOL - Standard package	£375*/£30**

*Price of software includes manual
**100% credit if software is purchased later

STARLINK -

Specially written to link CP/M on the Morrow M10, M20 and M26 hard disk drives to quad capacity mini-floppy disk drives in the North Star Horizon computer. With

STARLINK file transfer is simply accomplished using the standard CP/M "PIP" utility. **STARLINK** is available as a single or multi-user system. The multi-user version supports upto seven users each with upto 56K memory. **STARLINK** also supports tape cartridge backup for the Morrow hard disks.

COMSTAR - North Star BASIC Compiler. Consists of a full compiler which translates a North Star BASIC program into an assembly language source file, a disk-based macro assembler which further translates the source assembly language program into a relocatable machine equivalent, and a linking loader which combines the relocatable machine program with the requisite support routines to form an executable program. There is also a console command processor which reads a sequence of console commands from a disk file to automate the compilation process plus a character-oriented text editor to create console command files or modify assembly language programs. A **COMSTAR/CPM** interface is also available to enable compiled BASIC programs to run under CP/M.

KDS and **KDS-EXT** - A suite of menu driven utility programs written in assembler for fast operation. Developed as a debugging aid for long and complex programs, it includes a patch program to allow the **KDS** machine language routines to be hybridised to North Star BASIC. Consists of a compaction program which improves run time by up to 33%, a cross-reference program which creates and sorts a list of cross-reference items, a program to change the name of a variable globally within a line number range, a search program to locate a given syntax combination or byte value, and a program which compares two programs listing the differences between them. **KDS-EXT** is an extension package to **KDS** with many useful utilities. These include a protect program which also speeds up run times, a directory sort utility, a global editor for the search/replace of syntax combinations, a utility which enables transfer of programs to and from a disk file and then allows editing with a text editor. In addition there are programs to perform multiple variable exchanges, high speed disk dumps/searches, file dumps, and to find a list files of a given type. Highly recommended for North Star BASIC users.

Prices and specifications subject to change without prior notice.

HMSOS is a trademark of Hotel Microsystems, COMSTAR is a trademark of Allen Ashley Enterprises, KDS is a trademark of Kintock Development Systems, STARLINK is a trademark of Interam Computer Systems, CP/M is a trademark of Digital Research.

Main UK Distributor:

Interam Computer Systems Ltd.
46 Balham High Rd, London SW12 9AQ
Tel: 01 675 5325/6/7 Telex: 925859

169

PLEASE WRITE OR PHONE FOR FULL DETAILS

• Circle No. 322

Technology leaps ahead

with the Vector Graphic 3005 from Almarc



Almarc bring you the latest in micro computer technology. The 3005, 5.6 Mega byte hard disc system from Vector Graphic for the price of an 8" floppy disc system.

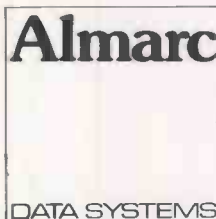
The 3005 represents the latest technology in desk top systems with the speed, capacity, convenience and reliability of State-of-the-art Winchester hard disc technology.

Ask Almarc about the 3005 and other Vector Graphic systems in the range. Full sales and servicing

facilities are available throughout the U.K. Specification includes:

- * A nearly silent 5¼" 5 Megabyte Winchester hard disc.
- * A 630K byte double-sided, quad density floppy drive.
- * The Vector 3 intelligent terminal.

Also the standard software package supplied with all Vector systems: CP/M 2.-2, Microsoft Basic 80, Scope (Editor) and Raid (Debugger).



Almarc Data Systems Ltd., 906 Woodborough Road, Nottingham NG3 5QS.
Nottingham (0602) 625035 Telex: 37407 Almarc/G

PERIFLEX & PERIDATA...

building blocks for microcomputer systems

■ PERIFLEX:2 ■

Microcomputer chassis and power supply. Includes a 20 slot S100 spec card cage with provision for two Micropolis 5.25" floppy disc drives with CP/M 2.2 drivers.

■ PERIFLEX 1024 ■

Two 8" floppy disc drives with 240V, 50Hz power supply — can be used with any suitable controller onto Tandy*, S-100*, Intel Multibus*, DEC LSI-11* etc.

■ PERIDATA 4100 ■

Micropolis Winchester disc drive (either 7.13, 21.4 or 35.6MB formatted) and Perex HD6400 17MB back-up cartridge. Interfaces for S-100 and Intel Multibus supported by CP/M 2.2 drivers and tape interchange package.

■ PERIDATA 4200/4500 ■

Add-on units with Winchester or cartridge drives for system expansion — up to 128MB (under CP/M) of Winchester disc capacity — as much cartridge back-up as you need.

■ PERIDATA 4900 ■

16MB micro Winchester (5.25") with S-100 interface and Perex HD6400 cartridge back-up.

For the OEM who requires a turnkey CP/M system, we have processor cards, RAM cards and disc controllers for the S100 bus all supported by CP/M 2.2. We can also offer the ultimate in flexibility by putting CMD drives onto the S100 bus.

All products are fully supported by our own Service Division, so if it's system building blocks you need — come to us.

*Registered trademarks



**Sintronic
Electronics**

Sintronic Electronics Ltd
Arkwright Road, Reading, Berks RG2 0LS
Tel: Reading (0734) 85464
Telex: 847395





Pete & Pam Computers

Micro Computer Hardware and Software Specialists in Applefare

We are distributors for: Microsoft, High Technology, Stoneware, Broderbund, California Pacific, United Software, Videx, On-Line Systems, Sirius, Stellation-Two, Daken Corporation, Micro-Pro Sub-Logic, ABT, Computer Station, Versa Computing, Syntec, Micro-Lab, Synergistic, Avant Garde, Lazer Systems, M & R Enterprises, South Coast Enterprises and Street Electronics.

We welcome dealer enquiries. All the products we advertise are available from your local dealer.

RAMCARD £109.95
A 16K Expansion card for your Apple. It will provide additional memory for Visicalc, load integer from a System Master and is fully compatible with Apples Pascal System.

Z-80 SOFTCARD £169.00
A Z-80 microprocessor for Apple. Comes with CP/M operating system and Microsoft Basic 5.

COBOL 80 £299.00
FORTRAN 80 £109.95
BASIC COMPILER £199.00
ASSEMBLY LANGUAGE DEVELOPMENT £79.00

THE MILL 6809 £169.00
A 6809 processor add-on for Apple. Can work in conjunction with 6502. Compatible with FLEX operating system. Assemblers are available.

PASCAL SPEED-UP KIT £79.00
Works in conjunction with the 6809 to greatly increase the speed of execution of Apple Pascal programs.

80 COLUMN BOARDS
Take your pick—
SUP-R-TERMINAL £195.00
VIDEX £185.00

PASCAL JOB CONTROL SYSTEM — From High Technology. £395.00
A fast, sophisticated job control/costing system able to control costs on 400 jobs, providing useful reports and maintaining 50 cost centres with 500 sub cost centres. Worth its weight in gold!

FLIGHT SIMULATOR by Sub-Logic Disk £19.95
Cassette £14.95
So realistic — you might feel airsick! — be warned!

DB MASTER £129.95
The Data Base with 100 fields operating on multi-diskette files for large capacity.

INFORMATION MASTER — Data Base £79.00
A dream to use, has advanced facilities such as global change and calculator mode of entering figures. A system that a novice can use with ease.

DATA MASTER £55.00
A utility for use with Information Master. Allows the splitting of a data base system selectivity, change of field types and transfer of print formats.

TRANSIT £29.00
A utility that enables you to link Information Master to many files including those created by Visicalc.

MICRO PRODUCTS £49.95
Editor/Assembler/Disassembler/Debug.

ECHO II £129.00
A speech synthesizer consisting of a card speaker and a diskette with software using "Linear Predictive Coding" to produce sound. Based on Texas Instruments TMS 5200 — an upgraded version of "speak and spell" chip.

CCS INTERFACE CARDS — at bargain prices
Centronics Parallel £66.00
Parallel £59.00
Synchronous £79.00
Arithmetic Processor £199.00
Clock/Calendar Card £69.95

MEMORY MANAGEMENT SYSTEM £29.00
A utility that moves DOS onto a 16K expansion card — freeing motherboard Ram space for larger programs.

MUSIC SYSTEM from Mountain £275.00
16 oscillator music synthesizer, in stereo Program your own waveforms to create any instrument sound. We put you in touch with the UK users group.

EXPANSION CHASSIS £399.00
Long awaited — here at last. More slots for your Apple.

CLEAR PLEXI-GLASS LIDS £14.95
Be vain — show off the inside of your Apple!

Apple Galaxian — Galaxy Wars — Head-On — Galactic Revolution — Galactic Trader — Galactic Empire — Olympic Decathlon — Mystery House — Bridge Partner — Checker King — Gammon Gambler — Roulette — Craps — Apple 21 — Puckman — Global War
All at £13.95

Microsoft Adventure — ABM — Dog Fight — Phantoms Five — Orbitron — Pulsar — Microchess 2.0 — Odyssey — La Land Monopoly — Morloc's Tower — Rescue at Rigel — Space Eggs — Trilogy of Games — The Prisoner
All at £14.95

Computer Conflict — Computer Quarterback — Cartels and Cutthroats — Space Album — Bill Budge 3D Graphics Tutor — Cyber Strike — 3 Mile Island — Adventure 123 — Adventure 456 — Adventure 789 — Hi-Res Soccer — Temples of Apshai — Hellfire Warrior — Zork.
All at £20.95

Buy any five games and you can deduct 5% off the total price!

Prices do not include VAT. Please add 15% VAT to your remittance. Postage and packing FREE. Yes! We do take Visa Cards.



Authorised Apple Sales and Service
98 MOYSER ROAD, LONDON SW16 6SH
Tel: 01-677 2052/7341

• Circle No. 325

INTELLIGENT ARTEFACTS LTD

ALL PRODUCTS
GUARANTEED FOR
ONE YEAR:

REPAIRS ON ANY
EQUIPMENT CARRIED
OUT BY TRAINED
ENGINEERS

4016 - 16K - £449 + VAT

4032 - 32K - £559 + VAT

4040 - Disk unit - £565 + VAT

8032 - 32K - £759 + VAT

8050 - "1MB" Disk £759 + VAT



Latest 4000 and 8000 series PETS with large Keyboards and 8K basic in ROM. Popular easy to use Microcomputer.



MX80T £275 + VAT
MX80FT £349 + VAT

Epson printers, quiet, bi-directional logic seeking. 9 x 9 matrix £ sign Pet and Apple interface lower case descenders.

SUPERBRAIN withdrawn due to quality problems.

32K Dual Drive DD - £1549 + VAT

32K Dual Drive QD - £1649 + VAT

64K Dual Drive QD - £1999 + VAT

Forth Language - £90 + VAT



North Star Horizon an established reliable basis for any microsystem complete with DOS 5.2 and Basic language.

Speech output for the Speakeasy. A low cost speech unit suitable for any small microcomputer. Ideal for anyone interested in developing speech output. Has infinite vocabulary — £69 + VAT.



EXTRAS

Toolkits from £24 + VAT

Cassettes £45 + VAT

Forth for PET £45 + VAT

Watanabe Plotter only £699 + VAT

Pet disk Debug — £18 + VAT Popular aid to disk programming and removable of disk corruptions.



Please send me.....

Name.....

Address.....

I enclose cheque/P.O. for £.....
(add £15 for P&P for each item of hardware).

INTELLIGENT ARTEFACTS LTD.
Canbridge Road, Orwell, ROYSTON, Herts.
Tel: Canbridge (0223) 207689

PC7/81

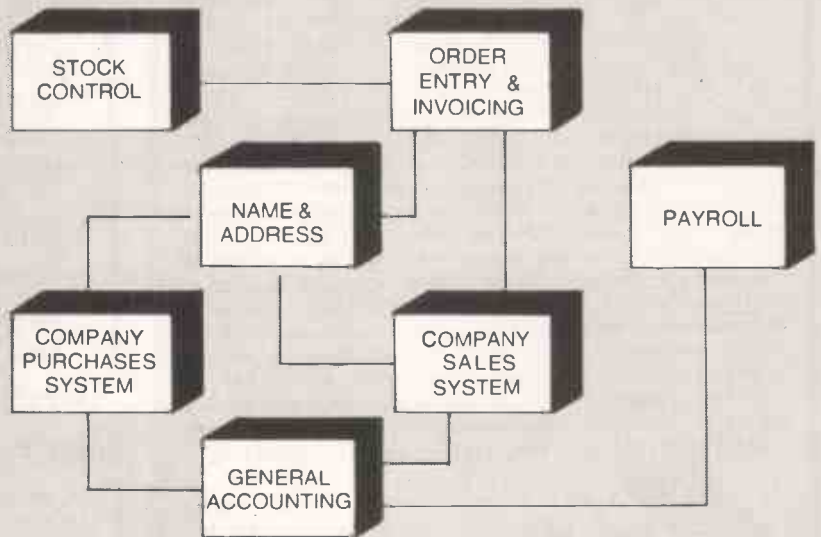
• Circle No. 326

INTEGRATED SMALL BUSINESS SOFTWARE

ISBS

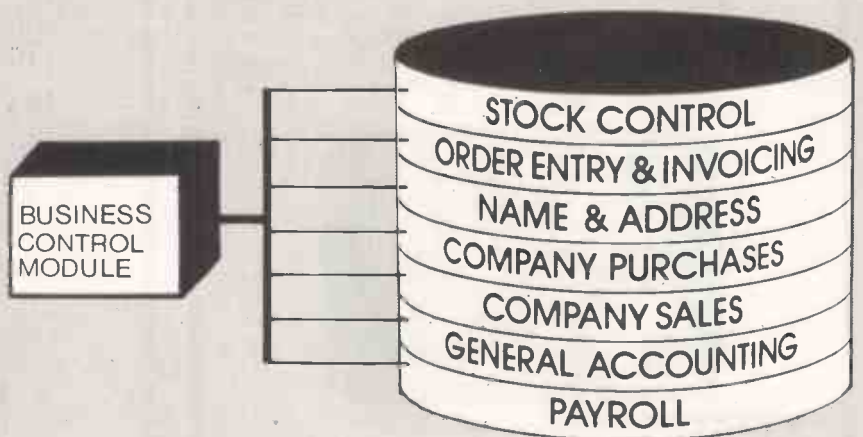
ISBS - F

A totally Integrated Small Business System designed for single user floppy disk based systems. ISBS-F is already being used by many Businesses and Professions throughout the UK. Each package can be used as standalone or can be built into an integrated system depending on user requirements. All packages are fully supported and maintained, and are supplied with easy to follow Reference Manuals. ISBS-F is easy to install and ideal for the first time small Business user with no previous computer experience.



ISBS - W

A Hard disk or Winchester disk based Integrated Business Software system which is upwards compatible with ISBS-F. This system is ideal for the small to medium size user where data storage and processing speed exceeds the capabilities of floppy disk based systems. Choose from any combination of modules and add others at a later stage if required. The system features many facilities found in minicomputer and mainframe business packages. All modules are fully supported and maintained and comprehensive documentation is supplied with each installation.



SYSTEM REQUIREMENTS

ISBS has been designed for most popular 8080/Z80 Microcomputer disk systems running under CP/M*

ISBS-F: 48k & 2 floppy disk system, VDU, 132 col printer, CP/M* 1.4 or 2.x

ISBS-W: 64k & Hard disk(s) system, VDU, 132 col printer CP/M* 2.x or MP/M*

Current installations on Rair Black Box, Northstar, Heath, Cromemco, Altos, Superbrain, IMS 5000/8000, Dynabyte, Micromation.

For further details and prices contact your nearest dealer or call us direct.

*CP/M, MP/M trademarks Digital Research.

GRAFFCOM
SYSTEMSGROUP

102 Portland Road, Holland Park, London W11 4LX Telephone: 01-727 5561



Software

Apple II is a trade mark of Apple Computers Inc.

NEW SUPERTEXT II

PROFESSIONAL WORD PROCESSOR

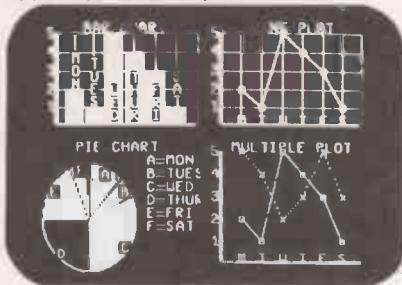
FEATURES

- Extremely fast editing
- Character-orientated, floating cursor edit with Add, Change, Math, Print and Preview modes.
- Single key cursor control
- Automatic word overflow
- Character, word and line Insertion/Deletion
- Forward and Backward scrolling
- Automatic on screen tabbing
- Auto paragraph indent
- Character word and line deletion
- Block copy, save and delete
- Advanced file handling
- Global (multi-file) search and replace
- Column decimal alignment and justification
- Automatic pagination
- printer tab controls
- Line Centering
- On-screen lower case with Data Shift Adaptor (Paymar also supported)
- Split-screen allows editing two portions of a file simultaneously
- Built in 15 digit floating point calculator performs on-screen calculations, column totals and verifies numeric data in statistical documents
- Maximum file size 20,049 characters.
- Automatic file linkage (Autolink) provides unlimited file size
- Preview a file exactly as it would print. The preview mode carries Autolink operations allowing inspection of large documents.
- Uses any printer which will interface with an apple computer
- Printing features include; underline, bold face, superscript, subscript. Complete software with full documentation and binder £145.00 plus VAT (requires 48k Apple II or Apple II plus).

NEW DATA-PLOT

GRAPH PROGRAM

Easy editing features allow you to create and modify a wide variety of full colour graphic representation. Bar charts, including additive bars, as well as single and multiple line charts may be plotted individually or cumulatively. Pie charts are easily sliced. All figures may be output to a graphics printer or saved as hi-res "pictures" for dramatic full colour recall as visual aids during presentations. Basic statistics are displayed automatically. (Requires 48k Apple II or Apple II plus) £56.00 plus VAT.



ADDRESS BOOK (Mailing List)

In our opinion, the BEST mailing list programme for Apple Stores 700 addresses per disk, select by record contents for viewing, label printing or may be used in conjunction with Super-Text II. £49.94 plus VAT (requires 48k Apple II or Apple II plus).

DATA SHIFT (Lower case Adaptor) £35.75 + VAT.

BARNSELY Wharnciffe Business Systems Tel: (0226) 86819 BRISTOL Dataforce (UK) Ltd Tel: (0272) 314496 (Main trade distributor) & Decimal Business Machines Tel: (0272) 214093 BIRMINGHAM Shield Business Systems Tel: (021) 359-7377 BLACKPOOL Coop & Naylor Ltd Tel: (0253) 23911 BOURNEMOUTH Logan Electronics Tel: (0425) 619761 CARDIFF David Potter Office Equipment Tel: (0222) 496785 & Sigma Systems Ltd Tel: 21515 & 34869 CHICHESTER Hugh O'Neill Computers (Selsey) Tel: 024361-4633/5856 ISLE OF SHEPPEY (KENT) Abbey Sales Tel: (0795) 873778 NORWICH Anglia Computer Centre Tel: (0603) 29652 SCOTLAND Dataforce Tel: Braemar 605 ST HELENS Pace Electronic Developments Tel: (0744) 21030 STOURPORT Data Design Tel: (02993) 6277 SWANSEA David Potter Office Equipment Tel: (0792) 462502 WEST BROMWICH H & H Business Systems Tel: (038) 483-2363 YEOVIL The Computer Room Tel: (0935) 20268

Supertext, Data-Plot and Address Book are trade marks.

In case of difficulty order direct from
C R Paym Ltd. Dept. P C 2
CLIFF ROAD
ASHTON GATE
BRISTOL
BS3 1RZ

• Circle No. 328

NEW LOW PRICES!

*FREE FLOPPY DISC

**FREE DATA DESK



CPS Data Systems is not just a hardware shop. Our name means what it says

Whilst we have a fine reputation for a wide range of computer hardware WE ALSO OFFER ALL THE SERVICES you would expect from one of the longest established companies in the microcomputer industry.

- Systems Analysis
- Programming
- Personnel Training
- Installation and Commissioning
- Total Engineering back-up

Ring us to find out more about any of these essential services.

Our hardware deals are:-

Commodore micros

at competitive prices e.g. 8032—for £820.00 + VAT
32K 4000 series CPU £555 + VAT

Qume Daisy Wheel Printers

For volume output of letter quality from £1,550 + VAT

New Olympia Scripta

Daisy Wheel Printer from £806 + VAT

Sanders Media 12/7

The unbelievable letter quality printer that can change type size and style as it prints—has to be seen to be believed.
From £2,390 + VAT

Ask about our special deals on demonstration equipment— at well below list prices.

* Before you buy! ring us and if we can't match or better the price you already have we will send you free a 5¼" mini floppy discette with our compliments
** *Free with all orders over £2,000.00



CPS (DATA SYSTEMS) LTD

Third Floor, Arden House,
1102 Warwick Road, Acocks Green,
Birmingham B27 6BH
Tel: 021-707 3866

A member of the CPS Group

• Circle No. 329



L&J COMPUTERS

192 HONEYPOT LANE, QUEENSBURY, MIDDX. HA7 1EE
THE "PET" SPECIALISTS



NOTE OUR NEW ADDRESS

THIS IS WHERE IT IS!

**ALTHOUGH WE HAVE MOVED
TO LARGER PREMISES,
WE ARE STILL GIVING
THE SAME PERSONAL SERVICE
THAT WAS OUR HALL MARK
AT KINGSBURY.**



**THIS INCLUDES FINDING OUT
WHAT YOU NEED BEFORE YOU BUY,
SO THAT YOU ARE ASSURED THAT
THE EQUIPMENT & SOFTWARE YOU PURCHASE FROM US FITS YOUR
REQUIREMENTS!**

AFFORDABLE CBM 'PET' PRICES!!

Available from stock:

4008 (8K)	£420*
4016 (16K)	£499*
4032 (32K)	£630*
8032 (32K SUPOPERPETS)	P.O.A.
EXT CASSETTE DECKS (inc. Counter)	£55

Printers	Disk Drives
CBM 4022	CBM 8050
Centronic 779	CBM 4040
Centronic 737	CBM 3040
Spinwriter 5510	COMPU/K 800K

**TRY US!
YOU WILL NOT BE
DISAPPOINTED**

Sundries	
Interfaces:	C12 Cassettes
Disks:	Library Cases
Paper (roll & tractor feed)	
Labels:	Dust covers

TOOL KITS (BASIC 2 & 4), SUPERCHIPS,
.....AND ALL SORTS OF OTHER CHIPS.....
UPGRADE YOUR PET EVEN MORE!!

THE "MUPETS" ARE HERE!
3 TO 8 PETS ONLY NEED 1 DISK DRIVE...
Daily demonstrations: Ring for details.



**COMPLETE SYSTEMS
FROM £1700!!**

**THE SYSTEMS WE SUPPLY & INSTALL ARE COMPLETE:
ESTIMATES GIVEN FREE WITH NO HIDDEN EXTRAS:
FULL BACK-UP: GUARANTEED EXPERTISE.**

* PRICES DO NOT INCLUDE VAT

PERSONAL SHOPPERS WELCOME
Phone & Mail Orders accepted.

SOFTWARE

As well as a full range of Petsoft and Commodore Software, we have some highly reliable "Home-Brewed" programs available.
STOCK CONTROL & INVOICING £60
(Handles up to 500 items — 32K) (180 on 16K). Stock depleted on invoicing, search etc. Cassette, disk (& print option).

CASH BOOK £90
Enter daily/weekly amounts — printout and totals, weekly/monthly analysis, totals and balances.

STOCK TAKING Cuts out all the hard work £230

OUTSIDE SERVICES (For Mini-Cabs Etc) £220

Sae for free software booklet

Specialists in: Commodore Business Programs
Bristol Trader, Item & Monitor
Superpay Word Processing.

**SPECIALISED SOFTWARE APPLICATIONS
UNDERTAKEN. RING FOR DETAILS**

2 FOR JUST OVER THE PRICE FOR 1!

We now have limited stock of NEW
CASSETTE DECKS, with built-in
COUNTER + SOUND BOX FOR PETS.
AT ONLY £65* EACH.

Orders dealt with in strict rotation

ALL GOODS SENT SAME DAY WHEREVER POSSIBLE
LARGE S.A.E. FOR LISTS ETC.



• Circle No. 330

Queues at Millbank!

for the



MILLBANK SYSTEM 10.

The integrated micro computer that more and more knowledgeable buyers are choosing. See it in action, along with our superb new British Accounting software, on Stand No. 19 at the 1981 Micro-Computer Show.

Our prices for Qume and Olivetti Daisywheel printers are incredibly competitive.

Call for details and your free Exhibition ticket.

MILLBANK COMPUTERS LIMITED · 98 LOWER RICHMOND ROAD
LONDON SW15 1LN · TELEPHONE: 01-788 1083

• Circle No. 331

EPROMS

LOWEST PRICE EVER
FROM LEADING
MANUFACTURER
BRAND SPANKING
NEW

2708	TRIPLE RAIL	£2.50
2716	SINGLE RAIL	£3.50
2532	SINGLE RAIL	£9.95
2732	SINGLE RAIL	£9.95

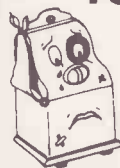


COMPLETE EPROM SERVICE
INCLUDING ERASING + PROGRAMMING,
ADDRESS CHANGES

YOU NAME IT WE'LL DO IT

DISCOUNT ON QUANTITIES POA
PLEASE ADD 60p P&P + VAT @ 15%

THIS COULD BE FUN (TECHNICAL SERVICES) LTD.



Amusement Machine Repair Specialists
307 New Kings Road,
London SW6 4RF.

Telephone: 01-736 5603

PLEASE QUOTE PC1

• Circle No. 332

THE NEW TRS 80 MODEL II

NOW AT **Johnson**
microcomputers

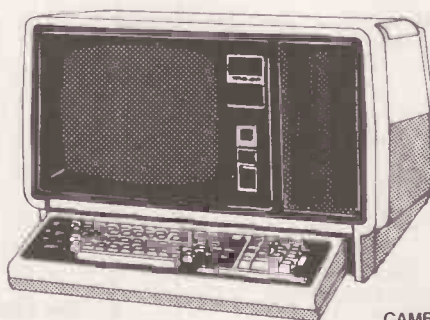
It takes over where the others stop

Speed, power and versatility - the TRS 80 is designed and built to grow with you!

- **DISK DRIVES FOR MODEL II**
Add-on Dual Drive (LOBO) providing 1MB capacity £900.00
- **SOFTWARE FOR MODEL II including:-**
C/PM - £99.00 Word Processor - £99.00
Fortran - £120.00 B.STAM - £89.00
Cobol - £120.00 Basic 80 - £99.00
Selector III - £99.00 Editor-Assembler - £90.00.
TRS80 Model I to Model II Conversion - £29.00
- **PRINTERS FOR MODEL II**
Anadex DP9500 fast dot matrix printer £895.00
Scripta daisy wheel printer (R/O) £837.00
- **And for TRS80 MODEL I users:-**
Shugart SA 400 Disk Drive (86K) £150.00
Micropolis Dual Disk Drive (360K) £399.00
One way / Two way / Four way
Disk Cables resp. £5/£10/£15
- **TRS80 POWER SUPPLIES -**
Much improved (with fuse) £9.00

Add-on Hard Disk Drive (Cameo) providing
5 MB fixed + 5 MB removable Cartridge
£1,990.00

- **TRS.80 MODEL II**
with full keyboard - 80 column
screen 64K RAM and 1/2 MB Disk Drive
(includes TRS DOS + Basic)



OUR PRICE ONLY

£1900

Johnson
microcomputers

A member of the T. V. Johnson Group

CAMBERLEY
Johnson House
75-79 Park Street
Camberley, Surrey
Camberley (0276) 20446

BRISTOL
48 Gloucester Road
Bristol BS7 8BH

OXFORD
148 Cowley Road
Oxford OX4 1JJ
Oxford (0865) 721461

PRICES EXCLUDE VAT AND DELIVERY

• Circle No. 333

LET'S PLAY GAMES!

WAR

Air Combat	22.00
Galactic Trader	13.95
Galactic Revolution	13.95
Galactic Empire	13.95
Flight Simulator (cass/disc)	20.00

ADVENTURE

Invasion Orion	14.00
Star Fleet Orion	14.00
Temple of Apshai	15.50
Apple Invaders	10.00
Morlocks Tower	12.00
Adventure	14.95
Asteroids in Space	12.50
Akalabeth	16.95
Hell Fire Warriors	15.50
Datestones of Ryn	13.00

SHOOTING

Wild West Gunfight	11.00
Battleship Commander	11.50
Bill Budge Space Album	20.95
Super Star Base Gunner	18.00
Star Cruiser	13.00
Bloody Murder	9.95
Hyper Space War	15.95
A.B.M.	16.00
Phantoms Five	16.00

OTHER

Monopoly	15.95
Olympic Decathlon	14.95
Apple Bowl	6.00
Tranquility Base	13.95
Puckman	16.00
Gammon Gambler	15.00
German Whist	15.00
Bridge Partner	14.00
Baseball	11.95
Soccer	15.00
Sargon Chess	18.00
Animation Pack	33.00
Extender Pack Versawriter	15.00
Mystery House	18.00

BUSINESS SOFTWARE

Visicalc	75.00
Information Master	73.95
Data Master	49.95
Integrated Ledgers	855.00
Wordstar	195.00
D.B. Master	109.95
Dakin 5 (utility 3.3)	79.00
Desk Top Plan	49.95
DMBS Database	49.95
Stock Systems from	100.00
Invoicer	140.00
Payroll	375.00
Apple Post	27.00

MISCELLANEOUS

Dos Tool Kit	42.00
Versawriter	124.95
Graphics Tablet	350.00
Joy Sticks	34.95

NEW

Apple Crates (wooden case to bridge apple & hold drives giving work top to support monitor)	30.00
---	-------

HARDWARE

Apple 16K	595.00
Disc Drives	265.00
Controller	75.00
12" G/B Monitor	145.00
Cable for monitor	9.00
9" B/W monitor	115.00

INTERFACE CARDS/ ACCESSORIES

Pascal Language	250.00
Integer Card	99.00
80 Col Card	165.00
Apple Juice	155.00
B/W Modulator	14.00
Music System	265.00
Apple Pilot	90.00

THIS MONTH'S SPECIALS

The Cashier Program	136.50
Clock Calendar Card	135.00
Graphics Tablet	350.00

MANUALS/ BOOKS

Apple II Ref Manual	11.00
6502 Hardware Manual	9.00
6502 Software Manual	9.00
Apple II Basic Program	6.00
Applesoft II Ref Manual	6.00
Dos 3.2 Manual	6.00
Pascal Reference Manual	8.50
Apple II Basic Tutorial	6.00
Autostart ROM Manual	4.50
Dos 3.3 Manual	4.80
The Book (Independent review of all available software/peripherals on Apple)	15.00

NOTICE

Due to the increased demand for our products we are now able to purchase direct from the manufacturers therefore offering much lower prices to our customers.

LEVEL 1 APPLE ACCREDITED SERVICE DEALER ONE YEAR'S FULL WARRANTY ON ALL APPLE EQUIPMENT

(ALL PRICES SUBJECT TO VAT, POSTAGE & PACKING. CREDIT CARD SALES SUBJECT TO 5% CHARGE OVER ADVERTISED PRICE)

Apple Accredited Level 1 Service Dealer
WE NOW OFFER ONE FULL YEARS WARRANTY ON ALL APPLE EQUIPMENT

Professional Data Systems.

CARNE HOUSE, MARKLAND HILL, CHORLEY NEW RD, BOLTON.

ALL PRICES CORRECT AT THE TIME OF GOING TO PRESS
(ALL PRICES SUBJECT TO VAT + POSTAGE & PACKING)



0204
493816



• Circle No. 334

CITY MICROSYSTEMS LTD

65, LONDON WALL, LONDON EC2
Telephone: 01-638 1312

We specialise in supplying top quality integrated accounting systems to smaller companies

Complete integrated accounting systems comprising : Computer matrix printer and software

from £2900 + VAT

Wordprocessors with letter quality daisy wheel printer

from £2900 + VAT

Programmes prepared for special applications.
Telephone or write to us to discuss your own requirements, without obligation.

DEMONSTRATIONS ANY TIME AT OUR PREMISES IN LONDON WALL

• Circle No. 335

Atom Explosion in Cambridge!

See the sensational Acorn Atom on demonstration at Cambridge Computer Store. Also the Acorn kit systems and the UK101 now at the reduced price of **£149 + VAT.**

We have low-power 2114 RAM at only **£4.38 + VAT** for 1K Byte and the stock in our Electronics Department includes a huge range of IC's and components.

Cambridge Computer Store

1 Emmanuel Street
Cambridge CB1 1NE
Phone (0223) 65334/5

• Circle No. 336

SOFTWARE FOR CP/M®

HIGH QUALITY SOFTWARE - WITH HIGH QUALITY SERVICE



NEW TELECOMMS PRODUCTS

★ ASCOM - General purpose communication, interactive and batch **£95**

★ TRANSFER - CP/M to CP/M including source code **£125**

WORDSTAR - Professional word processing software. On-screen formatting, wordwrap, pagination, line and character count on view. Micro-justification on daisy-wheel printer. Search and replace. Block/paragraph manipulation. External file read/write. Background printing during editing etc.	£250
MAIL-MERGE - Powerful Wordstar enhancement for file merging and document personalisation.	£65
DATASTAR Screen orientated system for Data Entry, Retrieval and Updating.	£175
SUPER SORT - Sort, merge and selection program.	£125
CONFIGURABLE BUSINESS SYSTEM (CBS) - Unique information management system with user definable files, powerful report generator, menu-driven for ease of use. No programming experience necessary!	£225
ACCOUNTING PACKAGES by Median - Tec: PAYROLL, SALES, PURCHASE, NOMINAL Specially developed by UK software house to exacting specifications. Written in Microsoft Basic each package may be customised by end user, all are widely used. Ledgers are open item. Payroll caters for weekly and monthly pay.	£500 each
PROJECT COST CONTROL/JOB ACCOUNTING - A comprehensive set of programs to monitor budgets, account for expenditure and project completion etc. Ideally suited for contractors. Written in CBASIC-2.	£150
STATISTICS PACKAGE - Over 25 routines including Regression & ANOVA	£100
MATHS PACKAGE - Over 40 easily used routines.	£100
IBM - CP/M COMPATIBILITY - Powerful utility to transfer data to/from IBM machines in standard disk format.	£110
MICROSOFT BASIC INTERPRETER	£155

MICROSOFT BASIC COMPILER	£195
MICROSOFT FORTRAN COMPILER	£270
MAGSAM - Versatile easy to use Keyed File Management System for Microsoft Basic or CBASIC.	£130
CIS - COBOL - ANSI' 74 implementation to full level 1 standard. Supports random, indexed and sequential files, features for conversational working, screen control, interactive debugging, program segmentation etc.	£425
FORMS 2 - Automatic COBOL code generator for screen formats.	£100
PASCAL-Z	£235
STRUCTURED BASIC - Relocatable compiler	£140
CBASIC-2 - Extended Disk Basic pseudo compiler and run-time interpreter.	£75
SELECTOR III - C2 - Information management system written in CBASIC-2 Maintains multi-key data base files and produces sorted formatted reports. Package includes simple application programs.	£185
SELECTOR IV - Upward compatible version of III with enhanced reporting.	£300
BSTAM - Telecomms facility for exchanging files between CP/M computers.	£75
ASCOM - Facility for communicating with other computers.	£95
MACRO 80 - Macro Assembler	£99
CP/M 2.2 - Standard Version 8" Single Density.	£99
Please contact us for availability of other products All orders must be PREPAID. Add £1 per item P & P (Minimum £1.50) and VAT CP/M is trade mark of Digital Research	



TELESYSTEMS LTD

P.O. Box 12, GREAT MISSENDEN, BUCKS, HP16 9DD
Telephone (02406) 5314



• Circle No. 337

NEW SUPERBOARD SERIES II

Ready built & Tested

New from OSI - Series II. Everything series I had but with more on a single board. Ideal for the beginner or experienced engineer alike. It needs only a 5V 3A power supply to be up and running. Fully expandable to a Floppy Disc and small business system.



ONLY £149
+ P&P £3.50 + VAT

- 625 lines jitter free Display.
- Memory Mapped Video Display with upper/lower case graphics and gaming characters.
- Software selectable Display 24 x 24 48 x 12
- Uses the ultra powerful 6502 Micro.
- 8K Microsoft Basic in Rom.
- Full feature Basic runs faster than currently available computers and all 8080 based business computers.
- 4K static Ram on board expandable to 8K.
- Full 53 Keyboard with upper/lower case and user programmability.
- Power on reset-standard.
- 2 second action break key.
- Kansas City standard Audio cassette interface for high reliability.

- 6 latch outputs available for control purposes.
- 8 bit Digital to Analogue converter.
- Full machine code monitor and I/O utilities in Rom.

Superboard II Series II £149.00 + VAT
Black ABS case £ 24.50 + VAT
Extra 4K Ram £ 12.00 + VAT
PSU 5A Ready Built £ 23.00 + VAT
Numeric Key Pad Kit £ 11.95 + VAT
610 Expansion Board with 8K fitted £150.00 + VAT
(expandable to 24K) £269.00 + VAT
WEMON £ 19.95 + VAT

Video swap tape FREE!

Series 2 User's Manual
The best single source of information £6.95, no VAT

SEIKOSHA GP80A

This Unihammer dot Matrix Printer gives Normal and Double Width Characters as well as Dot resolution Graphics.



- Printing Speed 30 cps
- Character Set 5 x 7 Matrix
- Print Density 12 CPI at 80 CPL
- Paper Feed 8" Tractor
- Parallel Interface Standard

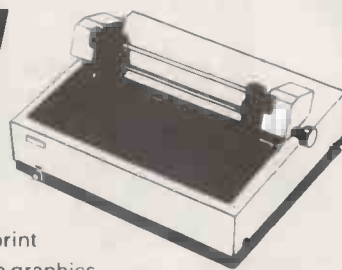
Other Interfaces
RS 232C £49 + VAT
IEE 488 or
Apple £35 + VAT
Pet £35 + VAT

£199
P & P £4.50 + VAT

500 Sheets of paper FREE!

EPSON TX80

A complete 80 column dot matrix printer, available in tractor or friction feed versions.



- Speed: 125cps.
- Unidirectional print
- PET compatible graphics.

500 Sheets of paper FREE! £235
Various Interfaces available from £35 P & P £4.50 + VAT

WEMON The Definitive Monitor

Look at these superb facilities:

- Full screen editing.
- Fully programmable cursor control with meaningful symbols on screen.
- Single key Basic
- Auto remote control of tape recorder (requires only a relay).
- Open line facility.
- Named tape files.
- Cursor indication of quotes mode.
- Auto list on error (displays faulty line upon carriage return).
- Single command save (automatically returns "list").
- Centronics compatible printer driver.

INCLUDING: Highspeed Cassette Save & Load

To order: Send £23.52 or phone your ACCESS number for same day despatch. State version required.

All this for only £19.95

+ 50p P&P + VAT.

Monitor functions include:

- Scrolling list in data mode.
- Warm restart vector.
- Fill memory.
- Search memory.
- Two save and three load routines.
- Floppy disc vector.
- Tabular display of memory.

SOFTY

The complete microprocessor development system for the Engineer and the beginner alike

- Displays memory contents on standard UHF TV.
- Can replace monitor Rom to test and develop programs.
- Ideal training aid.
- Two 8-bit I/O ports.
- Fast cassette interface.
- On-board Eprom programmer.
- Copies software.
- Simple modification for single rail.

Price: Kit.....£ 99.00 + VAT
Ready built.....£120.00 + VAT
PSU.....£ 20.00 + VAT
P & P.....£ 1.50 + VAT

FREE 2716 with each Softy

VIDEO GENIE

A Complete Computer System

- 16K User Ram
- 12 K Microsoft Basic in Rom.
- 64 x 16 line Display
- 128 x 48 dot graphics resolution.
- Software compatible with TRS80 level II.
- Built in Cassette Recorder.
- Output and Control for Second Cassette.
- Full expansion via Expansion box to Disc-Printer

£289 P & P £5 + VAT

COMPUTER IC'S	'D' CONNECTORS (Cannon type)		Covers plastic	DIL PLUGS (Headers)	DIL switches SPST
	Plugs	Sockets			
2114L-300n 160	9 way 90p	118p	—	14 pin 44p	4 way 10 way 85p 175p
2114L-200n 210	15 way 120p	167p	150p	24 pin 88p	6 way 98p SPDT
2532-2K £10	25 way 180p	280p	170p	40 pin 249p	8 way 4 way 115p 190p
2708 325	37 way 268p	390p	185p		
2716-450n £10					
2716-5V 330					
6115 150					
6602 675					
6520 325					
6522 670					
6522 795					
6548 1450					
6551 785					
6592 2572					
6800 490					
6802 595					
6810 280					
6821 315					
6840 750					
6850 315					
6852 390					
8080A 450					
8085A 1100					
81LS95 99					
81LS96 99					
81LS97 99					
8212 210					
8214 425					
8216 200					
8251 475					
8253 999					
8609 1550					
8726A 160					
8728A 160					
8795N 160					
8797N 150					
8797N 420					
AY-3-1015 420					
AY-5-1013 375					
AY-5-2376 750					
MC1488 90					
MC1489 90					
MC1441 950					
MC1442 £11					
MK4027-2 450					
RO-3-2513U 600					
SFF9636AE 950					
SFC71301 820					
TMS4627 250					
TMS5011 365					
280CPJ 2-5 600					
280ACPJ 4M 800					
280 P10 550					
280A P10 645					
280 CTC 550					
280A CTC 645					
280 DART £12					
280A DART £15					

DIL SOCKETS (TEXAS)	Low profile	Wire wrap
8 pin	10p	25p
14 pin	10p	35p
16 pin	10p	46p
18 pin	16p	52p
20 pin	22p	65p
22 pin	25p	70p
24 pin	30p	78p
28 pin	35p	85p
36 pin	—	105p
40 pin	40p	109p

JUMPER LEADS (Ribbon Cable Assemblies)	
Length	No. of pins
6"	14 16 24 40
6"	185p 205p 300p 465p
12"	195p 215p 315p 490p
36"	230p 250p 375p 595p

EDGE CONNECTORS (TEXAS) double type	1	156
2 x 10 way	—	82p
2 x 15 way	—	98p
2 x 18 way	140p	120p
2 x 22 way	150p	125p
2 x 25 way	165p	160p
2 x 30 way	185p	—
2 x 36 way	197p	—
2 x 40 way	205p	—
2 x 43 way	250p	—

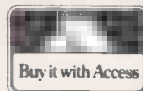
SPECIAL OFFER	
1+	50+
2114 - 450n	150p 128p
2114L - 300n	165p 135p
2114L - 200n	215p 185p
2532	£10 88
2708	350p 295p
2716	350p 295p
4027	250p 215p
4116	150p 110p

ACCESSORIES

TEX Eprom Eraser	£33	8" Fan-Fold Paper	
6Mhz Modulators	£2.80	500 sheets	£5.95
8Mhz Modulators	£4.50	9 1/2" Fan-Fold Paper	
STAKPAK 10 Cassettes	£5.50	500 sheets	£5.95
ASCII Keyboard	75p £40	TELEPRINTER ROLL	£3.00
		9" B & W Monitor	£65.00

ALL PRICES EXCLUSIVE OF VAT & CARRIAGE

The above is just a selection of our vast stocks of brand new, full spec, electronic components. To Order: Please add 15% VAT to all orders unless stated. On orders of less than £10 add 40p P&P. Terms of Business: Cash/Cheque/P.O.'s or Bankers Draft with order.



Access Orders: Minimum £10 please.

Government, Education Authorities & Trade Welcome.

JUST PHONE IN YOUR ORDER WE DO THE REST.

33/35 CARDIFF ROAD, WATFORD, HERTS. Telephone 40588

WATFORD ELECTRONICS

A MAJOR COMPUTER BREAKTHROUGH... ...WITH A MINOR COMPUTER PRICE-TAG

Things develop fast in computers – but so do prices! So who could have dreamt of a high-performance multi-user multiprocessor system for under £10,000?

Yet the Jarogate Z2-HMP is just that.

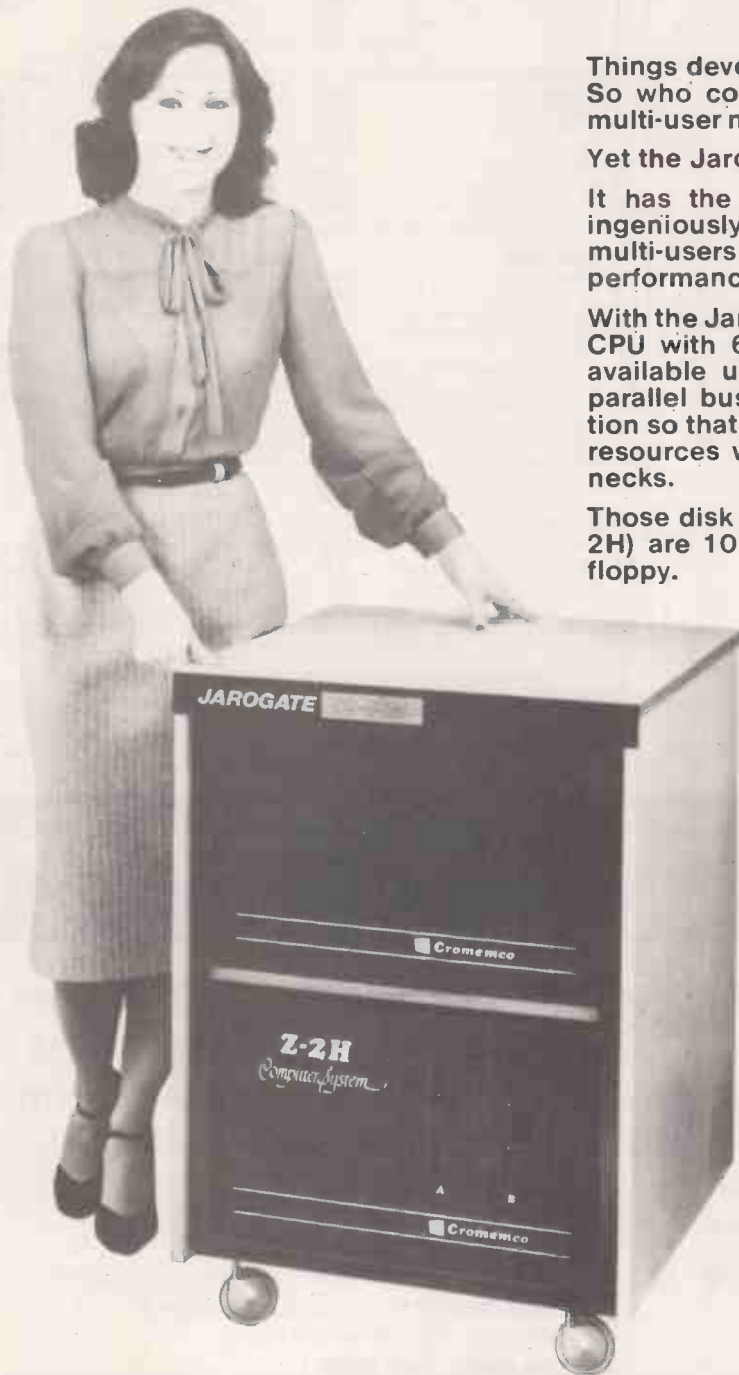
It has the multi-user cost-sharing advantage, yet ingeniously solves the big problem that has bugged multi-users until now . . . the serious degradation of performance caused by a shared CPU.

With the Jarogate Z2-HMP, each user has his own full CPU with 64k/bytes of RAM (CP/NET plus 60k of available user memory). And there's a high-speed parallel bus giving fast interprocessor communication so that users can have access to the central disk resources without the usual communication bottlenecks.

Those disk resources (the well-proven Cromemco Z-2H) are 10M/bytes of hard disk and 720k/bytes of floppy.

If you think all this is remarkable for under £10,000, look at some other specifications:

- Uses industry-standard MP/M and CP/NET
- Four users as standard – expandable to seven
- Features standard Cromemco hardware, including the well-proven Z-2H
- One 21-slot motherboard and power supply
- Existing CP/M programmes can be transferred direct
- Printer interface
- Complete system in attractive mobile furniture



Price: Complete Jarogate Z2-HMP, £9,995 (plus VAT)

For existing Cromemco Z-2H users, an upgrade package of hardware and software is available for £4,995 (plus VAT).

Illustrated data sheet available – just phone or write for a copy.

JAROGATE

JAROGATE LIMITED
MICROPROCESSOR CONSULTANTS

67 Tulsemere Road, West Norwood, London SE27 9EH
Telephone: 01-670 3674

• Circle No. 342

New!

EPROM ERASER - £40



- THIS IS OUR NEW 'EPROMPT GT' MODEL EPROM CHIP ERASER.
- A SAFETY-INTERLOCK SWITCH AND TESTED LIGHT-PROOFING ENSURE LOW RISK OF ACCIDENTAL EXPOSURE TO DIRECT UV.
- IT RUNS COOL AT THE EXACT WAVELENGTH FOR ALL EPROMS.
- IT WILL ERASE UP TO 32 EPROM CHIPS IN 30 MINUTES.
- IT OPERATES ON 200-250V A.C. LINE AT ABOUT 20 WATTS
- ★ AND IT COSTS ONLY £49 INCLUDING SHIPPING AND VAT.



New!

**ERASE TIMER
£15**

- THIS IS OUR NEW 'TEXTIME' SOLID-STATE POWER-DOWN TIMER.
- IT CAN TIME-OUT POWER TO MOST TYPES OF EPROM ERASER.
- IT RUNS ON 200-250V A.C. AND INCLUDES A 1/2 AMP FUSE.
- IT HAS TWO PUSHBUTTONS AND AN AMBER TIMING LIGHT.
- THE GREEN BUTTON TURNS IT ON TO POWER-UP THE LOAD;
- IT POWERS ITSELF DOWN ABOUT 30 MINUTES LATER; OR YOU CAN PUSH THE RED BUTTON TO TURN IT OFF SOONER.
- IT IS LIGHTWEIGHT, COMPACT, SAFE AND TOTALLY RELIABLE
- ★ AND IT COSTS ONLY £19 INCLUDING SHIPPING AND VAT.
- 'TEXTIME' ALSO SUITS ANY A.C. LOAD TO 100 WATTS AND CAN INCLUDE ANY FIXED OR VARIABLE TIMING TO ORDER.

★ SPECIAL OFFER: 'EPROMPT GT' + 'TEXTIME' £66 INCLUSIVE.

We are the manufacturers and you can buy direct from us. Mail-order prices: Eraser £49. Timer £19 all inclusive. Terms C.W.O. or C.O.D. (add £1) or trade references please. Educational & Public Authorities obtain immediate credit.

All orders and enquiries post-free to: -

TEX MICROSYSTEMS LTD. FREEPOST
ST. ALBANS, HERTS. AL1 1BR ST. ALBANS 64077/TRING 4797 ANYTIME

• Circle No. 343

TRS-80 in Surrey

SOFTWARE-BUSINESS-TANDY

General Ledger	69.95	Inventory Control	69.95
Visicalc	59.95	Scriptit Word Process.	69.95
Tandymail	85.95	Payroll Mod. 11	429.00
Sales Ledger Mod. 11	429.00	Inventory Control Mod. 11	129.95
Cassette Mailing List	19.50	Budget Management Cass.	19.95
In Memory Program Cass.	16.95		

***** PLUS A. J. HARDING SOFTWARE *****

SOFTWARE-GAMES-TANDY

Pyramid Adventure	9.95
Casino Games Pack	14.95
Invasion Force	11.95
Microchess	11.95
Micro Marquee	3.29
Level 1 Games Pack	14.95
Coreplan Business Game	39.95

SOFTWARE-UTILITIES-TANDY

Editor Assembler	24.95
T. Bug	11.95
Newdos Plus	56.35
Renumbr	5.95
Basic Course 1	8.95
Basic Course 2	11.95
Disk Basic Course	15.95

***** PLUS A. J. HARDING SOFTWARE *****

PRINTERS

Microline 80	399.00
Centronics P1	199.00
Printer Interface Cable-use a Printer without an expansion Interface	39.95
Tandy Lineprinter VI 132 Col. Bidirectional	599.00
— PRINTER PAPER IN STOCK —	
TRS-80 System Desk	119.00
Dust Covers Mod. 1	5.95
Blank Discs	2.99
C 20 Tapes each	1.49
10 for.	13.40

HARDWARE

Pocket Computer 1.9K RAM	119.00
Cassette Interface	17.95
Cassette Recorder	49.95
*Model III now in stock	£499
4K Ram Level I	£699
16K Ram Level II	
32K Ram Dual Double Density Disk Drive	£1,699
*Part exchange your old computer for new Model III	
*ZX80 & ZX81 Software and Book now in stock.	

BOOKS

Level 2 Programming	5.95	TRS-80 Graphics	2.99
TRS-80 Assembly Language	2.29	How to Program the Z80	6.99
84 Basic Computer Games	3.99	Basic Cookbook	1.59

***** ALL PRICES INCLUDE VAT WHERE APPLICABLE *****

SURREY MICRO SYSTEMS LTD

53 WOODCOTE ROAD, WALLINGTON, SURREY TEL: 01-647 5636

Access and Barclaycard Holders may 'phone their orders — Post and Packing extra — add 5% to order value. Send s.a.e. for full software

• Circle No. 344

MICRO FACILITIES

WORD PROCESSING SYSTEMS So much more for the same price

WE . . . like some of our competitors . . . supply the best Word Processing hardware

WE . . . like some of our competitors . . . supply the best Word Processing software

BUT WE. . . unlike our competitors . . . give a Full One Year's Warranty with ON-SITE Maintenance included in our price (within London & 25 miles radius)

WE know that you will need discs and paper — included in our price

WE understand that you may require training — included in our price

If required, we are happy to arrange both **Leasing** and **Financing** AND above all, we will be available for **Genuine After Sales Service** whenever you may need it.

AND when you have finished your Word Processing, we will be pleased to show you our range of database and accounting software. **AGAIN ONLY THE BEST!**

North Star

- North Star Horizon computer, 48Kb memory with Quad discs giving 720Kb storage.
- T.V.I.912C Visual Display Unit.
- Qume Sprint 5R0 daisy-wheel printer. 45 c.p.s.
- WordStar Word processing program
- all cables, plugs, discs and paper. **£4895.00** excl. VAT

Commodore

- CBM8032 computer with 80 column screen and typewriter keyboard.
- CBM8050 disc unit with 950Kb storage.
- CBM8026 daisy-wheel printer and keyboard. 16 c.p.s.
- Wordcraft 80 or WordPro 4 Wordprocessing program
- all cables, plugs, discs and paper. **£2995.00** exl. VAT

Micro-Facilities Ltd 129 High Street Hampton Hill Middlesex TW12 1NJ 01-979 4546 & 01-941 1197

• Circle No. 345

TTLs by TEXAS		74LS161		4002		20p		PERIPHERALS		MEMORIES		INTERFACE ICs		MISCELLANEOUS	
7400	11p	74173	90p	74151	75p	4002	20p	4560	180p	3242	800p	AD561J	1400p	6MHz UHF Mod.	350p
7401	12p	74174	75p	74152	90p	4006	70p	4569	180p	3245	450p	AD7524	600p	8MHz UHF Mod.	450p
7402	12p	74176	75p	74153	75p	4007	20p	4572	30p	6522	600p	DAC1408-B	200p	16 Key Pad	450p
7403	12p	74177	90p	74154	70p	4008	70p	4583	100p	6532	800p	DM8131	375p	SIN00 Busboard	1500p
7404	14p	74178	100p	74155	100p	4009	40p	4584	50p	6820	375p	DP8304	450p	DIN41612 Plug	450p
7405	18p	74180	80p	74156	120p	4010	40p	4585	100p	6821	180p	DS8835	250p	DIN41612 Socket	450p
7406	30p	74181	160p	74157	110p	4011	16p	4724	150p	6850	180p	DS8836	150p	43 way Edge Con	250p
7407	30p	74182	90p	74158	100p	4012	25p	40097	90p	6852	370p	DS8838	225p	31 way Plug 0.1"	120p
7408	16p	74184A	120p	74159	70p	4013	35p	14411	700p	8155	800p	MC1488	75p	31 way SKI 0.1"	120p
7409	16p	74185	120p	74160	200p	4014	75p	14412	900p	8205	320p	MC1489	75p	Logic Probe LP1	£31
7410	15p	74186	500p	74161	75p	4015	70p	14433	1100p	8212	175p	MC3446	325p	Logic Probe LP2	£18
7411	20p	74187	325p	74162	75p	4017	50p	14599	290p	8216	200p	MC3480	800p	Logic Probe LP3	£49
7412	20p	74188	75p	74163	75p	4018	70p			8224	250p	MC3487	300p	Zero Insertion Force Socket	24 pin £7
7413	25p	74189	75p	74164	75p	4019	45p			8226	250p	MMS8174	1200p	DIL Switches	
7414	35p	74190	75p	74165	75p	4020	65p			8228	250p	75107	160p	4 way SPST	90p
74C14	90p	74191	90p	74166	90p	4021	75p			8251	400p	75110	160p	6 way SPST	105p
7416	27p	74192	90p	74167	90p	4022	75p			8253	800p	75154	175p	8 way SPST	120p
7417	27p	74193	75p	74168	90p	4023	20p			8255	400p	75182	230p		
7421	17p	74194	75p	74169	120p	4024	40p			8257	800p	75324	375p		
7422	30p	74195	90p	74170	120p	4025	20p			8259	800p	75361	150p		
7423	22p	74196	90p	74171	120p	4026	130p			8279	950p	75363	400p		
7425	25p	74197	80p	74172	120p	4027	40p			Z80-CTC	550p	75365	150p		
7426	30p	74198	120p	74173	120p	4028	60p			Z80A-CTC	600p	75451/2	72p		
7427	30p	74199	120p	74174	120p	4029	40p			Z80-P10	550p	75491/2	70p		
7428	25p	74200	200p	74175	120p	4030	40p			Z80DART	£12	8T26	160p		
7430	30p	74201	110p	74176	120p	4031	170p			Z80ADART	£15	8T28	160p		
7432	17p	74202	140p	74177	120p	4034	200p			Z80ADMA	£12	8T95	160p		
7433	30p	74203	250p	74178	120p	4035	110p			Z80A-P10	600p	8T97	160p		
7437	30p	74204	100p	74179	120p	4036	295p			Z80A-510-1	2400p	81L59	120p		
7438	30p	74205	100p	74180	120p	4039	295p					81L596	140p		
7440	30p	74206	100p	74181	120p	4040	60p					81L597	120p		
7441	17p	74207	100p	74182	120p	4041	80p					81L598	140p		
7442A	70p	74208	100p	74183	120p	4042	65p					9601	110p		
7443	50p	74209	60p	74184	120p	4043	75p					9602	220p		
7444	112p	74210	60p	74185	120p	4044	70p					TMS9914	£25		
7445	112p	74211	60p	74186	120p	4046	80p								
7446A	80p	74212	100p	74187	120p	4047	75p								
7447A	93p	74213	120p	74188	120p	4048	55p								
7448	60p	74214	150p	74189	120p	4049	30p								
7450	80p	74215	14p	74190	120p	4050	65p								
7451	17p	74216	14p	74191	120p	4051	80p								
7453	17p	74217	18p	74192	120p	4052	80p								
7454	17p	74218	16p	74193	120p	4053	65p								
7460	17p	74219	20p	74194	120p	4054	130p								
7470	17p	74220	20p	74195	120p	4055	125p								
7472	36p	74221	20p	74196	120p	4056	120p								
7473	30p	74222	20p	74197	120p	4059	500p								
7474	32p	74223	20p	74198	120p	4060	90p								
7475	30p	74224	20p	74199	120p	4063	100p								
7476	38p	74225	20p	74200	120p	4066	35p								
7480	32p	74226	20p	74201	120p	4067	400p								
7481	50p	74227	50p	74202	120p	4068	15p								
7482	100p	74228	50p	74203	120p	4069	20p								
7483a	84p	74229	27p	74204	120p	4070	30p								
7484	60p	74230	27p	74205	120p	4071	25p								
7485	100p	74231	38p	74206	120p	4072	25p								
7486	110p	74232	38p	74207	120p	4073	25p								
7489	30p	74233	20p	74208	120p	4075	25p								
7490A	210p	74234	27p	74209	120p	4076	25p								
7491	30p	74235	27p	74210	120p	4081	22p								
7492A	30p	74236	30p	74211	120p	4082	22p								
7493A	40p	74237	30p	74212	120p	4086	72p								
7494	30p	74238	25p	74213	120p	4089	150p								
7495A	84p	74239	25p	74214	120p	4093	45p								
7496	60p	74240	20p	74215	120p	4094	200p								
7497	5p	74241	60p	74216	120p	4095	95p								
74100	180p	74242	30p	74217	120p	4096	95p								
74107	100p	74243	30p	74218	120p	4097	340p								
74109	34p	74244	27p	74219	120p	4098	90p								
74116	40p	74245	36p	74220	120p	4099	120p								
74118	100p	74246	36p	74221	120p	4098	90p								
74119	100p	74247	70p	74222	120p	4100	220p								
74120	100p	74248	70p	74223	120p	4101	132p								
74121	110p	74249	80p	74224	120p	4102	180p								
74122	34p	74250	36p	74225	120p	4103	180p								
74123	48p	74251	40p	74226	120p	4104	99p								
74125	60p	74252	50p	74227	120p	4105	120p								
74126	60p	74253	50p	74228	120p	4106	50p								
74128	60p	74254	60p	74229	120p	4107	60p								
74132	60p	74255	110p	74230	120p	4108	470p								
74136	60p	74256	45p	74231	120p	4109	100p								
74141	50p	74257	60p	74232	120p	4110	300p								
74142	200p	74258	40p	74233	120p	4114	250p								
74145	90p	74259	45p	74234	120p	4502	70p								
74147	120p	74260	45p	74235	120p	4503	50p								
74148	100p	74261	70p	74236	120p	4507	45p								
74150	120p	74262	60p	74237	120p	4508	200p								
74151A	50p	74263	180p	74238	120p	4510	70p								
74153	50p	74264	50p	74239	120p	4511	80p								
74154	90p	74265	50p	74240	120p	4512	80p								
74155	60p	74266	60p	74241	120p	4514	200p								
74156	60p	74267	30p	74242	120p	4515	200p								
74157	50p	74268	45p	74243	120p	4516	75p								
74159	120p	74269	55p	74244	120p	4518	70p								
74160	70p	74270	55p	74245	120p	4520	80p								
74161	70p	74271	120p	74246	120p	4521	210p								
74162	70p	74272	160p	74247	120p	4526	90p								
74163	70p	74273	140p	74248	120p	4527	150p								
74164	90p	74274	70p	74249	120p	4528	80p								
74165	90p	74275	60p	74250	120p	4532	110p								
74166	90p	74276	20												

IEEE-488 PET INTERFACES

B 300	Bi-directional RS232C serial	£186
Type C	Uni-directional RS232C serial	£120
AP	Addressable parallel for Centronics or Anadex printers	£106
GPI AP	Micro based bi-directional serial interface with buffering Custom GPI software development for special interfacing requirements	£275

- All serial interfaces incorporate:
- Software or switched Baud rate selection with 16 different rates selectable
 - Crystal controlled Baud rate
 - Full RS232C handshake
 - 20 mA current loop I.O. option.

All the above interfaces have two modes of code conversion to match print out to the PET screen for either display mode.

Non Addressable parallel	£45
TV/Video interface	£46

We also stock a range of PET connectors



**PET SOFTWARE
Intercomm . . .**

General-purpose Asynchronous communications package . . .

- Emulates a wide range of terminals
- Sends and receives program & data files
- Permits communication with mainframes, networks, other micros, other PETs

Wordcraft 80	£350
TCL Pascal	£375
	£120

S100 HARDWARE and SOFTWARE

P&T S100 IEEE controller board with CP/M, North Star or Custom Software
Measurement Systems high quality dynamic memory boards. £350

Low cost Micro-processor development aids

8048 programming card	£395
Prom simulator development board	£249
A range of cross assemblers for most popular micros	£85

PRINTERS...PRINTERS...PRINTERS

RP 1600 Daisy Wheel Printer
60 CPS PET, centronics, RS232 interfaces

New . . . RP 1600 with intelligent interface
Bi-directional printing with large buffer

Centronics 737 80 CPS proportionally spaced complete with non-addressable interface for PET or addressable interface	£395 £445
--	--------------

Full range of Hewlett Packard HP-85 and CBM PET Systems

As IEEE-488 interfacing specialists we can provide full technical support and advice on scientific, industrial and word processing application.

• Circle No. 347

Mailing Floppy Disks?

Use Swan Disk Mailers — and get Safety in the Mail

Now used by over 1,000 computer companies, Swan Disk Mailers provide outstanding postal security at economical prices.

Combining great strength with simplicity of use, Swan Disk Mailers are manufactured from rigid white corrugated, holding up to four disks.

There are two sizes available: 8.75" X 8.75" & 6" X 6"



ring
01 609 1746
for Free samples
and prices

• Circle No. 348

ZX81 owners

have you seen

The Cambridge Collection

A book of

30 PROGRAMS

For Only **£4.95**

NO MEMORY EXPANSION NEEDED

Each program has been designed to fit into 1K of RAM

TEACH YOURSELF PROGRAMMING

Comprehensive explanations of each listing will teach you many techniques of **ZX81** programming.

HOURS OF AMUSEMENT

With titles such as FORTRESS, BALLOON, and ODD MAN OUT, you could easily become a **ZX81** addict. Plus, entirely new implementations of well-known favourites; LUNAR LANDING, MASTER CODE, ORBITAL INVADERS, and many others.

CASSETTE AVAILABLE TOO!

If you order the book you can also buy the programs on a quality cassette for only **£4.95 extra.**

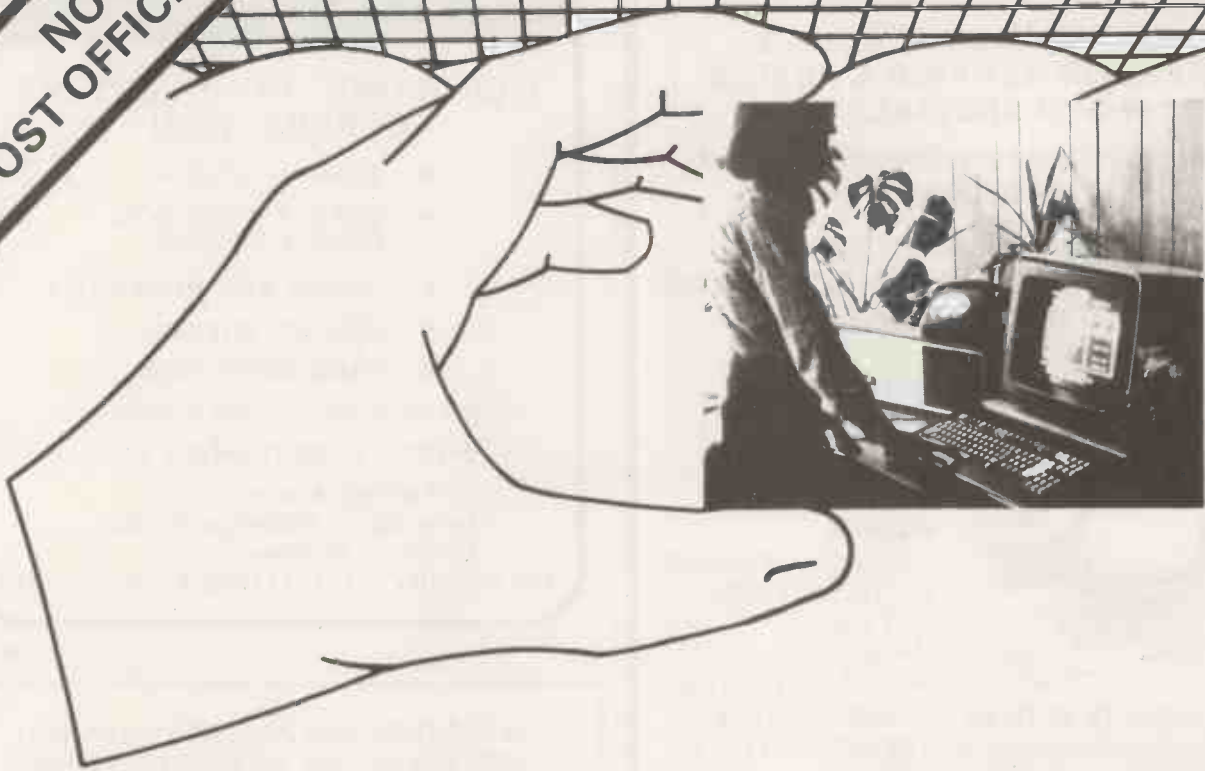
Please send me:

copies of the book at
£4.95 each
copies of the book and
cassette at **£9.90 pair**

Please send your orders with cheques/PO's to:
Richard Francis,
22 Foxhollow, Barhill,
Cambridge, CB3 8EP.

• Circle No. 349

**NOW WITH
POST OFFICE APPROVAL**



S100 COLOUR VIEWDATA DISPLAY CARD - UHF	£295
S100 COLOUR VIEWDATA DISPLAY CARD - RGB	£244
S100 PRESTEL AUTODIAL MODEM (2 CARDS)	£300
14" COLOUR VIEWDATA MONITOR (RGB)	£325
NORTH STAR VIEWDATA SYSTEM (ILLUSTRATED)	£2605

PRICES DO NOT INCLUDE VAT

**FULL RANGE OF VIEWDATA ITEMS SUPPLIED
CALL FOR DETAILS**

HI·TECH ELECTRONICS

54 HIGH ROAD, SWAYTHLING, SOUTHAMPTON SO2 2JF
TEL 0703 581555 TELEX NO.47388 HTEL

• Circle No. 350

BITS & P.C.S.

COMPUTER PRODUCTS LTD

The North's Leading Nascom Specialist

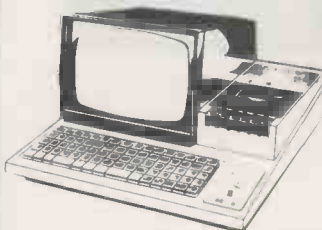
**FULL RANGE STOCKED
NASCOM SERVICE & ADVICE
OUR SPECIALITY**

See the Nascom Distributor ads
for full details

****NEW FOR NASCOM 1**
THE Mk11 BITS & P.C.S. GRAPHICS
SYSTEM GIVES NASCOM 2
GRAPHICS ON A NASCOM 1.**



**Quantum Micros HIGH
RESOLUTION
GRAPHICS FOR
MZ80K**



FULLY COMPATIBLE
WITH EXISTING
SOFTWARE/
HARDWARE
BUILT & TESTED UNIT.

COMPLETE WITH DEMO SOFTWARE &
EDITOR. RESOLUTION DOWN TO 1 DOT
LARGE SAE FOR FULL DETAILS

SHARP

WE STOCK THE FULL MZ80K RANGE
AT COMPETITIVE PRICES



Software for MZ80K £7.00 each

- GAMES (1)** Star Trek, Spacefighter, Stock car,
Labyrinth, Reverse, Test.
- GAMES (2)** Electric organ, Othello, Ambush,
Fox & hounds, Metric conversions,
Hangman, Shuffle.
- GAMES (3)** Ten pin, War, Swamp, Minefield,
Biorythm, Scramble.
- GAMES (4)** Paper stone, Jumping balls,
Bounce, Race, Calendar, Alarm
clock, One armed bandit.
- GAMES (5)** Poker, Stamp, Obstacle,
Battleships, Surround, Animal.

PC1211 POCKET COMPUTER £96.00 inc VAT
**PC1211 POCKET COMPUTER
PRINTER £88.00 inc VAT**
PC1211 CASS INTERFACE £16.95 inc VAT

BITS & P.C.s Computer Products Ltd.
4 Westgate, Wetherby, West Yorkshire.
LS22 4LL Tel: 0937 63744.

SAE for details: prices include VAT and postage and
package.



• Circle No. 351

MAINS POWER FROM BATTERIES



**OUR RANGE OF INVERTERS
OFFERS YOU!**

- 250VA to 1000VA.
- QUARTZ PRECISION
REMOTE CONTROL.
- POWER MOS RELIABILITY.
- HIGH EFFICIENCY.
- PRICE 250 VA. £480 + VAT.

For more information contact:-

BOOTH ELECTRONICS LTD.

NO7 Middle March,
Long March Industrial Estate,
Daventry, Northants.

Tel: Daventry (03272) 71360/1 Telex: 311103.

• Circle No. 352

**WHEREVER YOU ARE, WHOEVER YOU
ARE, IF YOU ARE SELLING OR BUYING
ANYTHING TO DO WITH COMPUTERS,
USED OR NEW,**

Don't delay,
COMPUTACOMPUTER on:

01-659 7997

Kellys Computer Market

If you are **BUYING**
IT'S FREE

We have the largest list of
NEW and USED equipment in
the country. Telephone for
immediate details of your
nearest supplier of USED or
NEW Computers, Software,
Electronic games, Interfacing,
Hardware, Service Contracts,
Consumables etc. etc., or just
advice.

If you are **SELLING**
Can you afford not to be on
our list?

We have **BUYERS WAITING**
for USED and NEW
Computers, Software,
Electronic games, Interfacing,
Hardware, Service Contracts,
Consumables, etc. etc. etc.

Pay for one month, then its
FREE. Or advertise weekly.

KELLYS COMPUTER MARKET
46, Kent House Lane, Beckenham, Kent.

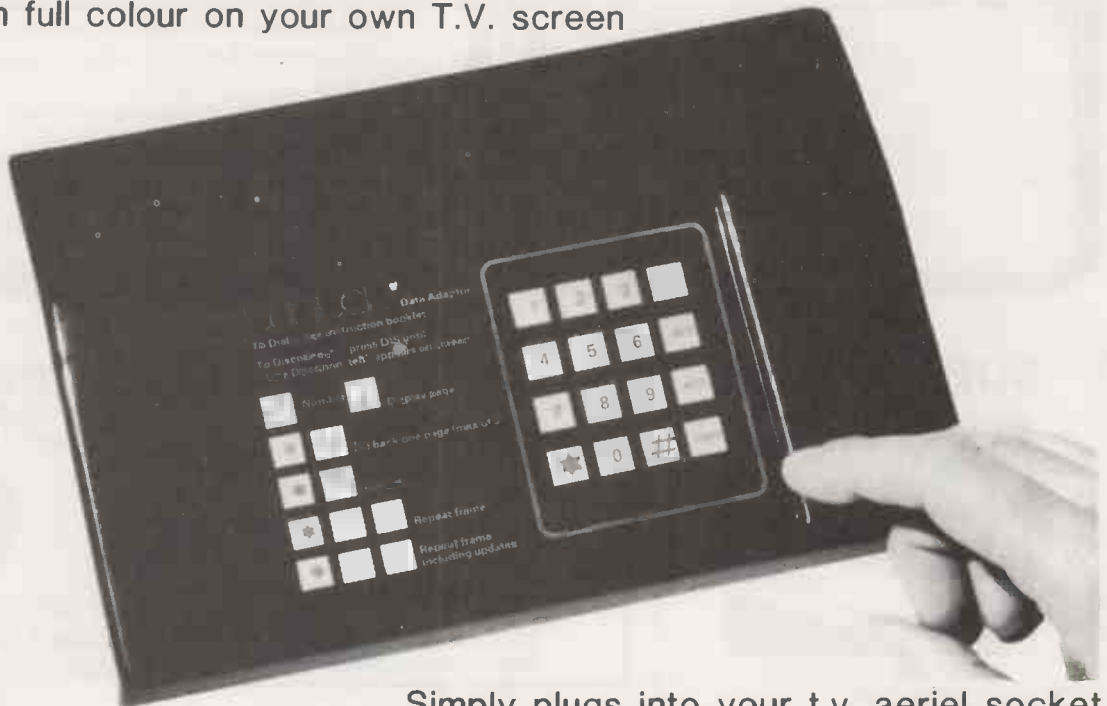
• Circle No. 353

PRESTEL.

POST OFFICE
APPROVED

THE BIGGEST BREAKTHROUGH IN COMMUNICATION SINCE THE TELEPHONE AND TELEVISION.

- 180,000 Pages of information instantly available
- Ask Prestel a question and up pops the answer in seconds in full colour on your own T.V. screen



EXPENSIVE?

Simply plugs into your t.v. aerial socket

Tantel requires a jack socket on your telephone line (available from the Post Office)

NOT ANY LONGER WITH

Tantel

BY TANGERINE

Only £170 + VAT

PC7/81

PLEASE SEND METANTEL ADAPTORS
 I ENCLOSE CHEQUE / P.O. TO THE VALUE OF
 OR DEBIT MY ACCESS/BARCLAYCARD No.

NAME

ADDRESS

.....

PAYABLE TO TANGERINE COMPUTER SYSTEMS LIMITED

FOR FURTHER INFORMATION PLEASE SEND A 12p STAMP TO :-
 TANDATA MARKETING
 FOREHILL WORKS
 ELY CAMBS CB7 4AE

• Circle No. 354



PET GRAPHICS SOFTWARE



FOR 8K TO 32K PETS EQUIPPED WITH
3022 OR 4022 PRINTER ONLY

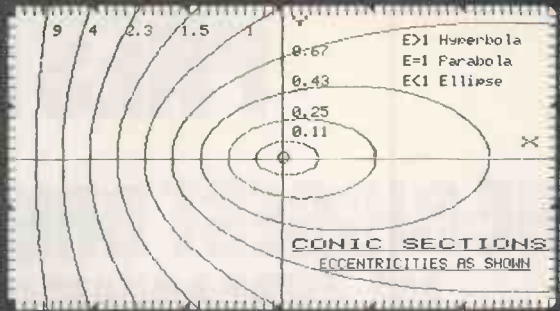
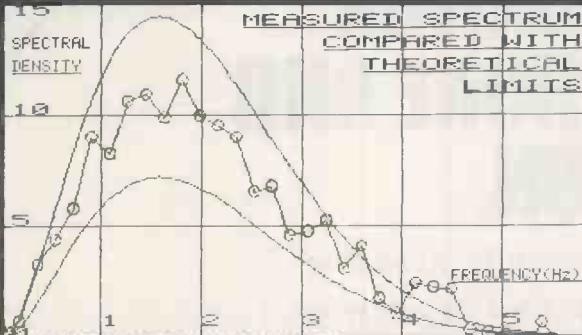
(No disk drive and No plotter required)

COMPUTACE Ltd.

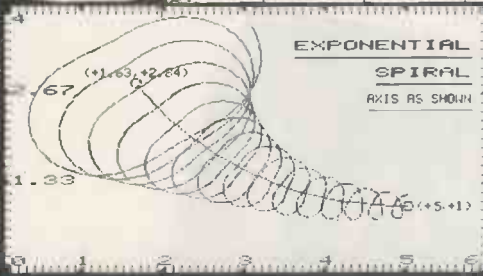
INFABCO HOUSE,
552/556 LONDON ROAD,
NORTH CHEAM, SUTTON, SURREY



NOW
AUTOGRAPH
is available for
8K PETS



Professional Quality, single Pixel accuracy graphs are printed on the standard Pet Tractor Feed Printer by the AUTOGRAPH programme: Simple to use, all Basic software Fully flexible graph dimensions and page position Plots multiple x,y functions on same axes. Automatic Scale Selection option Plain, Dotted or Squared graph background Comprehensive Alphanumeric labelling (as illus.) on and around graph enabling rapid, quality presentation. Send for brochure.



AUTOGRAPH is written and supported exclusively by COMPUTACE Ltd and is supplied with extensive

AUTOGRAPH I
(16K, 32K only)
AUTOGRAPH II
(16K, 32K only)
AUTOGRAPH 0
(8K upwards)

Plots graphs in continuous line (as illus) or in spaced dots. £35.50 incl. As Autograph I but includes multiple data point plotting with joining line and marking circle options (as centre graph) £39.50 incl. Simpler form of Autograph I but with the same plot quality £29.50 incl.

• Circle No. 356

SUPERBRAIN



Superbrains* at competitive prices.

350K, 700K & 1.54 models available now.

5 meg. integral Winchester to be released soon.

SUPERVID — adds lower descenders, reverse flashing underline display etc.

SUPERBIOS — adds real time clock & date X-ON/ X-OFF, ETX/ACK. Supports 5¼" & 8" drives, type ahead facility. From £100.



SPECIAL DEAL FOR SMALL BUSINESSES

350K Superbrain + Printer + Int. Sales/Purch/Nominal + Wordstar

from £3,000 + VAT

DAY 1 MAINTENANCE SOFTWARE SUPPORT

COBOL — 80 £375
FORTRAN — 80 £270
BASIC — 80 £215
WORDSTAR £250
DATASTAR £195
Int. Sales/Purch/ Nominal £1,650

(modules may be purchased separately)

Incomplete Records Solicitors' Accounts Etc.

'Bespoke' software to suit your particular needs.

PRINTERS

IBM GOLFBALL PRINTERS
From £395 + VAT



Reconditioned printers with keyboard parallel interface, RS232 & /EEE also available

Tec DAISYWHEEL printer with DIABLO mechanism which produces quality print at a dot matrix price. From £1085.

Oki range of reliable, quiet dot matrix printers. 80, 82 & 83

from £349

E.I.S. (Bristol) Ltd.
Electronic Information Systems
Frampton Cotterell
BRISTOL BS17 2HU
Tel: Winterbourne (0454) 774564

• Circle No. 357

NASBUS NEWS

COMPATIBLE

More great deals from 6 Nascom Dealers

A NASCOM-2 BASED SYSTEM FOR £1549 + VAT

The proven Nascom-2 microcomputer can now be bought as a complete system from £1549 + VAT. For this price you get the Nascom-2 kit, 16K RAM board kit, Kenilworth case with 2 card frame, Centronics 737 printer, 10 inch monitor, and the

Gemini Dual Drive Floppy Disk System. The CPU and RAM boards are also available built - the additional cost is available on application.



GEMINI G805 FLOPPY DISK SYSTEM FOR NASCOM-1 & 2

It's here at last. A floppy disk system and CP/M.

CP/M SYSTEM. The disk unit comes fully assembled complete with one or two 5¼" drives (FD250 double sided, single density) giving 160K per drive, controller card, power supply, interconnects from Nascom-1 or 2 to the FDC card and a second interconnect from the FDC card to two drives, CP/M 1.4 on diskette plus manual, a BIOS EPROM and new N2MD PROM. All in a stylish enclosure.

Nascom-2 Single drive system. **£450 + VAT**
 Nascom-2 Double drive system **£640 + VAT**
 Nascom-1 Single drive system. **£460 + VAT**
 Nascom-1 Double drive system **£650 + VAT**
 Additional FD250 drives **£205 + VAT**

D-DOS SYSTEM. The disk unit is also available without CP/M to enable existing Nas-Sys software to be used. Simple read, write routines are supplied in EPROM. The unit plugs straight into the Nascom PIO.

Single drive system **£395 + VAT**
 (please state which Nascom the unit is for)
 Certain parts of the CP/M and D-DOS disk systems are available in kit form.
 Details available on request.

KENILWORTH CASE FOR NASCOM-2

The Kenilworth case is a professional case designed specifically for the Nascom-2 and up to four additional 8" x 8" cards. It has hardwood side panels and a plastic coated steel base and cover. A fully cut back panel will accept a fan, UHF and video connectors and up to 8 D-type connectors. The basic case accepts the N2 board, PSU and keyboard. Optional support kits are available for 2 and 5 card expansion.

Kenilworth case **£49.50 + VAT**
 2-card support kit **£7.50 + VAT**
 5-card support kit **£19.50 + VAT**

GEMINI EPROM BOARD

This Nasbus compatible EPROM board accepts up to 16, 2716 or 2708 EPROMs. It has a separate socket for the MK36271 8K BASIC ROM for the benefit of Nascom-1 users. And for Nascom-2 users, a wait state for slower EPROMs. The board also supports the Nascom Page Mode Scheme.

EPROM Board (kit) **£55 + VAT**
 EPROM Board (built & tested) **£70 + VAT**

CASSETTE ENHANCING UNIT

The Castle interface is a built and tested add-on unit which lifts the Nascom-2 into the class of the fully professional computer. It mutes spurious output from cassette recorder switching, adds motor control facilities, automatically switches output between cassette and printer, simplifies 2400 baud cassette operating and provides true RS232 handshake.

Castle Interface Unit **£17.50 + VAT**

A-D CONVERTER

For really interesting and useful interactions with the 'outside world' the Milham analogue to digital converter is a must. This 8-bit converter is multiplexed between four channels - all software selectable. Sampling rate is 4KHz. Sensitivity is adjustable. Typical applications include temperature measurement, voice analysis, joystick tracking and voltage measurement. It is supplied built and tested with extensive software and easy connection to the Nascom PIO.

Milham A-D Converter (built and tested) **£49.50 + VAT**

PROGRAMMER'S AID

For Nascom ROM BASIC running under Nas-Sys. Supplied in 2 x 2708 EPROMs. Features include: auto line numbering; intelligent renumbering; program appending; line deletion; hexadecimal conversion; recompression of reserved words; auto repeat; and printer handshake routines. When ordering please state whether this is to be used with Nas-Sys 1 or 3. **Price £28 + VAT.**

DUAL MONITOR BOARD

A piggy-back board that allows N1 users to switch rapidly between two separate operating systems. **Price (kit) £6.50 + VAT.**

NASCOM-2 Microcomputer Kit **£225 + VAT**
 NASCOM-1 Microcomputer Kit **£125 + VAT**
 Built & tested **£140 + VAT**
 IMP Printer. Built & tested **£325 + VAT**

CENTRONICS 737 MICRO PRINTER

A high performance, low price, dot-matrix printer that runs at 80cps (proportional) and 50cps (monospaced). This new printer gives text processing quality print. And can print subscripts and superscripts. It has 3-way paper handling and parallel interface as standard. Serial interface is optional. **Price £425 + VAT.** Fanfold paper (2000 sheets) **£18 + VAT.**

GEMINI 'SUPERMUM'

12 x 8 piggy-back board for Nascom-1 offering five-slot motherboard, quality 5A power supply and reliable buffering with reset jump facility. **Kit Price £85 + VAT.**

BITS & PC's PCG

5 x 4 board which plugs straight into Nascom-2. Operates on cell structure of 128 dots, producing 64 different cells. Once defined, each cell may be placed anywhere, any number of times on screen simultaneously. Max screen capacity: 768 cells. Dot resolution: 384 x 256 = 98304. Many other features including intermixing of alpha-numeric characters and pixels. **Price (kit) £60 + VAT.**

GEMINI 64K RAM BOARD

Newly developed Nasbus compatible board that can accommodate up to 64K of RAM including Page Mode facility. **Kit Prices: £110 (16K), £130 (32K), £150 (48K), £170 (64K). Add VAT to all prices.**

All prices are correct at time of going to press and are effective 1st June 1981.

DISKPEN

The powerful text editor written for the Nascom is now available on a 5¼ inch floppy disk with a number of new features. **Price £43.25 + VAT.**

PORT PROBE

Allows monitoring of input and output of Nascom PIO. This board can generate interrupts and simulate handshake control. **Price (kit) £17.50 + VAT.**

HEX & CONTROL KEYPADS

Hexadecimal scratchpad keyboard kit for N1/2. **Price £34 + VAT.**
 As above but including (on the same board) a control keypad kit to add N2 control keys to N1. **Price £40.50 + VAT.**

BASIC PROGRAMMER'S AID

Supplied on tape for N1/2 running Nas-Sys and Nascom ROM BASIC. Features include auto line number, full cross-reference listing, delete lines, find, compacting command, plus a comprehensive line re-numbering facility. **Price £13 + VAT.**

GEMINI EPROM-PROG.

2708 (multi-rail) and 2716 (single-rail) EPROM programmer kit controlled by N1/2 PIO. Supplied with comprehensive software for use with Nas-Sys. **Kit Price £29.50 + VAT.**

WE STOCK
Nasbus
 COMPATIBLE
COMPUTER
PRODUCTS

All the products are available while stocks last from the Nascom dealers below. (Mail order enquirers should telephone for delivery dates and post and packing costs.) Access & Barclaycard welcome.

BITS & PC'S
 4 Westgate, Wetherby, W. Yorks.
 Tel: (0937) 63774.
BUSINESS & LEISURE
MICROCOMPUTERS
 16 The Square, Kenilworth, Warks.
 Tel: (0926) 512127.

ELECTROVALUE LTD.
 680 Bumage Lane, Bumage,
 Manchester M19 1NA.
 Tel: (061) 432 4945.
 28 St Judes, Englefield Green,
 Egham, Surrey TW20 OHB.
 Tel: (0784) 33603. Tlx: 2644 75.

TARGET ELECTRONICS
 16 Cherry Lane, Bristol BS1 3NG.
 Tel: (0272) 421196.
INTERFACE COMPONENTS LTD.
 Oakfield Corner, Sycamore Road,
 Amersham, Bucks.
 Tel: (02403) 22307. Tlx: 837788.

HENRY'S RADIO
 404 Edgware Road, London W2.
 Tel: (01) 402 6822.
 Tlx: 262284 (quote ref: 1400).



• Circle No. 358



**CRYSTAL ELECTRONICS
CC ELECTRONICS**

**THE SKY'S THE LIMIT
FOR YOUR SHARP MZ80K with
SHARP CP/M 2.21 (XTAL)**

CP/M is the trade mark of Digital Research.

**This sophisticated interactive program
development system will give your home computer
BUSINESS/INDUSTRIAL potential.**

Basic CP/M facilities include:

- Dynamic file management
- General purpose editor
- SHARP CP/M 2.21 (latest version) on disc
- XTAL Monitor and Operating system
- 7 Digital Research manuals
- CP/M Handbook (by RODNAY ZAKS)
- 12 months guarantee and up-dates

YOUR SHARP CP/M 2.21 (XTAL) PACKAGE INCLUDES
Hardware modification (if fitted by a SHARP dealer does NOT break the guarantee)

- Fast assembler
- Advanced debugging utility

**IF YOU ARE A SHARP MZ80K OWNER, CP/M 2.21 (XTAL)
IS A MUST FROM £200.00**

Ask your SHARP dealer for further details or contact
CRYSTAL ELECTRONICS

**CP/M SOFTWARE HOUSES—XTAL CAN HELP YOU
ESTABLISH YOUR SOFTWARE ON THE SHARP**

Members of Computer Retailers Association & Apple Dealers Association

Shop open 0930-1730 except Saturday & Sunday

40 Magdalene Road, Torquay, Devon, England. Tel: 0803 22699

Telex 42507 XTAL G

Access and Barclaycard welcome.



• Circle No. 359

**THE WESTFARTHING
SMALL BUSINESS SYSTEM**

for Apple/ITT2020 Sharp micros

Designed from first principles for the family business, it will pay for itself by keeping the accounts in good order, saving management time on paperwork, and accountants' fees.

FUNCTIONS: (in short, everything you need)

- Invoicing (+ discounts, quotations, delivery notes)
- Customer accounts and shop sales
- Bank and cash balances calculated weekly
- Sales and overheads (30 categories) totalled weekly
- VAT return calculated (while you have lunch)

SPECIAL FEATURES FOR OWNER - MANAGERS:

- VAT - inclusive bills split automatically
- Messages can be printed on invoices
- Automatic payment entry when customer pays on the spot
- Uses plain fanfold paper, prints your heading
- Prints s/a customer address labels
- User's manual (50 pages) in clear, non - technical style
- Designed to be user - modifiable

Requires 48K RAM, Applesoft in ROM, 1 or 2 disc drives, printer.
Program lives in core. Includes pages of program information, hundreds of REMS, disc map, etc.

Cost: £750 + VAT, includes setting-up assistance. User's manual £10.
New program available, CAR SALESMANS SYSTEM £450 + VAT.



**Westfarthing
Computer Services Ltd.**
21 Wendron St. Helston, Cornwall.
Tel: Helston [03265] 4098.

• Circle No. 360

**A DYNAMIC REVOLUTIONARY CONCEPT IN
APPLE WORD PROCESSING**

**PRICE £79.95 + V.A.T.
Postage & Packing Free**

**SOLE U.K.
DISTRIBUTOR**



Magic Window
word processing system

See your local dealer
or send cheques to

SBD SOFTWARE
15 JOCELYN ROAD
RICHMOND TW9 2TJ

Tel: 01-948 0461 Telex: 22861



Novice typists to professional secretaries and administrators are amazed at the ease and simplicity of **MAGIC WINDOW**.

MAGIC WINDOW is a Apple II word processing/text editing system that is designed to increase your office productivity — those time-consuming typing tasks can now be done quickly and efficiently.

The simplest and best-known word processing machine is the standard typewriter. We have retained the simple operating features of the typewriter while providing complete editing facilities.

MAGIC WINDOW is a word processing system that allows text to be entered, edited, printed, and saved on a diskette. **MAGIC WINDOW** is unique in the way it performs these functions.

Most systems separate the tasks of editing text and formatting for printing. This separation requires formatting commands to be placed in the text file. **MAGIC WINDOW** has no need for these commands because it formats the text as you enter it. What you see is truly what you get. There is no guesswork in laying out your document.

MAGIC WINDOW will instantly convert your Apple system into a word processor — no modifications or fancy gadgets to buy. Simply insert the **MAGIC WINDOW** diskette into your disk drive and experience word processing as never before.

MAGIC WINDOW allows you to type up to **EIGHTY CHARACTERS** per line!!! This allows you to see your letter, report, etc., exactly the way it will be printed. Inserting, deleting, centering, and justifying can be done on the screen without the need to print a work copy.

The real power and sophistication of a word processor is judged by how easy it is to use. **MAGIC WINDOW** is as easy to use as a standard typewriter, yet it has the **POWER** a PROFESSIONAL requires.



MAGIC WINDOW

LOOK INTO OUR MAGIC WINDOW AND EXPERIENCE A WONDERLAND IN WORD PROCESSING.

NO MATTER WHAT YOUR ABILITY, MAGIC WINDOW'S HUMAN ENGINEERING WILL GUIDE YOU FROM BEGINNING TYPING THROUGH PROFESSIONAL DOCUMENTS INSTANTLY AND EFFORTLESSLY.

• EDITING & FORMATTING

USING VERY SIMPLE KEY STROKES, **MAGIC WINDOW** WILL MANIPULATE PARAGRAPHS, MAKE ADDITIONS, DELETIONS AND CORRECTIONS. THE DAYS OF RETYPING ARE OVER.

• AFFORDABLE & EXPANDABLE

MAGIC WINDOW DOES NOT REQUIRE ANY MODIFICATION TO YOUR APPLE II COMPUTER. YOU CAN MODIFY **MAGIC WINDOW** TO USE ANY CUSTOM ADDITIONS YOU HAVE IN YOUR APPLE: LOWER CASE MODIFICATION, LANGUAGE CARDS, CUSTOM PRINTER INTERFACES ETC.

• HUMAN ENGINEERING

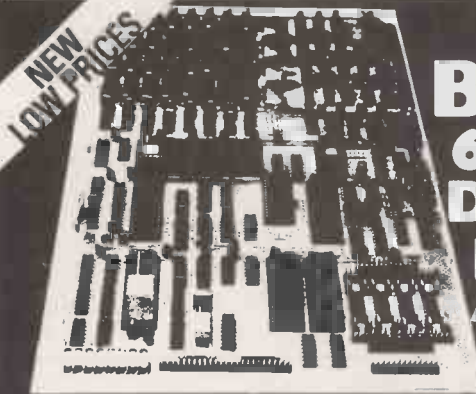
MAGIC WINDOW'S FOUR WAY SCROLLING ALLOWS YOU TO VIEW EIGHTY-COLUMNS ON YOUR FORTY-COLUMN SCREEN. MOST PAPER SIZES CAN BE SIMULATED. **MAGIC WINDOW** WILL SHOW ALL FOUR EDGES OF THE "PAPER" AS YOU TYPE. THIS SIMULATION OF A STANDARD TYPEWRITER HAS CAUSED A REVOLUTION IN APPLE II WORD PROCESSING.

MAGIC WINDOW WILL KEEP YOU SPELLBOUND WITH OUR SPELLBINDER — A WEBSTER'S WORD SPELLER/DIVIDER.

• Circle No. 361

**MICRO
BYTE**

We bring you the lowest prices-first!
Compare our prices before you buy elsewhere! All devices are brand new, factory prime, full spec. and fully guaranteed!



Introducing the incredible
BIGBOARD Single Board Computer
64K RAM! Z-80 CPU! FLOPPY DISK CONTROLLER! 24x80VDU! PFM 3.3 2K SYSTEM MONITOR! ALL THIS ON ONE BOARD COMPLETELY ASSEMBLED

£375 plus £5 p&p and VAT

NEW 6809 S-100 SINGLE BOARD COMPUTER
● Meets IEEE S-100 Standard!
● Uses Motorola's Powerful MC6809 CPU!
● 4K, 8K, 16K ROM!
● 2K RAM!
● ACIA, PIA, 8080 Simulated I/O!
Bareboard only £49! (plus £1 p&p), CPU (6809) £19.00! AD5MON; Monitor (2716) £25! COMPLETE BOARD ASSEMBLED AND TESTED, ONLY £250! (plus £2 p&p).

SALE

THE NEW GI COMPUTER SOUND CHIP

The amazing AY-3-8910 is a fantastically powerful sound and music generator, perfect for use with any 8-bit micro processor. Contains 3 tone channels, noise generator 3 channels of amplitude controls 16 bit envelope period control 2 parallel I/O. 3D/A converters plus much more. All in 40 pin DIP Super easy to interface to the S 100 or other Busses.

ONLY £8.50 + VAT, including FREE reprint of BYTE 79 article! Also, add £2.25 for 60 page data manual. "Perhaps the next famous composer will not direct a 150 piece orchestra but rather a trio of microcomputers controlling a bank of AY-3-8910s. BYTE July '79.

BARE P.C.B. + ROM £150 + £2 p&p + VAT

PLUS THESE OPTIONS ON THE BOARD £75 + VAT

Serial I/O Full 2 channels using the Z-80 S10 and the SMC 8116 Baud Rate Generator. You get FULL RS232. For synchronous or asynchronous communications, and clocks can be transmitted or received by a modem in the former. Both channels can be set up for either data communication or data terminals. Supports mode 2 Int.

Two Port Parallel I/O Uses Z-80 PIO to give full full 16 bits, fully buffered and bi-directional. User selectable hand-shake polarity.

Real Time Clock Uses Z-80 CTC and can be configured as a counter on Real Time Clock.

CP/M 2.2 The popular CP/M D.D.S. as modified by Micronix including Monitor Listing and Printer Routine £150.

Power Supply for BigBoard + Two Disk Drive £150 (£3 P&p)

Floppy disk Drives Siemens S/D S/S £275
YE 174 D/D/S £375
Full set of cables and connectors for BigBoard only £25.

SALE EXCITING, ENTERTAINING SOFTWARE FOR THE APPLE II and APPLE III! PLUS!! **ASTEROIDS IN SPACE!!!**

If you liked Invaders you'll love ASTEROIDS IN SPACE by Bruce Wallace! Your spaceship is travelling in the middle of a shower of asteroids. Blast the asteroids with lasers, but beware - BIG ASTEROIDS FRAGMENT INTO SMALL ASTEROIDS! The apple game paddles allow you to rotate your spaceship, fire its laser gun, and give it thrust to propel it through endless space. From time to time, too, you'll encounter an alien spaceship whose mission is to DESTROY YOU, so you'd better destroy it first! High resolution graphics and sound effects add to the arcade-like excitement this program generates. RUNS ON ANY APPLE II WITH AT LEAST 32K AND ONE DISK DRIVE!

ON DISK DRIVE ONLY £9.95 WHILE STOCKS LAST

NEW SENSATIONAL LOW PRICE ON 64K DYNAMIC RAMS ONLY £12.95

Minimum order: 8 pcs. P&P 50p & VAT (for Quantity 1-7, £14.95 + P & P + VAT)
Ex STOCK WHILE SUPPLY LASTS!
From HITACHI. HM4864-3 (65K x 1) 200NS, Single + 5V Supply, 16 pin. Complete with Data sheet and Cross reference list.

NEW LOW, LOW, PRICES ON MEMORIES!!!

Compare our prices before you buy elsewhere! All devices are brand new, factory prime, full spec. and fully guaranteed!
All prices exclude P&P and VAT. Please refer to Ordering Information before ordering.
DON'T DELAY - BUT TODAY - SUCH LOW PRICES DON'T LAST FOR EVERY!!

STATIC RAMS	1-24	25-99	100+	CMOS RAMS	1-24	25-99	100+
2114L 200 NS	1.60	1.45	1.30	TC5514P 4K			
Lower Power				(1K x 4) (same as 6514)			
4118 250 NS DYNAMIC RAMS	6.25	5.95	5.25	450NS (2K x 8)	3.25	2.95	2.60
4116 150NS	1-24	25-99	100+	200 NS	12.95	11.95	9.95
4116 Ceramic Package Gold Plated	2.50	2.25	1.95				
200 NS	1.40	1.25	1.15	EPROMS	1-24	25-99	100+
HM4864 64K (65K x 1)				2708 450 NS	2.95	2.75	2.50
Single 5V 200 NS	14.95	13.95	12.95	2716 5V 450 NS	2.95	2.75	2.50
				2532 5V 450 NS	8.95	8.50	8.25
				2732 450 NS	8.95	8.50	8.25

RIBBON CABLE AND CONNECTORS

All Bigboard Interfacing is by block headers and require flat ribbon cable (IDC) type header sockets. We stock all necessary types.

TYPE	WAYS	PRICE EACH	PRICE EACH - ASSEMBLED WITH 1 METRE CABLE
IDC Socket	10	1.25	2.95
	16	1.95	3.95
	26	2.95	4.95
	40	3.50	5.95
	50	4.50	7.50
	50	1.25	
P.C.B. Mounting Block Header	16	1.75	
	26	2.50	
	40	3.25	
	50	3.95	
IDC Edge Connector (for 8" Disk Drives)	50	4.95	7.95
		Price/Metre	
Ribbon Cable	26	1.49	
	40	2.30	
	50	2.90	

Microchips at micro prices!

INTERFACE LINEAR	SUPPORT DEVICES	Z80 S100	6504	£6.50
MC1488 70p	6521	£22.95	6505	£7.00
MC1489 70p	6522	£24.95	6800	£4.00
DM8123 125p	6532	£22.95	6802	£6.00
75150 125p	6551	£24.95	6809	£1.40
75154 125p	6810	£22.95	8080A	£4.00
75182 195p	6820	£24.95	8085A	£6.00
75322 250p	6821	£3.60		
75324 325p	6845	£1.95	AY-5-1013A 325p	£4.95
75325 325p	6850	£2.00	AY-3-1015D 398p	£5.95
75361 350p	6852	£3.25	IM6402IPL 325p	Z80A
75365 295p	8212	£1.50	CPU's	Z8001
75451 50p	8214	£4.25	6502	£5.00
75491/2 75p	8216	£1.60		
8126 140p	8224	£2.50		
8128 140p	8228	£3.95	EPROMs	
8195 140p	8251	£4.50	2708 450 NS	375p
8197 175p	8253	£7.95	2716 5V 450 NS	£2.95
KEYBOARD ENCODER	8255	£4.45	2532 32K 450 NS	£8.95
AY-5-2376 695p	8257	£7.95	2732 Intel-type 450 NS	£8.95
KR 3600 695p	8259	£7.95	2564 64K (8K x 8) 450 NS 28-pin NEW!	£77
GENERATOR	MC 144			
RO-3-2513	12V	£7.97		
UC	Z80 P10	£3.95		
DEVELOPMENT MODULE	Z80 CTC	£3.95		
Z8000 DM	Z80A P10	£4.95		
	Z80A CTC	£4.95		
	Z80 DMA	£10.95		
	Z80A DMA	£11.95		

Ordering information. Unless otherwise stated, for orders under £50 add 80p p&p. Add 18% VAT to total (no VAT on books). All devices are brand new, factory prime and full spec. and subject to prior sales and availability. Prices subject to change without notice. Minimum telephone order using ACCESS is £10. If ordering by post with ACCESS, include name, address and card no.

written clearly. Please allow 4/6 weeks delivery on books.

MICRO BYTE
Microbyte, Dept. PCB Unit 9/10, 1st Floor, E Block, 38 Mount Pleasant, London WC1X 0AP. Telephone: 01-278 7369 Telex: 896 3084

(MICRO DIVISION OF MAPLIN-ZANO ELECTRONICS LTD)

• Circle No. 362

microware

MEMOREX FLOPPY DISKS

WHOLESALE PRICES FOR END USERS

**MAIL
ORDER**

5¼" SINGLE SIDED	SINGLE DENSITY	£1.65
DOUBLE SIDED	DOUBLE DENSITY	£2.10
8" SINGLE SIDED	SINGLE DENSITY	£2.39
DOUBLE SIDED	DOUBLE DENSITY	£3.45

**LOW
LOW
PRICES**

COVER CRAFT PLASTIC COVERS SOLD IN BOXES OF 10

FOR: MICRO's
PRINTERS
V.D.U.s
FROM £6.95 - £9.95

We also stock Wheels and
Mutli-coloured ribbons
For: Qume, Diablo, N.E.C.

FLOPPY DISK SUBSYSTEMS

Double density single sided drives with power supply and enclosure	
Single 5.25" Drives	£175.00
Dual 5.25" Drives	£295.00
Single 8" Drives	£395.00
Dual 8" Drives	£695.00

INCREASE THE LIFE EXPECTANCY OF YOUR FLOPPY DISKS

INDEXING SYSTEMS	FLOPPY SAVER KITS	5¼" DISK STORAGE SYSTEMS	8" DISK STORAGE SYSTEMS
5¼" £1.50	5¼" Saver Kit £7.95	* Capacity: _____ 50 Disks	* Capacity: _____ 50 Disks
8" £5.95	Refill pack £4.95	* Colour: _____ Smoke/Sand	* Colour: _____ Seville/Black
For use with our Polymer Plastic Boxes	8" Saver Kit £8.95	* Construction: _____ Polymer	* Construction: _____ Polymer
	Refill Pack £5.95	Plastic/3 partitions *** £14.95 ***	Plastic/6 partitions * Carrying Handle * Lock and Key *** £24.95 ***

Terms: payment with order in favour of Microware (London) Ltd.
Please add 15% V.A.T. and 50p Postage.
Telephone and Mail Orders accepted. Tel: 01-346 8452

Microware (London) Ltd., 5 Western Court, Huntly Drive, London N3 1NX

• Circle No. 363

He gave you the fantastic best seller Arcade Invaders, but now Mike Chalk has excelled even that with another 'arcade' game —

U-BOAT STRIKE!

Again, it's a fast moving, all-action genuine arcade game, with you as the U-Boat captain sinking the enemy ships, by either single or volleys or torpedoes.

There are no less than 16 different types of ships travelling at various speeds and distances — and what is unique — in both directions!

The convoy is protected by destroyers which drop clusters of depth charges, modern ones, which home onto the last position from where you fired, and which of course, unless you move quickly, can put you out of action.'

It's all in real-time, with a time limit and scores kept, with the best five displayed together with the names of players.

The game is like the 'Sea-Wolf' of the Arcades, but better, for Mike has given it much more variation.

It's from Kansas and only from Kansas at a sensible £9.50

Kansas

Kansas City Systems, Unit 3, Sutton Springs Wood, Chesterfield, S44 5XF. Tel. 0246 850357

• Circle No. 364

All prices are Vat paid and post free. Return first class post service. Barclaycard Visa orders sent same day if phoned in by 3pm. Answering machine ordering service after 6pm and Sundays to allow use of cheap rate. Catalogue available upon request.

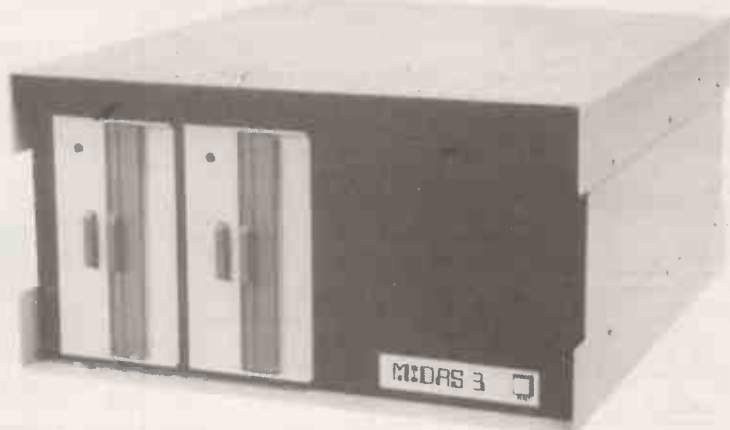
SIRTON COMPUTERS



76 Godstone Road, Kenley (Nr Croydon) Surrey CR2 5AA
Tel: 01-668 0761/2

NOW WITH MP/M

MIDAS S.100 SYSTEMS



MIDAS 1: From £750
MIDAS 2: From £1580
MIDAS 3: From £2150
MIDAS 3HD: From £4720
ITHACA-DPS 1: From £1075

- Our versatile Z80 Microcomputers are available as standard units or custom configured to your exact specification from a comprehensive range of stocked S100 boards.
- Disc storage capacity of the MIDAS 3 can be 2M Bytes, expandable to over 80M Bytes with a Winchester Hard Disc Unit in our MIDAS 3HD range.
- MIDAS runs CP/M and MP/M. Other Software includes M-BASIC, C-BASIC, FORTRAN, COBOL, CIS-COBOL, PASCAL and Word Processing.
- A MIDAS 3, with 64K RAM and 2M Bytes storage on two 8" drives with two Serial I/O Ports and CP/M 2 only £2835.
- Multi-User System (four users) — MIDAS 3 with 112K of RAM, 1MByte disc storage on two 8" drives and four Serial I/O Ports, and CP/M2 + MP/M — £3850.
- Multi-user Hard Disc System (three users) — MIDAS 3HD with 160K of RAM, 1MByte Floppy Disc and 10MByte Winchester Disc; Four Serial I/O Ports and CP/M 2.2 + MP/M — £6300.
- Printers, VDUs and other peripherals stocked to give complete package system at keen prices.

Boards stocked from Ithaca, Godbout, SSM, S D Systems, Vector, Micromation, Mullen, Mountain Hardware, Hi-Tech, Video Vector, Pickles & Trout, Cromemco, Morrow — Send for full Price List (many available in kit form).

Processor		RAM	
Z80 Starter Kit	£188	Dynamic RAM 16K-64K	from £205
SBC100	£208	Static RAM 16K-64K	from £195
8085/88 CPU	£237	Memory Manager	£52
Z80 CPU 4 MHz	from £150	I/O	
EPROM		2S/4P prov 4K RAM/4K ROM	£169
2708 EPROM (16K)	£60	2S/2P or 2S/4P or 3P/1S or 4S/2P	from £135
2708/2716 Programmer	from £134	Analogue 8 or 12 bit	from £287
Video		Optically isolated I/O	£114
16 lines, 32/64 ch	from £104	IEEE 488 Interface	£350
24 lines, 84 ch	from £265	Miscellaneous	
Disc Controllers		Real Time Clock	£180
Versafloppy S/D	£198	High Dens Graph/8K RAM	£333
Doubler D/D	£280	Hi-Tech Colour	£295
Godbout D/D — DMA	£160	Motherboards — various from	£34
Mainframes		Extender Board/logic probe	£39
		Maths Board AMD 9511	£330

We are the sole UK Distributor for Integrand Mainframes and Disc Enclosures, available in nine models including Desk Top and Rack Mounting, with or without provision for Disc Drives. All units totally enclosed, painted on all external surfaces and complete with power supply etc.

Software
CP/M 1 & 2, MP/M, PL/1, C-BASIC 2, M-BASIC V5, XYBASIC, FORTRAN 80, COBOL 80, CIS-COBOL, PASCAL/Z, PASCAL (UCSD), PASCAL M/T, Forth, MAC, ZSID, Disassembler, Wordstar, Datastar, Magic Wand, Wordmaster, Supersort etc etc.

WRITE OR PHONE FOR CATALOGUE
PRICES EXCLUSIVE OF VAT

• Circle No. 365

OHIO SCIENTIFIC COMPUTERS



SUPERBOARD 3

Superboard 3 £159. Power supply kit £11.95. Modulator £3.50. Guard band kit £10. 4K extra ram £15.60. Case £27. Cassette recorder £18. Ceymon improved monitor rom £29.50. Assembler/Editor tape £25. Word processor program £10. Display expansion kit 30 lines x 54 characters for Superboard 2 (not 3) £14. Wemon £19.95. Centronics interface kit £10.

CHEAPO EXPANSION OFFER

Buy a 610 expansion board with 8K ram on board and space for another 16K for £159 and get a free 5V 3A power kit and any extra ram you want for £3/K. Buy a mini-floppy + case + power supply + 2 copies of DOS for £275 and we will do the extra ram for £2/K (Max 16K). We can also supply a version to suit UK101.

SPECIAL OFFER

Superboard 3 + power supply and modulator kit + guard band kit (converts the display to 32 x 32, gives 1200 and 300 Baud tape speeds, increases computing speed by 50% and converts to 50 Hz). Only £172.

SERIES 2 CHALLENGER

Microcase versions 4K £212. 8K £228.

PRINTERS



Buy any of the below and get a free interface kit and word processor program for UK101 or Superboard:— OKI Microline 80 (Illustrated) £299. Epson MX80 tractor £359. Epson MX80 tractor + friction £399. Epson MX70 £279. Epson TX80 £295. Seikosha GP80 £199.

5V POWER KITS

Fully stabilized 5V computer and TTL power kits. Automatic current limiting and short circuit protection. Crowbar over-voltage protection. 1 1/2 A £7.83, 3A £12.17, 6A £19.13.

MEMORY CHIPS

2114 450ns £1.95. 4116 200ns £1.99. 4027 £1.30. All low current.

ZX81 Secondhand poa.

SWANLEY ELECTRONICS

Dept. PC, 32 Goldsel Rd., Swanley, Kent BR8 8EZ.

Postage £3.50 on Superboard, £4.50 on printers and 45p on other orders. Lists 27p post free. Please add VAT to all prices. Official credit orders welcome. ZX81 part exchange possible.

• Circle No. 366

Computers for All

ONLY £205.00

THE ATOM BEGINNER'S COMPUTAPACK 1 contains:

- * Acorn Atom assembled (8K ROM, 2K RAM)
- * 4 extra 1K RAM (giving you 4K total)
- * 1 Acorn Atom mains adaptor
- * 1 Atom manual
- * 1 cassette with 6 programs to demonstrate capabilities of the Acorn Atom
- * 1 copy of "GETTING ACQUAINTED WITH YOUR ACORN ATOM"
- * 6 blank C-15 cassettes



COMPUTERS FOR ALL

2 KING EDWARD ROAD, ROMFORD, ESSEX, RM1 2DH. Telephone Romford 26220 (24 hours)

All these items are available separately. S.A.E. for details.

• Circle No. 367



INTERFACE ENGINEERING (LEEDS) LTD.

NORTH STAR HORIZON HARDWARE AND SOFTWARE COMPETITIVE PRICES E.G. 64K DUAL QUAD £1875

PAYROLL — COMPREHENSIVE FACILITIES £350

SALES AND PURCHASE LEDGER EACH £300

ACCOUNTANTS PACKAGE — FULL BOOK KEEPING AND A/Cs PREPARATION

FROM LEDGERS, CASHBOOK THROUGH TO P & L, "NOTES

TO A/Cs" etc. P.O.A.

BILL OF QUANTITIES & VALUATION — ANY SIZE CONTRACT P.O.A. PLUS
SOFTWARE FOR OTHER MACHINES

ALSO INTERFACES

FROM ANYTHING TO ANYTHING

2, KNOTT LANE, LEEDS LS19 6JL (0532) 505494

• Circle No. 368

SYSTEM 4000 EPROM EMULATOR/PROGRAMMERS

EX-STOCK



P4000 PRODUCTION EPROM PROGRAMMER

This unit provides 'simple, reliable' programming of up to 8 EPROMs. It has been designed for ease of operator use — a single 'program' key starts the blank check — program — verify sequence. Independent blank check and verify controls are provided along with mode, pass/fail indicators for each copy socket and a sounder to signal a correct key command and the end of a programming run. Any of the 2704/2708/2716 (3 rail) and 2508/2758/2516/2716/2532/2732 EPROMs may be selected without hardware or personality card changes. 2 year warranty. Price **£545 + VAT**:

VM10 VIDEO MONITOR

This compact, lightweight Video Monitor gives a clean crisp picture on its 10" screen. Suitable for use with the EP4000, SOFTY and other systems. 12 month warranty. Price **£88 + VAT, carriage paid**.

MODEL 14 EPROM ERASERS



MODEL UV140 EPROM ERASER

Similar to model UV141 but without timer. Low price at **£61.50 + VAT, postage paid**.

EP4000 EPROM EMULATOR/PROGRAMMER

The microprocessor based EP4000 has been designed as a flexible, low cost, high quality unit for emulating and programming all the popular NMOS EPROMs without the need for personality cards, modules or hardware changes. Its software intensive design permits selection of the 2704/2708/2716 triple rail EPROMs and the 2508/2758/2516/2716/2532/2732 single rail EPROMs for both the programming and emulating modes.

The video output (T.V. or monitor) for memory map display in addition to the built-in Hex LED display, for stand alone use, is unique in this type of system. This, with the double function 28 key keypad, powerful editing features, powered down programming socket, buffered tri-state simulator cable and 4k x 8 data RAM gives you the most comprehensive, flexible and compact systems available today.

2 year warranty. Price **£545 + VAT**:

MODEL UV141 EPROM ERASER

- 14 EPROM capacity
- Fast erase time
- Built-in 5-50-minute timer
- Safety interlocked to prevent eye and skin damage
- Convenient slide-tray loading of devices
- Available Ex-Stock at **£78 + VAT** Postage Paid

EX-STOCK

EXPORT CUSTOMERS: TELEX OR PHONE FOR QUOTATION AND TERMS

GP INDUSTRIAL ELECTRONICS LTD,

UNIT 6, BURKE ROAD, TOTNES INDUSTRIAL ESTATE, TOTNES, DEVON.
TELEPHONE: TOTNES (0803) 863360 (Sales) / 863380 (Technical Service)
DISTRIBUTORS REQUIRED — EXPORT ENQUIRIES WELCOME
TELEX: 42596 GPELEC

SOFTY SYSTEM

EX-STOCK

Low cost card 2704/2708 emulator/programmer features:

- Direct output to T.V.
- High speed cassette interface
- On card EPROM programmer
- Multifunction Keypad
- 1K monitor in 2708
- 1K RAM
- 128 byte scratchpad RAM
- 22 in/out ports
- Access at card edge to all buses
- 1K EPROM EMULATION
- Direct memory access for fast data transfers
- Editing facilities, including — data entry/deletion, block shift, block store, match byte, displacement calculation
- Supplied with Zif socket, simulator cable and comprehensive manual

SOFTY Kit of parts **£100 + VAT**
SOFTY Built & tested **£120 + VAT**
SOFTY Built power supply **£20 + VAT**

P&P IS INCLUDED IN ALL PRICES



SOFTY CONVERSION CARD

Enables SOFTY to program the single rail EPROMs, 2508/2758/2516/2532. Selection of device type and 1K block are by pcb slide switches. Programming socket is zero insertion force. Easy connection to SOFTY with the DEP Jumper supplied. Built and tested: **£40 + VAT, postage paid**.

SOFTY PRINTER

- 40 column electrosensitive printer
 - 5 x 7 dot matrix
 - print sizes
 - Push button hex print-out of SOFTYs RAM, EPROM or inter-cursor contents
 - On card PSU
 - Selection of bytes per line.
- Built and tested **£145 + VAT, postage paid**.

EX-STOCK EPROMS

	1-9	10-24	25 up
2716 (single rail)	5:00	4:50	4:00
2708	3:90	3:50	3:10
2532	17:00		
2732	17:00		

ADD VAT AT 15% — POSTAGE PAID

WRITE OR TELEPHONE FOR DETAILS ON ANY OF OUR PRODUCTS

• Circle No. 369

COMMERCIAL OPERATING SYSTEM FOR MICROS

The Interface Computer Services Commercial Operating System will enhance the capabilities of any Z80 or Z80A based microcomputer with a minimum of 32K running under CP/M* or MP/M*.

Cobol Compiler

At the heart of the system is our own COBOL compiler. Designed to ANSI Level 1 specifications, with some extensions, it provides massive savings in disk and memory space requirements compared to interpretive systems.

Improved Screen Handling

The extended I/O routines provide greatly enhanced operator cursor control. COBOL DISPLAY and ACCEPT verbs have been modified to provide excellent screen-handling facilities and there is software control over the type, format and length of data accepted from the keyboard.

Optimised Disk I/O

Logical records are packed into physical sectors and may extend across sectors, even in direct access files. Disk I/O is also very fast.

Improved Printer Handling

Where a parallel printer port is used, the extended I/O routines recognise printer status signals and give operator messages on the screen. With a serial port, the system prompts the operator to prepare the printer when printing is about to commence.

On-Line Debugging Tool

A powerful interactive debugging tool provides trace, checkpoint, field monitoring and field change facilities.

Job Executive

Job control is user-written in COBOL so it has all the flexibility that COBOL provides. Subroutines are

provided to schedule single or multiple programs, to abort and restart jobs, to control mounting and dismounting of disks and to assign logical I/O units to physical units. Disk volumes are numbered and volume numbers can be checked by the system. Automatic disk backup, backup disk cycling and print spooling may be optionally configured and automatic job start-up is provided for end-user systems.

Print Spooling

Print spooling may be automatically implemented and provides the advantage of controlled printing independent of applications programs. Facilities are provided for restart, automatic production of multiple copies and special stationery alignment.

Cost

The cost of a full development system is £450. Additional systems for machines of the same type within the same company cost £250. The system is also supplied in an end-user version (without COBOL compiler and debugging tool) for £200 (CP/M) or £400 (MP/M).

Applications and Utilities

A file dump utility (£30) and a sort utility (£50) are available. Application packages include Word Processing (£200), mailing (£200), generalised data management (£200), Stock Recording (£350), Invoicing (£250) and Sales, Purchase and Nominal Ledgers' (£350 each).

Availability

The Commercial Operating System and its associated utilities and applications are available directly from Interface Computer Services or from the following dealers:

- Computer Sales and Software Centre. 01-554 3344. Contact K. Neal
- Culloville. 024541 3919. Contact M. Knight
- Metrotech. 0895 58111 extensions 247 and 269
- Orchard Microbyte. 0268 741271. Contact M. Dean

Manuals are available at £15 each.

When ordering software please state make and model of micro, VDU and printer. Please add V.A.T. to all orders except for manuals.

**FIRST FLOOR,
17 GUTHAVON STREET,
WITHAM,
ESSEX, CM8 1BJ
TELEPHONE: WITHAM (0376) 518112**

*MP/M and CP/M are trademarks of Digital Research

INTERFACE COMPUTER SERVICES LIMITED

TRANSAM COMPUTER SYSTEMS

THE TUSCAN S100 MICROCOMPUTER SYSTEM

Designed, built and supported in Britain by TRANSAM, the Tuscan S100 system is an economical and very powerful computer system, designed to be used in several configurations dependent of user requirements.

Using the Z80 processor, it is CP/M compatible with S100 expansion onboard. If that doesn't mean much to you now, then rest assured that it will when it comes to ease of expansion and software availability. An ideal system for use at home, in the office, at school, in the lab or in development applications, TRANSAM take care of all your requirements. Our new systems catalogue covers the Tuscan and a whole range of computer hardware now available.



DESK TOP S100 SYSTEMS TO SUIT YOUR NEEDS

We support the S100 bus! Our experience in microcomputer design and development enables us to support a whole range of computer hardware, to help and explain systems and to offer the level of support you can only get when dealing direct with the manufacturer.

We have laid out in our new systems catalogue all you need to know about choosing your hardware, how to choose the right printer and the size of disc drive, and what future expansion to consider. Our advice is free and our systems are very competitive.

Even if you don't have an S100 system, our catalogue has something of interest to everyone. Send for your copy now, or better still call in and see us and collect your copy from our London showroom. We sell direct and by mail order worldwide.

SOFTWARE

TCL SOFTWARE — A DIVISION OF TRANSAM

TCL Software specialize in producing British software for the British market. We have several major software packages to our credit, the most famous being TCL Pascal, our own British Pascal compiler. It was originally produced to run on our own Triton and Tuscan computers, but is now available as a standard CP/M package and for the CBM PET computer, officially marketed by Commodore worldwide. An example of British software at its best.



SOFTWARE PACKAGES TO SUIT YOUR APPLICATIONS

We have compiled a new software catalogue primarily aimed at CP/M users. This lists all the applications packages we have available, several languages and plenty of interesting program development aids. It's hard to think of an occupation for which a micro would not be an aid. Software is continually being developed and improved for use in almost every professional field. With good advice you can choose the right package to suit your application. Our software catalogue has something for all.

AND SPARES

MICROCOMPUTER SPARES AND ACCESSORIES

Have you ever had problems getting the right connector or replacing a faulty interface cable? Have you ever thought you could do a better job if you could only get the right spare parts?

We specialize in microcomputers and stock a comprehensive range of components and spares: memory and support chips; microprocessors; TTL logic; and all those hard to get connectors and cables.



PROTOTYPING AND DEVELOPMENT SYSTEMS

Fast, return of post mail order service on all our products. Telephone credit card orders accepted or call at our showroom. All our products are brand new and fully guaranteed. From prototype through to production our range of microcomputer products will cover your requirements. Hobbyist, school, university, R & D or OEM. Send for our new components catalogue.

... three new catalogues

TRANSAM

NOBODY DOES IT BETTER!

Transam Components Ltd
59/61 Theobald's Road
London WC1
Tel: 01-405 5240/2113
Callers welcome



Three new catalogues available from Transam, the British microcomputer specialists. Catalogues are 40p each or all three for £1 (free to government departments, schools and companies). Please send large (A4) SAE. PC7/81

- Please send me the computer systems catalogue
- Please send me the software catalogue
- Please send me the components and spares catalogue

NAME

ADDRESS

TELEPHONE

Number one for PET in London.

01-579 5845



The news
is travelling fast
amongst the

professionals that Adda
are the Number One people to go

to in London for Commodore Pet microcomputer systems.

Commodore's new generation of desk-top computers and software packages for accountants and solicitors can be made to realise their full potential with professional advice from Adda. This, together with exceptional standards of service, will help you stay on top and in complete control of the latest advances in microcomputing.

WORD PROCESSING FROM AS LITTLE AS £2900

With the WORDCRAFT 80 programme, Adda can show you how to make use of a Commodore Business System in the dual role of a fully-fledged word processor. There's capacity for 250-300 pages of text, the functions you'll find on very much more expensive word processors, and a wide choice of output printers including daisy-wheel. Add on the DMS file management programme for £195 and you can access several thousand names and addresses for personalised mailing. Mu-Pet enables you to build up a multi-terminal word processing system linking from three to eight microcomputers to one Commodore disc drive and printer for as little as £595.

CALCULATOR, PEN AND PAPER - ALL IN ONE - WITH VISICALC

When you need to work things out on paper, using a calculator, the VisiCalc programme can do it so much easier and quicker on computer - and instantly display the answers you are looking for. And you can get a hard printout later. The applications are numerate and innumerable - get Adda to show you. Find out more about how these developments can best be employed in the professions - with professional advice from Adda. Phone 01-579 5845 today.



**A FREE VIC-20 home colour
computer worth £229.90.**

Phone 01-579 5845 today

**for details. Offer closes
31st August 1981.**



Adda Computers Ltd, 14 Broadway
West Ealing, London W13

• Circle No. 372

Old tricks for new Pets...

COMMAND-D is a FOUR KILOBYTE Rom for the 4000/8000 Basic 4 Pets with all the "Toolkit" commands RENUMBER (improved), AUTO, DUMP, DELETE, FIND (improved), HELP, TRACE (improved & includes STEP), and OFF - plus PRINT USING - plus four extra disk commands INITIALIZE, MERGE, EXECUTE, and SEND - plus extra editing commands SCROLL, MOVE, OUT, BEEP, and KILL - plus SET user-definable soft key, 190 characters - plus program scroll up and down - plus 8032 control characters on key. Ask for Model CO-80M for the 8032 or CO-40N for the 4016/4032. £50.00 plus Vat

New tricks for old Pets...

DISK-D-PRO is a FOUR KILOBYTE Rom that upgrades 2000/3000 Pets, but lets you keep all your old software - including Toolkit. As well as REPEAT KEYS and PRINT USING, you get all the Basic 4 disk commands COMEAT, OPEN, CLOSE, RECORD, HEADER, COLLECT, BACKUP, COPY, APPEND, OSAVE, OLOAD, CATALOG, RENAME, SCRATCH and DIRECTORY - plus extra disk commands INITIALIZE, MERGE, EXECUTE and SEND - plus extra editing commands SCROLL, MOVE, OUT, BEEP and KILL - plus SET user definable soft-key, 80 characters - plus program scroll-up and scroll-down. We recommend the 4040 disk or upgraded 3040 for full benefit of disk commands. Ask for Model DDP-16N for new Pets 2001-3032, and 2001-8 with retrofit Roms & TK160P Toolkit. £50.00 plus Vat, other models available.

PRONTO-PET hard/soft reset switch for the 3000/4000 Pets. We don't think you'll "crash" your Pet using our software, but if you do the Pronto-Pet will get you out! Also clears the Pet for the next job, without that nasty off/on power surge. £9.99 - Vat

and no tricks missed!

KRAM Keyed Random Access Method. Kid your Pet it's an IBM! V5AM disk handling for 3032/4032/8032 Pets with 3040/4040/8050 disks means you retrieve your data FAST, by NAME - no tracks, sectors or blocks to worry about. Over 2,500 users worldwide have joined the "Klub"! Now you can too, at the 1981 price, £75.00 plus Vat.

SPACEMAKER All our Rom products are compatible with each other, but should you want, say, Wordpro with Kram, or Disk-o-pro with Visicalc, then SPACEMAKER will allow both Roms to address one Rom socket, with just the flip of a switch, for £22.50 plus Vat.

We are sole UK distributors for all these fine products. If your CBM dealer is out of stock, they are available by mail from us, by cheque/Access/Barclaycard (UK post paid) or send for details.

Calco Software

Lakeside House Kingston Hill Surrey KT27QT Tel 01-546-7250

• Circle No. 373



Avalon Computers

formerly Beaver Systems, Thame

The 6502 system specialists

Software and hardware for

ACORN TANGERINE OHIO SCIENTIFIC

Many systems in stock
at competitive prices

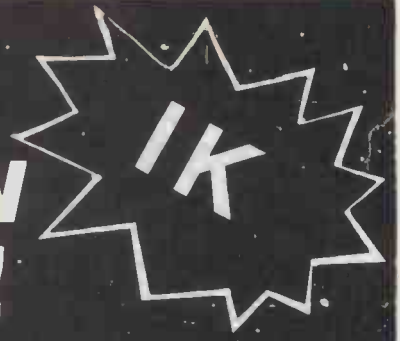
Over 200 program titles available

Avalon Computers Street, Somerset BA160LQ
Telephone: Street (0458) 47007 (24 hr)

• Circle No. 374

PRACTICAL COMPUTING July 1981

NOW YOU CAN PLAY SUPER INVASION ON YOUR ZX80!



TOTALLY FLICKER FREE

Absolutely no flicker. You don't need to press anything for the display to move!

3 LEVELS OF PLAY IN EACH GAME

From easy to dangerously difficult — you'll find it hard to resist the challenge time after time!

MOVING GRAPHICS

No hardware modifications required for these exciting moving graphics games! Just follow the instructions for cassette loading and off you go — no need for new ROM or extra memory.

MACHINE LANGUAGE

These programs are written in the computer's own language — only this way is it possible for continuous, flicker free action to occur.

ALL PROGRAMS ON CASSETTE

Loads just like any other program on cassette. Each tape contains instructions on how best to load the cassette.

FITS IK BASIC MACHINE

Amazing as it is, all these moving graphics programs fit into your basic IK Sinclair!



COME & SEE
THE ACTION

SUPER ZX80 INVASION

SUPER ZX80 INVASION is the moving graphics machine language game you and your Sinclair have been waiting for. Cruel and crafty invaders have been spotted in battle formation ready to attack with your ship just below them! Quickly and skilfully you shift right and left as you carefully fire your lasers at them. But watch out — they are accurate! 3 levels from easy to almost impossible to beat. Added bonus — each cassette also has more sophisticated 2K version which will automatically reset and challenge you for hours!



DOUBLE BREAKOUT

You'll be amazed to see how difficult it is for you to break through the ZX80 DOUBLE BREAKOUT — and even more astonished to see this exciting moving graphics game fit into your IK Sinclair ZX80! Try your skill on the easiest level because even with the most skilful bat control you'll find it hard to catch at the fastest level! Breaking through the first barricade is easy but don't be fooled for a second — it's much harder than you think! Two ball angles and curved bat will keep the excitement going for hours! Superb graphics!



THE ESSENTIAL SOFTWARE CO. (VISCONTI LTD)
47 BRUNSWICK CENTRE, LONDON WC1N 1AF
 OLD ROM NEW ROM
Please send me _____ copies SUPER ZX80 INVASION and
I enclose cheque/postal order for _____ copies DOUBLE BREAKOUT.
Name _____ Address _____ plus 50p post and pack. PC7/81

Order your games for
New ROM now!!

THE ESSENTIAL SOFTWARE COMPANY

BRINGS YOU
QUALITY PROGRAMS CHOSEN FOR THEIR SUPERB GRAPHICS AND
SMOOTH ACTION

TRS80

COSMIC
FIGHTER
WITH
SOUND



Your fighter appears below a convoy of aliens! If you destroy them another set appears who seem to be slightly cleverer than before! Soon your space station nears but before you can dock the station comes under attack! Survival is up to you! The excitement is just beginning!!

TRS80 Levels I & II 16K Tape £10
Video Genie 16K Tape £10

Video Genie



ASTEROID
NOVA



Now the amazing ASTEROIDS arcade game for your TRS80! Your Ship is floating in the middle of an asteroid belt! Your only escape is to destroy them and the crafty alien spacecraft! Blast them with your laser, thrust, rotate or hit hyperspace to survive!

TRS 80 Level 1 or 11.16K Tape £10
Video Genie 16K Tape £10

ZX80

GALAXY
INVASION
WITH
SOUND!



The newest and most exciting invaders type game yet! Cruel and crafty aliens attack Earth. You are the sole defender. As you fire your laser at the aliens they swoop down and bomb you. Exciting use of graphics! Must be seen.

TRS 80 Levels 1 and 11.16K Tape £10
Video Genie 16K Tape £10

3-D ADVENTURES

A must for all adventure addicts! Walk down corridors depicted in full 3-D graphics. Look around to find the objects you need to survive. But beware! Monsters and Incredible Obstacles can lurk round every corner!

LABYRINTH TAPE £10 DEATHMAZE TAPE £10

THE ESSENTIAL SOFTWARE COMPANY (Visconti Ltd.)
47 Brunswick Centre, London WC1N 1AF 01-837 3154

I have a _____ microcomputer
 Please send me your software catalogue. I enclose a stamped self addressed envelope.
 Please send me _____
I enclose a cheque/postal order for £ _____ (plus 50p post & packing)

Signature _____
Name _____
Address _____
PC7/81 Postcode _____

NEW
for TRS80
LEVEL II 16K

• Circle No. 375

oap Flexible Diskettes

OFFICE DATA PRODUCTS

Quality Floppy Discs from the World's Largest Manufacturer of this type of Product. Fully Guaranteed.



Single Sided Single Density 5 1/4" Diskette 40 Track Certified	£1.75
Double Sided Double Density 5 1/4" Diskette 40 Track Certified	£2.49
Single Sided Single Density 8" Diskette 26 Sectors, 128 Bytes/Sector	£2.29
Double Sided Double Density 8" Diskette Certified	£3.64

These prices are for small quantities and do not include v.a.t.

DISCOUNTS FOR LARGER QUANTITIES.

Full range of other configurations available from stock.

Other products include: —

- Floppy Disc Head Cleaning Kits.
- Floppy Disc Storage. Fire Protection.
- Printer Ribbons etc.

Full range of media and Accessories also available for the larger Computer.

TRADE ENQUIRIES WELCOMED.



**D.N. COMPUTER SERVICES LTD.,
WEST CROFT INDUSTRIAL ESTATE,
MANCHESTER OLD ROAD, MIDDLETON,
GREATER MANCHESTER.**

Tel: 061-643 0016 Telex: 635091

• Circle No. 376

When you need SAS*Help!
~CALL CROESO



Working Business Systems for Apple II

CCS-CLASS

Client Ledger and Statistical Analysis for Finance Companies Maintains borrowers' accounts and provides full management information.

CCS-STOCKTAKERS

Licensed Trade Stocktake and Retail Analysis for professional Stocktakers. Provides Stock item details, Stock reports, summary sheets and full printed analysis for any number of clients.

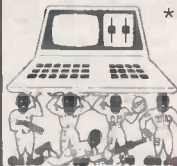
CCS-PUBSTOCK

Stocktakers system for individual hotels, pubs, bars. Provides all the facilities of the professional system, but for one specific licensed house.

Please ring for detailed overview or demonstration — all our systems are tested and guaranteed.

Plain listing paper £7.50 per '000 (in boxes of 2000) 5 1/4" single sided disks £19.50 per 10 (inc. free library box).

VAT and postage extra.



*Specialist Application Software

CROESO COMPUTER SERVICES

516 Mumbles Road Mumbles Swansea
Telephone: (0792) 60624/68078

• Circle No. 377

WIDEBAND

WIDEBAND PRODUCTS

Presents

SPEAKEASY

Speech Synthesiser

Complete with loudspeaker and parallel input, suitable for most computers: e.g. ACORN, PET, APPLE, NORTH STAR, PDP11, IBM370.

Clear intelligible male speech is programmed with phonetic codes.

As featured on BBC Radio 4, BBC and ITV television.

RETAIL PRICE ONLY £89 + VAT

Dealer Enquiries Invited

Phone: 0223 20 8017

• Circle No. 378

NOW —

SUPERBRAIN™ HD

NOW SUPERBRAIN™ has 5MB of INTERGRAL HARD DISC PLUS 0.8MB FLOPPY DISC STORAGE

THE FIRST DESK TOP MICRO INCORPORATING SEAGATE'S MINNIE-WINNIE GIVING 5MB OF FORMATTED WINCHESTER DISC CAPACITY.



- * ULTRA HIGH RELIABILITY
- * FAST DATA WRITING & RETRIEVAL
- * SILENT OPERATION
- * LOW COST - £3950.00*

OF COURSE WE STILL SELL THE STANDARD SUPERBRAIN™

But with these options available

HIGH RESOLUTION GRAPHICS and SOFTWARE

- * 512 x 256 PIXEL GRAPHICS
- * 16K I/O MAPPED
- * MIXED TEXT & GRAPHICS

£435.00 (*Easily installed board*)

- * TEXTRONIX EMULATION £140
- * SURFACE PLOTTING £200
- * 3-D GRAPHICS £160
- * GRAPH PLOTTING £ 80
- * SYMBOL GENERATOR £ 80

£330.00 — SUITE OF SOFTWARE (*purchased with board*)

TRUE LOWER CASE BOARD

- * LOW COST (£50.00)
- * TRUE DECENDERS
- * UNDERLINE
- * £ SIGN
- * INVERSE VIDEO
- * STRIKE THROUGH

DISC MOTOR OFF

- * LONGER MEDIA LIFE
- * LOWER MAINTENANCE COSTS

* * * P.O. SPECIFICATION VERSION NOW AVAILABLE * * *

* CALL FOR THE BEST OEM/DEALER PRICES AVAILABLE *

DEALERS:

SCOTLAND:

MAP Computers, Glasgow (041) 204 1927

NORTH:

MAP Computers, Oldham (061) 624 5662

MIDLANDS:

Warncliffe Business Systems, Sheffield (0226) 86819

LONDON:

Quest Computers, Birmingham (021) 622 5793

HOME COUNTIES:

ERIO Computer Serv. Newcastle-U-Lyme (078) 262657

WALES:

Rebvale Computers, Bury St Edmunds (095381) 316

SOUTH:

Boyd Microsystems, Bushey Heath (01) 950 0303

REP. IRELAND:

Oceanic, City of London (01) 488 9751

SPECIALIST SUPPLIERS:

Printing: Stephen Cox & Ptnrs, London (01) 407 1982

Instrumentation & Scientific: Anaspec Research Laboratories, Newbury (0635) 44329

Transport Planning: Systematica, London (01) 836 9379

Abtex Computer Systems, Aberdeen

(0224) 55074

MAP Computers, Leeds (0532) 445234

Spot Computers, Doncaster (0302) 25159

Systems Micros, Telford (0952) 460 214

Micropeople, Nottingham (06076) 69117

Britannia Bus. Systems (01) 658 0341

EMG Microcomputers, Croydon (01) 688 0088

Microbyte, Egham 87 35996

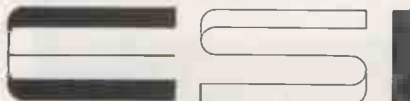
3D Computers, Sutton, Surrey 01-337 4317

MBS Rentals, West Byfleet (09323) 53151

AID Office Supplies, Bristol (775276) 0454

Workflow, Cowden, Kent (034286) 357

DISTRIBUTED IN THE U.K. BY:—



Telephone: 01-686 9687/8

Encotel Systems Sales

530 PURLEY WAY, CROYDON, SURREY

• Circle No. 379

BUSINESS COMPUTERS (NW) LIMITED

QUEENS PARK, QUEENSWAY, WREXHAM LL13 8UN
AND AT 96A DUKE STREET, LIVERPOOL 1.

Compare Our Prices!!!

Supertext.....	70.00
Address Book.....	50.00
Form Letter Module.....	70.00
Lower Case Adaptor.....	45.00
Easywriter.....	70.00
Text File Library.....	90.00
Visicale.....	75.00
Desk Top Plan.....	64.00
C.C.A. Data Base.....	75.00
High Technology Database.....	60.00
Diary.....	25.00
M'EN'U (Programmed Learning).....	50.00
Stock Control — The most Advanced Stock Control Program written in PASCAL.....	600.00
Barrister's System — for a Chamber of up to 15 Barristers.....	500.00

All Prices are exclusive of V.A.T.

Please Add £2.00 Postage + Packing to all Orders

**TELEPHONE SUE HOBAN
ON 0978 (WREXHAM) 365200**

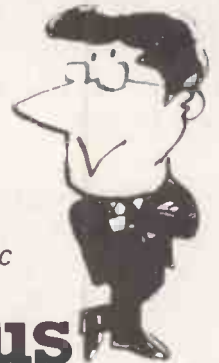
• Circle No. 380

Master Your Micro FAST with...

Little Genius floppy diskette based courses will teach you, how to use your system and how to realise the full potential of the "Mighty Micro". These fully interactive computer lessons will guide you quickly to a high level of understanding and confidence in your ability to make the most of your microcomputer system.

Courses now available:

- | | |
|----------------------------|--------------------------|
| - Applesoft BASIC | - Palsoft BASIC |
| - Advanced Applesoft BASIC | - Advanced Palsoft BASIC |
| - Using your Apple | - Using your 2020 |
| - PET BASIC | - 380Z BASIC |
| - Advanced PET BASIC | - Advanced 380Z BASIC |
| | - Using your 380Z |



Little Genius

Each course, comprising a floppy diskette, and starting instructions, costs only £40.00 plus VAT.

SPECIAL "3 in one" OFFER for 3 courses covering the same system only £99.00 plus VAT.

Little Genius courses are available from most computer retail outlets, or direct mail order from:

LITTLE GENIUS

Suite 504, Albany House, 324 Regent Street, London W1R 5AA.
Telephone: 01-580 6361

• Circle No. 381

INDEPENDENT COMPUTER ENGINEERING LTD

CROMEMCO SYSTEMS & SOFTWARE

CP/M 2.2 FOR CROMEMCO — £95

MP/M 1.1 for Cromemco — £350

Cromemco System Zero — £575

S100 Peripherals:

Dump your hard disk to 'reel' tape in 10 minutes —

½" 9-track 1600 BPI IBM/ANSI compatible tape drive

+ controller + software — £2500

5¼" Winchester Drive + Controller + software — £1560

Cartridge Disk — from £3950

CALIFORNIA COMPUTER SYSTEMS

S100 Boards and Systems

64K Dynamic RAM (bank select) — £350

Centronics 737 — £350

600 LPM BAND PRINTER £3750

ALL PRICES EXCLUDE VAT

Further details, please contact:

ICE Independent Computer Engineering

16/18 Littleton Road, Ashford,

Middlesex TW15 1UQ

TELEPHONE: ASHFORD (STD 07842) 47171

TELEX: 8952042 (DPCUST G)



EPSON MX80 SERIES DOT MATRIX PRINTERS

- * 9 x 9 matrix (true descenders lower case)
- * 80cps bidirectional printing, with logical seeking print head
- * 96 ASCII character set, plus 64 graphics incorporating 4 switch selectable European language options
- * Programmable forms handling
- * 12 different print modes, up to 132 characters per line
- * Operator controls & indicators, self test
- * Options — high resolution graphics, dual friction/ tractor feed unit
- * £395 with standard parallel interface (interface options = RS232, Pet, TRS80, MZ80, Apple)

COMPUTER SOLUTIONS TO BUSINESS PROBLEMS — SOFTWARE PACKAGES / HARDWARE
MAINTENANCE / HARDWARE CONFIGURATION & DESIGN

• Circle No. 382

PRACTICAL COMPUTING BACK NUMBERS & BINDERS



BINDERS

UK — £4.60 including packing, postage and VAT
Overseas — £5.75 including packing and postage
Please make all cheques payable to *Practical Computing* and sent to the General Sales Dept.

BACK NUMBERS

Fill in the coupon in every issue and return it with your remittance to *Practical Computing*, General Sales Dept. Room 205, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

TRS-80 & Video Genie Programs

DUPLITAPE £9.50

A copy program which can copy any length program or data-file on a machine with 4K of R.A.M. DUPLITAPE is not a simple copy program but is designed to alter and reposition the tape pulses so that difficult tapes will load easily. It requires two cassette recorders. It will copy most protected tapes and adventures.

CHAIN LINK £9.50

This program allows long BASIC programs to be split up so that they will run in a small memory size. It allows variables including strings to be passed from one program to another. It has a built in MERGE for BASIC programs and allows two BASIC programs to be kept separate in memory if needed. 16 KL11 only.

WIZARDS CASTLE £9.50

A role playing adventure with real maps. The objective is to find the treasures in a 500 room castle. The castle has monsters which have to be fought, together with other hazards. Every time the program is run, the castle will be different. Magic spells are also used. For dwarves, hobbits, elves and humans. 16K L11 only.

ACULAB DATA-BASE £9.50

A general purpose data base to run with an Aculab Floppy Tape under Extended BASIC. The use of the P.I.M.S. manual by Scelbi Publications is recommended. Functions supported include Help Command, Arithmetic, Searching, Sorting, Listing, Printer output, if required; Printing of 5 line address labels. Commas are allowed in the text lines. As this is intended for present owners of P.I.M.S., the instructions will only cover the commands fully, other commands being summarised.

AND NOW NIGHT DRIVER BY B. DANIELS

A fast 3-D car drive along a road at night. You see the twisting road through your windscreen. Can you control your car and avoid the police speed patrol? With sound.

Disc £11.50 Tape £9.50

From **ALBION SOFTWARE, LAMMAS ROAD,
LONDON E10** or SAE for more details

• Circle No. 383

YOUR COMPUTER

OUT NOW! The new home computer magazine
which introduces you and your family to the
fascinating world of computing.

If you are a newcomer to computing, interested in the growing range of equipment — Sinclair ZX80 and 81, Acorn Atom, Commodore VIC 20, TV games, programmable calculators and kit computers — now available for less than £300 — *Your Computer* is your magazine.

The first issue contains:

- Review of the new Sinclair ZX81
- The first of a regular series on pocket programmable calculators
- A look at the Atari 400 and 800 video games
- Introduction to kit-building techniques
- Two articles examining different aspects of the Basic programming language
- A behind the scenes investigation of BBC plans to popularise the computer in a TV series to be screened early in 1982.

All this plus an advice column and more than
20 games and program listings for only **50p**



Your Computer is your home computer magazine.
Ask your newsagent for a copy or post this coupon now.

To: General Sales Dept., IPC Electrical Electronic Press, Room 205,
Quadrant House, The Quadrant, Sutton, Surrey, SM2 5AS.

Please send me the June/July issue of *Your Computer* at a price of
50p plus 10p postage and packing.

I enclose a cheque/PO for 60p payable to IPC Business Press Ltd.

NAME _____

ADDRESS _____

PC

CC MICRO SYSTEMS

SOFTWARE

APPLE II . ITT 2020

MANAGEMENT INFORMATION SYSTEM

* Including ARITHMETIC CAPABILITY

THE SUPERIOR DATABASE

APPLICATIONS INCLUDE:

- MEDICAL RECORDS
- SALES INFORMATION
- CUSTOMER ACCOUNTS
- STOCK CONTROL
- PERSONNEL RECORDS etc

FEATURES:

- create your own file structure
- Add/Delete/Update/Search facilities
- Report Generating Options
- Powerful Field Arithmetic
- Amendable to specific requirements

Price **STANDARD M.I.S. £126 + VAT**
ARITHMETIC M.I.S. £156 + V.A.T

For further details contact:

CC MICRO SYSTEMS

48 Melrose Avenue
 Penylan
 Cardiff
 CF3 7AS

Tel: 0222 495257

• Circle No. 384



THE LONDON SORCERER CENTRE

EMG MICROCOMPUTERS LTD.

30 HEATHFIELD ROAD, CROYDON, SURREY CRO 1EU.

TEL: 01-688 0088

We are specialists in complete installations, tailor made software for your business needs.

WORD PROCESSING SYSTEM £14.99/WEEK
 COMPLETE BUSINESS SYSTEM £24.99/WEEK

Software includes customer and invoice system, leads and sales system, VAT outputs and debtors, insurance agents system, car sales program, order processing program.

We provide any printer to fit your Sorcerer e.g. Qume, Starwriter, Spinwriter, Centronics 737 and NEW Adcomp printer plotter matches '8 8 Graphics capability of Sorcerer to give complete graphics.

★ SPECIAL OFFER ★

Sorcerer 48K for only £595

- ★ Special Educational Discount
- ★ Demonstrations and Quotes given
- ★ Free Software and Hardware catalogue
- ★ 6 copies of Source magazine £6

ALL PRICES EXCLUDE VAT

AN EMG COMPANY

• Circle No. 385



centralex

A comprehensive range of Microcomputers Equipment, Peripherals, Software and Services for those who value Professional Standards, Guidance and Continuing Support for Hardware and Software.

APPLE
 TEXAS
 MICROPOLIS
 DIABLO
 MICROLINE

PET
 OHIO SCIENTIFIC
 CENTRONICS
 QUME
 HITACHI

ITT 2020
 CROMEMCO
 ANADIX
 DEC
 LEXICON

EXIDY
 MICROSTAR
 INTEGRAL
 DATA GENERAL
 ETC. ETC.

HORIZON
 SHUGART
 TELETYPE
 EPSON

INFORMEX-80 Printer

£ 399+VAT

Special offer - for a limited period

For PET, APPLE, EXIDY, TRS80, ETC
 A high quality, high speed printer
 (125 cps) Upper and lower case letters
 plus graphics as standard
 Interface and cable for TRS80, PET,
 APPLE or RS 232 £69 + VAT
 Tractor feed option only £39



ALSO Training, Consultancy, Systems Design,
 Programming and Software

PAYROLL - INVOICING - STOCK CONTROL -
 SALES/PURCHASE LEDGER - VAT - MEDICAL
 RECORDS - EDUCATIONAL & ENGINEERING
 PROGRAMMES - HOTEL RESERVATION - ESTATE
 AGENTS - BUILDING MAINTENANCE - COBOL -
 FORTRAN - ETC.

Maintenance Contracts including stand-by equipment during repair periods - Free Delivery Nationwide - Terms arranged - Credit Cards and official orders accepted.



• Circle No. 386



COMPUTER WAREHOUSE

NOW OPEN
MONDAY-SATURDAY
9.30-5.30

RAM AND EPROM NEW LOW VAT INCLUSIVE PRICES

2716 5v Rail	£7-50	4116	200 NS 16KX1 DYN.	8 for £19-95
2716 3 Rail	£8-50	2114L-3	300 NS 10K4 ST.	8 for £22-50
2708 450 NS	£4-50	2102L-3	650 NS 10K1 ST.	8 for £ 5-50
2708 Ex Equip	£2-25	TMS4030JL	300 NS 4KX1 DYN	8 for £ 9-95

All devices full spec. and guaranteed. Bulk enquiries welcome.

In stock now test equipment, microprocessors, teletypes, transformers, power supplies, scopes, sig. gen's, motors, peripheral equipment, I.C.'s, tools, components, variacs, keyboards, transistors, microswitches, V.D.U.'s sub-assemblies + thousands of other stock lines. Just a mere fraction of our vast range, is displayed below: 100's of bargains for callers.

TELETYPE ASR33 I/O TERMINALS



From **£195** + CAR + VAT

Fully fledged industry standard ASR33 data terminal. Many features including: ASCII keyboard and printer for data I/O, auto data detect circuitry, RS232 serial interface, 110 baud, 8 bit paper tape punch and reader for off line data preparation and ridiculously cheap and reliable data storage. Supplied in good condition and in working order. Options: Floor stand £12.50 + VAT Sound proof enclosure £25.00 + VAT

ICL TERMPRINTER 300 BAUD TERMINALS



PRICES REDUCED

ONLY £295 + CAR + VAT

Made under licence from the world famous GE Co. The ICL Termpriinter is a small attractive unit with so many features it is impossible to list them in the space available! Brief spec. as follows: RS232 serial interface, switchable baud rates 110, 150, 300, (30 cps), upper and lower case correspondence type face, standard paper, almost silent running, form feed, electronic tab settings, suited for word processor applications plus many more features. Supplied in good condition and in working order. Limited quantity.

SCOOP PURCHASE 12" VIDEO MONITORS



CONNECT DIRECT TO YOUR MICRO

Made by the "BALL MIRATEL" CORPORATION USA, the CO12 is a self contained, mains powered chassis professional monitor. All controls are inbuilt on a single PCB with exception of the brightness control which can be brought out for external use. Many features such as composite video, quoted bandwidth of 19 Mhz, superb linearity and definition make this a must for any MICRO/CCTV application. Brand new and boxed only + carriage £7.50 + VAT. **£97.50 + VAT** Input harness, brightness pot and connector £2.50 + VAT. Dimensions 9"H x 11"D x 11 1/2"W **HURRY WHILE STOCKS LAST**

EX STOCK SOFTY

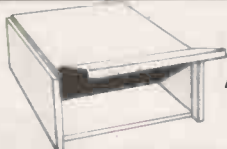
EPROM BLOWER
Software development system invaluable tool for designers, hobbyists, etc. Enables open heart surgery on 2716, 2708 etc. Blows, copies, reads EPROMS or emulates EPROM/ROMRAM in situ whilst displaying contents on domestic TV receiver. Many other features. £115 + carr. + VAT. Optional 2716, 2716 Function Card £40 + VAT. PSU £20 + £1.50 carr. + VAT. Write or phone for more details.

JUST IN

Secondhand chassis 9" Blue-best mains powered, video monitors, composite video input with inbuilt 5v 3 amp DC P.S.U. Tested, but unguaranteed.

£39.99 + £7.50 carriage
Complete with circuit.

EQUIPMENT CASES



GIVE YOUR M.P.U. A HOME ONLY £9.95 + 1.05 pp

Superb professional fully enclosed, made for the G.P.O. to the highest standard, offered at a fraction of their original cost they feature aluminium sides, hinged removable front panel, which can be secured by 2 screws to prevent prying fingers. All are finished in two tone G.P.O. grey and although believed brand new may have minor scuff marks/scratches due to bad storage. Dimensions 16" D x 6 1/2" H x 14 1/4" W

NATIONAL MA1012 LED CLOCK MODULE

- ★ 12 HOUR
- ★ ALARM
- ★ 50/60 HZ



The same module as used in most ALARM/CLOCK radios today, the only difference is our price! All electronics are mounted on a PCB measuring only 3" x 1 1/2" and by addition of a few switches and 5/16 volts AC you have a multi function alarm clock at a fraction of cost. Other features Include snooze timer, am pm, alarm set, power fail indicator, flashing seconds cursor, modulated alarm output etc. Supplied brand new with full data only Suitable transformer £1.75. **£5.25**

SEMICONDUCTOR 'GRAB BAGS'

Amazing value mixed semiconductors, include transistors, digital, linear I.C.'s, triacs, diodes, bridge recs. etc. etc. All devices guaranteed brand new, full spec. with manufacturers markings, fully guaranteed. 50 + BAG £2.95 100 + BAGS £5.15

MUFFIN FANS

Keep your equipment Cool and Reliable with our tested equipment "Muffin Fans" almost silent running and easily mounted. Available in two voltages. 110 V.A.C. £5.05 + pp 90p OR 240v A.C. £6.15 + pp 90p DIMENSIONS 4 1/2" x 4 1/2" x 1 1/2"

ELECTRONIC COMPONENTS & EQUIPMENT

66%
DISCOUNT

Due to our massive bulk purchasing programme which enables us to bring you the best possible bargains, we have thousands of I.C.'s, Transistors, Relays, Cap's., P.C.B.'s, Sub-assemblies, Switches, etc. etc. surplus to our requirements. Because we don't have sufficient stocks of any one item to include in our ads., we are packing all these items into the "BARGAIN PARCEL OF A LIFETIME" Thousands of components at giveaway prices! Guaranteed to be worth at least 3 times what you pay plus we always include something from our ads. for unbeatable value!! Sold by weight

2.5kts £ 4.75 + pp £1.25 5kts £ 6.75 + pp £1.80
10kts £11.75 + pp £2.25 20kts £19.99 + pp £4.75

SAVE OVER £1400

THE PRINTER SCOOP OF THE YEAR THE LOGABAX Z80 MICROPROCESSOR CONTROLLED LX180L MATRIX PRINTER



A massive bulk purchase enables us to offer you this superb professional printer at a fraction of its recent cost of over £2000. Utilising the very latest in microprocessor technology, it features a host of facilities with all electronics on one plug in P.C.B. Just study the specification and you will instantly realise it meets all the requirements of the most exacting professional or hobbyist user.

STANDARD FUNCTIONS ★ Full ASCII character set ★ Standard ink ribbon ★ RS232C/24 serial interface - 7 xtal controlled baud rates up to 9600 ★ 134 characters per line ★ Parallel interface ★ Handshakes on serial and parallel ports ★ 4 Type fonts, italic script, double width, italic large, standard ★ Internal buffer ★ Internal self test ★ 170 CPS ★ Variable paper tractor up to 17.5" wide ★ Solid steel construction ★ All software In 2708 eeproms easily reconfigured for custom fonts etc.

All this and more, not refurbished but BRAND NEW At Only **£525** + VAT + carriage and ins. £18.00 + VAT
OPTIONAL EXTRAS ★ Lower case £25.00 ★ 16K buffer £30.00 ★ Second tractor for simultaneous dual forms £85.00 ★ Logabax maintenance, P.O.A.

MAJOR SAVINGS HARD DISK DRIVES

Another major purchase allows us to bring you the professional technology of hard disk drives at a price you can now afford. Just imagine absolutely masses of correct data transferred or saved on your system by the time your finger leaves the carriage return key!! All drives offered are made to the highest professional standard by the DRE Co., perhaps the largest of UK OEM peripheral manufacturers. All components are batch selected to obtain the utmost reliability and after having run two series 30 and a 4000 drive continuously 24 hours a day for over a year without a single read/write error we can most certainly vouch for the quality.

DIABLO/DRE series 30. Fully refurbished this 2.5 MB drive accepts 2315 exchangeable (via removing top cover) disk cartridges. Sectoring is a feature of the disk pack and may range from 8-48. Fully DEC RK05, Nova, Texas, system compatible. Requires + & -15v DC Supply. Series 30 Drive £475 + VAT Series 30 Front Loader £695 + VAT DC Power Supply £125 + VAT **DRE 4000 B Series, Model 4044.** Technology at its finest, this drive currently manufactured by DRE features 10 MB's of on line storage split into two disk platters, 1, 5 MB fixed and 1 top load 5 MB type 5440 exchangeable cartridge. Features, DC drive motor, built in air conditioning system, write protect, mains powered, etc. Supplied Brand New and Boxed complete with Manual and Rack Slides. Manufacturers current price £3100, our price £1495 + VAT

*For DEC compatibility or alternate sectoring please enquire. Xylogics DEC LS1 11 controller for 4 S30 or 2 4000 drives £850 + VAT Newton Labs S100 controller for 4 S30 or 2 4000 £625 + VAT Controller for TRS80, PET, APPLE, price to be announced. NEW 2315 12 sector disk packs £40 + VAT NEW 5440 any sector packs £48 + VAT **ORDER NOW!!** These prices may never be repeated. Specialist carriage S30 £15.00 + VAT 4000 £20 + VAT.



Dept. P.C. 64-66 Melfort Rd., Thornton Heath, Croydon, Surrey. Tel: 01-689 7702 or 01-689 6800

MAIL ORDER INFORMATION

Unless otherwise stated all prices inclusive of V.A.T. Cash with order. Minimum order value £2.00. Prices and Postage quoted for UK only. Where post and packing not indicated please add 60p per order. Bona Fida account orders minimum £10.00. Export and trade enquiries welcome. Orders despatched same day where possible. Access and Barclaycard Visa welcome.

STEP INTO THE 80's WITH TOMORROW'S WORLD TECHNOLOGY TODAY

THE TANTEL PRESTEL-VEWDATA ADAPTOR

At last this amazing piece of micro technology is available at a price you can afford. Just connect to the aerial socket of any colour or black and white domestic TV receiver and to your Post Office installed jack socket and you are into the exciting world of PRESTEL. Via simple push button use you are able to view a staggering 170,000 pages of up to the minute information on many services and utilities, order goods from companies, even play games!! All this and more without ever leaving your armchair!

ONLY £170
+ £1.75 carr. + VAT
SEND £197.51

RCA FULLY CASED ASCII CODED KEYBOARDS



IDEAL - TANGERINE, OHIO ETC.

Straight from the U.S.A. made by the world famous R.C.A. Co., the VP600 Series of cased freestanding keyboards meet all requirements of the most exacting user, right down to the price! Utilising the latest in switch technology Guaranteed in excess of 5 million operations. The keyboard has a host of other features including full ASCII 128 character set, user definable keys, upper/lower case, rollover protection, single 5V rail, keyboard impervious to liquids and dust, TTL or CMOS outputs, even an on-board tone generator for keypress feedback, and a 1 year full R.C.A. backed guarantee.

VP601 7 bit fully coded output with delayed strobe, etc. **£43.95**
VP611 Same as VP601 with numeric pad. **£54.95**
VP606 Serial, RS232, 20MA and TTL output, with 6 selectable Baud Rates. **£60.95**
VP616 Same as VP606, with numeric pad, Plug and cable for VP601, VP611 £2.25 **£72.50**
Plug for VP606, VP616 **£2.10**
Post, Packing and Insurance. **£1.95**
ORDER NOW OR SEND FOR DETAILS

5v D.C. POWER SUPPLIES

Following the recent "SELL OUT" demand for our 5v 3 amp P.S.U. we have managed to secure a large quantity of ex-computer systems P.S.U.'s with the following spec.: 240 or 110v A.C. input. Outputs of 5v @ 3-4 amps, 7.2v @ 3 amps and 6.5v @ 1 amp. The 5v and 7.2v outputs are fully regulated and adjustable with variable current limiting on the 5v supply. Unit is self contained on a P.C.B. measuring only 12" x 5" x 3". The 7.2v output is ideal for feeding "on board" regulators or a further 3 amp LM323K regulator to give an effective 5v @ 7 amp supply. Supplied complete with circuit at only £10.95 + £1.75pp. Believed working but untested, unguaranteed.

• Circle No. 387

Intex DATALOG LTD

INTEX DATALOG announce the 'PC-BASIC' BASIC compiler for the CBM range of microcomputers

- A program which has been SAVED normally on disk is compiled back onto disk into a directly loadable program file. The compiler is completely written in machine code and is fully compatible with CBM-Microsoft interpreted BASIC.
- It supports all BASIC commands and all CBM peripherals.
- The largest program that can be compiled is about 28K (depending on its structure).
- The increase in speed depends again on the type of program, but P.C.W. benchmark tests indicate that a compiled program will run at up to 10 times faster than its interpreted equivalent.
- Extra facilities available in a compiled program include:- 1) Integer loops for faster execution. 2) RUN/STOP disable/enable command. 3) Optional fully formatted listing of the program as it is compiled. 4) Optional production of a cross reference table of variables and line references at compilation. FULL DETAILS ON REQUEST.

ITEM	PRICE	TOTAL INC. VAT.	ITEM	PRICE	TOTAL INC. VAT.	ITEM	PRICE	TOTAL INC. VAT.	BOOKS	PRICE
DUSTCOVERS			RIBBONS			COMPUTHINK EX. DEMO. DISK UNITS 3000 SERIES			PET & THE IEEE 488 BUS	9.95
PET - ALL MODELS	5.75	6.90	TELETYPE 43	7.72	9.17	400K DISK DRIVES	695.00	799.25	PROGRAMMING A MICRO 6502	7.25
T1743 PRINTER	5.75	6.90	ANADIX DP8000	2.75	3.45	800K DISK DRIVES	895.00	1029.25	A QUICK LOOK AT BASIC	8.95
ANADIX DP8000	3.50	4.35	ANADIX DP9500/1	15.00	18.40				TTL COOKBOOK	7.15
CBM 3040 DISK (4040/8050)	3.50	4.35	CBM 3022	2.75	3.45				TTL EXPERIMENTS VOL 1	7.25
CBM 3022 PRINTER	3.99	4.80	QUME (FABRIC)	4.25	5.18	APPLE SOFTWARE - ON DISKETTE			TTL EXPERIMENTS VOL 2	7.25
COMPUTHINK DISK	3.00	3.75	QUME (CARBON M/S)	4.50	5.46	25% OFF LIST PRICE + VAT.			TV TYPEWRITER COOKBOOK	7.25
ACCUSTIC COVER FOR CBM 3022 PRINTER	49.00	62.00	QUME (CARBON S/S)	5.00	6.04				555 TIMER	5.35
D/O DISKETTES IN FREE CASE			DAISY WHEELS						PROGRAMMING THE 6502	8.75
BASF	35.00	40.83	QUME SPRINT 5	6.50	7.76				6502 APPLICATION BOOK	8.75
VERBATIM	30.00	35.08	PET ENHANCEMENT UNIT						ACCENT ON BASIC	4.95
LIBRARY CASE	3.50	4.60	INCLUDES	45.00	51.75	MAIL ORDER SERVICE BY RETURN OF POST.			ADVANCED BASIC	6.85
BLANK CASSETTES			REPEAT KEYS, KEY CLICK, RESET KEY, MUSIC FACILITY, FOR 374000 SERIES ONLY.			24HR. TELEPHONE ANSWERING SERVICE.			BASIC BASIC	6.75
C15 (PER 10)	4.00	5.75	PROGRAMMERS TOOLKITS	15.00	17.25				BASIC COMPUTER GAMES	5.50
C60 (PER 10)	6.00	8.65	PET DIGITIZER	10.00	11.50	BARCLAYCARD - ACCESS FACILITIES.			THE BASIC HANDBOOK	11.00
CONNECTORS			REPEAT KEY	5.00	5.75				BASIC PRIMER	6.95
USER/IEEE PORT	1.30	1.78	PEISET 1 A 10 0 CONVERTER	99.00	113.85				BASIC PRIMER FOR PET	10.95
CASSETTE PORT	.99	1.43	TCM 100 PRINTER WITH APPLE INTERFACE (Ex Demo)	200.00	230.00				6502 ASSEMBLY LANG. PROG.	10.50
USER PORT COVER	2.50	3.16	PAPER PRINTOUT TRAY						PROG. & INTERFACING THE 6502	4.35
MALE 'D' PLUGS	2.50	3.16	FORMS RECEIVING TRAY						PET LIBRARY OF SUBROUTINES	8.95
FEMALE 'D' SOCKETS	3.50	4.31	(CBM 3022 - DP8000 - MICROTEK)	17.00	19.55				PET LIBRARY OF SUBROUT. DISK	11.50
'D' CONNECTOR COVERS	2.50	3.16								



Barclaycard & Access Welcome

Showroom & Mail Order Departments

Commodore & Pet Software

Appleware & Nascom

Leasing, Hire Purchase, Short Time Hire, ask for written details

Books, Manuals, Accessories, Paper, Diskettes, Cassettes.

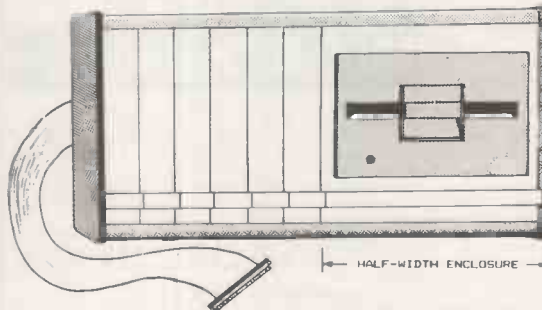
Eaglescliffe Ind. Est. Stockton

Cleveland TS16 0PN Tel(0642) 781193

Intex

• Circle No. 388

CU-DISK FOR AIM 65 OR ACORN ATOM



PRICE OF COMPLETE 1-DISK SYSTEM

AIM 65 TYPE £550
ATOM TYPE £480

The system includes a single sided, single density 5.25" floppy disk drive and floppy disk controller card (which can drive up to 4 disks), all interconnecting cables, half-width enclosure as illustrated above, with built-in power supply, Disk Operating System firmware (in 4K ROM) and user manual. (all items are available separately). The AIM 65 version includes a Cubit interface card for making the AIM/Acorn bus connection, and the Atom version includes a connector for the Atom board.

The full width (12") version of the illustrated enclosure is also available, and will take two disks, or one disk and six card modules, or twelve card modules. It is of metal construction, and is stackable.

CONTROL UNIVERSAL SUPPLY ACORN, ROCKWELL, CUBIT, ASTEC, SEIKOSHA, G.P. INDUSTRIAL ELECTRONICS, AND MANY MORE. SEND FOR FREE CATALOGUE.

CONTROL UNIVERSAL LTD

11-15 Bush House, Bush Fair, Harlow, Essex.
tel Harlow (0279) 31604/ 412043

• Circle No. 389

May the Force be with you...

Businessmen and professional people alike can rid themselves of day-to-day problems and increased workload with a microcomputer.

Just a few tasks a microcomputer could be organising for your company, division or department:-

- Accountants
- Estate Agents
- Retailers
- Insurance Brokers
- Doctors
- Dentists
- Solicitors
- Architects
- Engineers
- Chemists
- Farmers
- Bankers
- Teachers

to name but a few



- Integrated Accounts
- Sales Ledger
- Purchase Ledger
- Nominal Ledger
- Sales Forecasting
- Stock Control
- Job Costing
- Estimating
- Payroll
- Word Processing

(automatic compilation, editing and production of repetitive letters and documents).



	PET	APPLE II	SHARP	SUPERBRAIN	RAIR
SYSTEM A Basic computer including screen & keyboard	£399	£775	£450	—	—
SYSTEM B As 'A', plus floppy disk drive(s) and matrix printer for small business user.	£1700	£1655	£1750	£2200	£2480
SYSTEM C As 'B', but quality printer for word processing instead.	£2700	£2050	£2250	£2600	£2850
SYSTEM D As 'C', plus hard disk for up to 10,000,000 bytes on line.	—	£5550	—	—	£5350

Prices exclude V.A.T. Rental, Leasing, and/or Maintenance Contracts plus System Software Consultancy available.

Johnson

microcomputers

A member of the T. V. Johnson Group



Johnson House, 75-79 Park Street,
Camberley Surrey. Telephone 0276 20446
48 Gloucester Road, Bristol. Telephone 0272 422061
148 Cowley Road, Oxford. Telephone 0865 721461

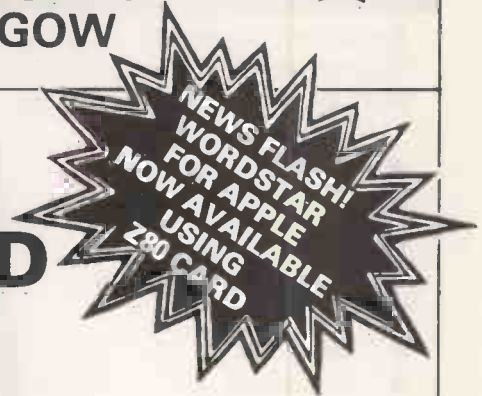
● Circle No. 390

GATE MICROSYSTEMS LIMITED
MICROCOMPUTER SALES + SUPPORT
NOW IN DUNDEE + GLASGOW



Announce: —

THE
 MICROSOFT
Z80 SOFTCARD
 FOR YOUR
APPLE II PLUS



- * Z80 Softcard is a circuit board with a Microprocessor and I/O Circuitry which plugs into any slot (except 0 in your APPLE).
- * Z80 Softcard allows you to run CP/M, CP/M based languages and CP/M application programs on your APPLE.

- * Z80 Softcard enables you to switch your APPLE back and forth from 6502 processing to Z80 processing via a single instruction.
- * Z80 Softcard gives you Microsoft Basic 5.0 on your APPLE.

PRICE **£200.00** EX VAT

GATE MICROSYSTEMS LTD
 THE NETHERGATE CENTRE
 66, NETHERGATE, DUNDEE DD1 4ER (0382) 28194

GATE MICROSYSTEMS LTD
 ABBEY HOUSE; 10 BOTHWELL STREET
 GLASGOW G2 6NU 041-221-9372

• Circle No. 391

new...new..

COBOL on a PET?
FORTRAN on a PET?
WORDSTAR™ on a PET?
in fact... CP/M on a PET!

The CP/M Box plugs into the IEEE port on the back of your PET and instantly, you have 60K CP/M 2.2 up and running. You now have access to the vast range of languages and software available under the worlds most popular operating system. Housed in a compact box, it utilises existing PET disc drives.

£550 +VAT

SEE US AT THE PET SHOW!

from small systems 2-4 Canfield Place London NW6 3BT Telephone

01 328 7145 Telex 27950

• Circle No. 392

PRACTICAL COMPUTING July 1981

apple®][PLUS Financial Modelling

© Apple is a trade mark of Apple Computer Inc., Cupertino, CA. USA.



Complete Systems from

£ 1200

STARTING WITH:

- 48k Apple II plus
- Disc Drive with Controller
- Choice of 12" Monitor
(Green/Orange/B & W)
- Visicalc

Open Saturday
(All Day)

London Office
Opening Soon

Supplies of Apple III
suspended

Authorized Apple Dealer

QUESTEL

We supply all Apple products at competitive prices

For Free Advice

Telephone: 0273-695264

15 GRAND PARADE, BRIGHTON, SUSSEX, BN2 2QB

• Circle No. 393

Sole UK distributors for Instant Software™

Please tick the programs you require and use this page as your order form.

(C) Cassette
(D) Disk

**DEALER ENQUIRIES
INVITED**

TRS-80 SOFTWARE

Level II Games - Cassette

- | | |
|--|--------|
| <input type="checkbox"/> Space Trek II | £6.50 |
| <input type="checkbox"/> Space Trek IV | £6.50 |
| <input type="checkbox"/> Ham Package I | £6.50 |
| <input type="checkbox"/> Electronics I | £6.50 |
| <input type="checkbox"/> Oil Tycoon | £6.50 |
| <input type="checkbox"/> Romrom Patrol | £6.50 |
| <input type="checkbox"/> Santa Poravia/Fiumaccio | £6.50 |
| <input type="checkbox"/> Demo II | £6.50 |
| <input type="checkbox"/> Demo III | £6.50 |
| <input type="checkbox"/> Air Flight Simulation | £8.50 |
| <input type="checkbox"/> Cribbage/Checkers | £8.50 |
| <input type="checkbox"/> Skirmish 80 | £8.50 |
| <input type="checkbox"/> Othello | £8.50 |
| <input type="checkbox"/> Grade Book | £8.50 |
| <input type="checkbox"/> Bell Turret Gunner | £8.50 |
| <input type="checkbox"/> Teacher | £8.50 |
| <input type="checkbox"/> Amateur Radio | £8.50 |
| <input type="checkbox"/> Polygons | £8.50 |
| <input type="checkbox"/> Chessmate 80 | £16.50 |

Adventure International

- | | |
|---|--------|
| <input type="checkbox"/> Adventureland (C) | £12.50 |
| <input type="checkbox"/> Pirate's Adventure (C) | £12.50 |
| <input type="checkbox"/> Mission Impossible (C) | £12.50 |
| <input type="checkbox"/> —All three on disk | £33.00 |
| <input type="checkbox"/> Voodoo Castle (C) | £12.50 |
| <input type="checkbox"/> The Count (C) | £12.50 |
| <input type="checkbox"/> Strange Odyssey (C) | £12.50 |
| <input type="checkbox"/> —All three on disk | £33.00 |
| <input type="checkbox"/> Mystery Fun House (C) | £12.50 |
| <input type="checkbox"/> Pyramid of Doom (C) | £12.50 |

- | | |
|--|--------|
| <input type="checkbox"/> Ghost Town (C) | £12.50 |
| <input type="checkbox"/> —All three on disk | £33.00 |
| <input type="checkbox"/> Star Trek (C) | £12.50 |
| <input type="checkbox"/> Star Trek (D) | £16.50 |
| <input type="checkbox"/> Galactic Empire (C) | £12.50 |
| <input type="checkbox"/> Galactic Empire (D) | £16.50 |
| <input type="checkbox"/> Slag (C) | £12.50 |
| <input type="checkbox"/> Kid Ventures (C) | £12.50 |
| <input type="checkbox"/> Galactic Saga (C) | £12.50 |
| <input type="checkbox"/> House of 30 Gables (C) | £12.50 |
| <input type="checkbox"/> Six Micro Stories (D) | £12.50 |
| <input type="checkbox"/> Local Call for Death (D) | £16.50 |
| <input type="checkbox"/> Two Heads of the Coin (D) | £16.50 |
| <input type="checkbox"/> Dragonquest (D) | £16.50 |
| <input type="checkbox"/> Savage Island (D) | £16.50 |
| <input type="checkbox"/> Galactic Trilogy (D) | £33.00 |

TRS-80 Utilities

- | | |
|--|--------|
| <input type="checkbox"/> Utility I (C) | £8.50 |
| <input type="checkbox"/> Utility II (C) | £8.50 |
| <input type="checkbox"/> The Disassembler (C) | £8.50 |
| <input type="checkbox"/> TRS-80 Tests (C) | £8.50 |
| <input type="checkbox"/> Basic Programming Assistant (C) | £12.50 |
| <input type="checkbox"/> Labeling Disassembler (C) | £12.50 |
| <input type="checkbox"/> Labeling Disassembler (D) | £16.50 |
| <input type="checkbox"/> Disk Scope (D) | £16.50 |
| <input type="checkbox"/> Utility Pack (D) | £16.50 |
| <input type="checkbox"/> IRV (C) | £20.50 |
| <input type="checkbox"/> IRV (D) | £24.50 |
| <input type="checkbox"/> Enhanced Basic (C) | £20.50 |
| <input type="checkbox"/> Master Directory (D) | £24.50 |
| <input type="checkbox"/> Disk Editor (D) | £33.00 |
| <input type="checkbox"/> Find-it Quick (D) | £41.00 |
| <input type="checkbox"/> Oracle 80—Forecasting (D) | £81.82 |

APPLE II SOFTWARE

- | | |
|--|--------|
| <input type="checkbox"/> Golf (C) | £6.50 |
| <input type="checkbox"/> Mimic (C) | £6.50 |
| <input type="checkbox"/> Bowling Trilogy (C) | £6.50 |
| <input type="checkbox"/> Math Tutor I (C) | £6.50 |
| <input type="checkbox"/> Math Tutor II (C) | £6.50 |
| <input type="checkbox"/> Sahara Warriors (C) | £6.50 |
| <input type="checkbox"/> Space Wars (C) | £6.50 |
| <input type="checkbox"/> Oil Tycoon (C) | £8.50 |
| <input type="checkbox"/> Air Flight Simulation (C) | £8.50 |
| <input type="checkbox"/> Super Shooters (C) | £8.50 |
| <input type="checkbox"/> Santa Poravia/Fiumaccio (C) | £8.50 |
| <input type="checkbox"/> Santa Poravia/Fiumaccio (D) | £16.50 |
| <input type="checkbox"/> Dr Chips (D) | £12.50 |
| <input type="checkbox"/> Math Fun (D) | £16.50 |
| <input type="checkbox"/> Apple Fun (D) | £16.50 |
| <input type="checkbox"/> Finance & Investment (D) | £16.50 |
| <input type="checkbox"/> Paddle Fun (D) | £16.50 |
| <input type="checkbox"/> Skybombers II (D) | £16.50 |
| <input type="checkbox"/> Apple Clinic (D) | £20.50 |
| <input type="checkbox"/> Astrology (D) | £24.50 |
| <input type="checkbox"/> Solar Energy (D) | £28.50 |

Adventure International

- | | |
|---|--------|
| <input type="checkbox"/> Asteroid (D) | £16.50 |
| <input type="checkbox"/> Adventureland/Pirate's Adventure | |
| <input type="checkbox"/> Mission Impossible | |
| <input type="checkbox"/> —all three on disk | £33.00 |
| <input type="checkbox"/> Voodoo Castle/The Count/Strange Odyssey | |
| <input type="checkbox"/> —all three on disk | £33.00 |
| <input type="checkbox"/> Mystery Fun House/Pyramid of Doom/Ghost Town | |
| <input type="checkbox"/> —all three on disk | £33.00 |

PET SOFTWARE (cassette)

- | | |
|--|-------|
| <input type="checkbox"/> Ham Package I | £6.50 |
| <input type="checkbox"/> Dungeon of Death | £6.50 |
| <input type="checkbox"/> Casino I | £6.50 |
| <input type="checkbox"/> Casino II | £6.50 |
| <input type="checkbox"/> Checkers & Baccarat | £6.50 |
| <input type="checkbox"/> Tangle/Supertrap | £6.50 |
| <input type="checkbox"/> Cubic 4/Go-Moku | £6.50 |
| <input type="checkbox"/> PET Demo | £6.50 |
| <input type="checkbox"/> Mimic | £6.50 |
| <input type="checkbox"/> Penny Arcade | £6.50 |
| <input type="checkbox"/> Arcade I | £6.50 |
| <input type="checkbox"/> Arcade II | £6.50 |
| <input type="checkbox"/> Turf & Target | £6.50 |
| <input type="checkbox"/> Chimera | £6.50 |
| <input type="checkbox"/> Code Name Cipher | £6.50 |
| <input type="checkbox"/> Trek-X | £6.50 |
| <input type="checkbox"/> Pet Utility I | £6.50 |
| <input type="checkbox"/> Hoodtoddle | £6.50 |
| <input type="checkbox"/> Santa Poravia/Fiumaccio | £6.50 |
| <input type="checkbox"/> Electronic Engineer ACS | £8.50 |

All prices include 15% VAT and inland postage and packing. Send 50p for comprehensive catalogue. Please supply the software programs I have marked.

Name _____

Address _____

Phone _____ (Day/Evg)

TRS-80 trademark of Tandy Corp. Apple trademark of Apple Inc. PET trademark of CBM Inc.

CALISTO

COMPUTERS LIMITED

SPECIALISTS IN MICROCOMPUTER HARDWARE & SOFTWARE

119 John Bright Street, Birmingham B1 1BE. Phone 021-632 6458.

• Circle No. 394

MICRO-80

UK Subscription Dept.

24 Woodhill Park Pembury Tunbridge Wells Kent TN2 4NW

DO YOU KNOW the cure for the Summer Time Blues?

PERK-UP your computing with a subscription to MICRO-80.

EVERY MONTH we publish at least one application program in Level 1 BASIC, one in Level 11 BASIC and one in DISK BASIC (or disk compatible Level 11) plus utility programs in Level 11 BASIC and Machine Language

MICRO-80. The specialist monthly magazine for the TRS-80 and Video Genie user.

Please send me a sample copy. I enclose £1.50

or Please enrol me for an annual subscription. I enclose £16.00

(tick the box and enclose your cheque/P.O. made payable to MICRO-80 for the correct amount and send to the above address)

Name.....

BLOCK CAPITALS PLEASE

Address.....

THE VIDEO GENIE SYSTEM

Ideal for small businesses, schools, colleges, homes, etc. Suitable for the experienced, inexperienced, hobbyist, teacher, etc.

EXTENDED GUARANTEE BY COMPUKARE

16K
£279
VAT

EG3000
Series

WITH
NEW
EXTRA
KEYS!

● 16K user RAM plus extended 12K Microsoft BASIC in ROM ● Fully TRS-80 Level II software compatible ● Huge range of software already available ● Self contained, PSU, UHF modulator, and cassette ● Simply plugs into video monitor or UHF TV ● Full expansion to disks and printer ● Absolutely complete — just fit into mains plug.

YOUR ZX80 IS NOW NO LONGER REDUNDANT

Upgrade your ZX80 to the full animated graphics of the ZX81. (No screen flicker). For only £12.95 + VAT, in kit form. Works only in conjunction with new 8K ROM from Sinclair (not included).

EXTENDED GUARANTEE BY COMPUKARE

WE ARE NOW STOCKING THE AUTOSTART APPLE II AT REDUCED PRICES



EXTENDED GUARANTEE BY COMPUKARE

16K £549
32K £579
48K £599

Getting Started APPLE II is faster, smaller, and more powerful than its predecessors. And it's more fun to use too because of built-in features like:

- BASIC — The Language that Makes Programming Fun.
- High-Resolution Graphics (in a 54,000 Point Array) for Finely-Detailed Displays.
- Sound Capability that Brings Programs to Life.
- Hand Controls for Games and Other Human-Input Applications.
- Internal Memory Capacity of 48K Bytes of RAM, 12K Bytes of ROM; for Big-System Performance in a Small Package.
- Eight Accessory Expansion Slots to let the System Grow With Your Needs.

You don't need to be an expert to enjoy APPLE II. It is a complete, ready-to-run computer. Just connect it to a video display and start using programs (or writing your own) the first day. You'll find that its tutorial manuals help you make it your own personal problem solver.

INTRODUCING

THE NEW & EXCITING TRS80 MODEL III



EXTENDED GUARANTEE BY COMPUKARE

16K £559 + VAT 32K £589 + VAT 48K £619 + VAT

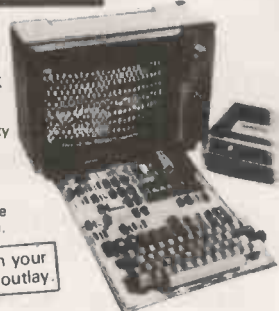
The Radio Shack TRS 80™ Model III is a ROM-based computer system consisting of:

- A 12-inch screen to display results and other information
 - A 65-key console keyboard for inputting programs and data to the Computer
 - A Z-80 Microprocessor, the "brains" of the system
 - A Real-Time Clock
 - Read Only Memory (ROM) containing the Model III BASIC Language (fully compatible with most Model I BASIC programs)
 - Random Access Memory (RAM) for storage of programs and data while the Computer is on (amount is expandable from "16K" to "48K", optional extra)
 - A Cassette Interface for long-term storage of programs and data (requires a separate cassette recorder, optional/extra)
 - A Printer Interface for hard-copy output of programs and data (requires a separate line printer, optional/extra)
 - Expansion area for upgrading to a disk-based system (optional/extra)
 - Expansion area for an RS-232-C serial communications interface (optional/extra)
- All these components are contained in a single moulded case, and all are powered via one power cord.

EUROPE'S FASTEST SELLING ONE BOARD COMPUTER

COMPUKIT UK101

★ 6502 based system — best value for money on the market. ★ Powerful 8K Basic — Fastest around ★ Full Qwerty Keyboard ★ 4K RAM Expandable to 8K on board. ★ Power supply and RF Modulator on board. ★ No Extras needed — Plug-in and go ★ Kansas City Tape Interface on board. ★ Free Sampler Tape including powerful Disassembler and Monitor with each Kit. ★ If you want to learn about Micros, but didn't know which machine to buy then this is the machine for you.



Build, Understand and Program your own Computer for only a small outlay.

NEW MONITOR IN ROM available separately £22 + VAT
Revised BASIC 3 ROM — contains cure for GARBAGE collection routine — allows correct use of STRING ARRAYS. Suitable for CompuKit or SuperBoard £7.50 + VAT.

FOR THE COMPUKIT — Assembler Editor £14.90 Screen Editor Tape £1.90
GAME PACKS — 1). Four Games £5.00 2). Four Games £5.00 3). Three Games 8K only £5.00
Super Space Invaders (8K) £6.50 Space Invaders £5.00 Chequers £3.00 Realtime Clock £3.00
Case for CompuKit £29.50 40 pin Expansion Jumper Cable £8.50 All Prices exclusive VAT

NEW ISSUE COMPUKIT WITH ALL THE FEATURES THAT MADE IT THE MOST PROFESSIONAL COMPUTER KIT ON THE MARKET. Now WITH FREE NEW EXTENDED MONITOR (a saving of £22), which includes Flashing Cursor, Screen Editing, & Save Data on Tape.

KIT ONLY £149 + VAT
Fully Assembled — £199 + VAT
DEALER ENQUIRIES INVITED

4K Upgrade Kit £15.90 + VAT

NEW REDUCED PRICES

8K £399
16K £449
32K £499

VAT

RRP £795 for 32K



The PEDIGREE PETS Very popular for home & business use 8K Microsoft Basic in ROM 8K Pet 32K & 16K with new improved keyboard. All with green screen.

Cassette Deck £55 extra Full range of software available
Interface PET IEEE — Centronics Parallel
Decoded £77.00 + VAT

SPECIAL SCOOP

GET YOURSELF A NEW MX80 PRINTER AND SAVE A FORTUNE

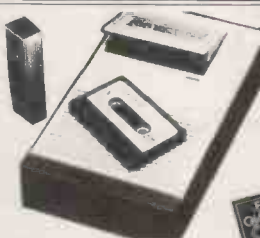
only £299 + VAT

Interface Cards for Apple, Pet, TRS80, Nascom and CompuKit — RS232 Interface Cards not necessary for parallel. £49 + VAT

Full TRS80/Genie Graphics including cables. Ready to go. **EX-STOCK.**



Now Available Fiction Feed Option £49 + VAT



NOW AVAILABLE PANASONIC KX-T1520 AUTOMATIC ANSWERING SYSTEM £190 + VAT

LOW COST TELEPHONE ANSWERING MACHINE

only £99.95 + VAT

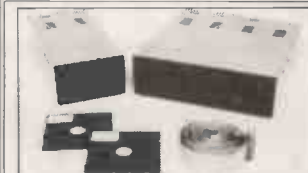
Microprocessor controlled answering machine. Plug into your phone line. Records any phone call messages. Remote bleeper enables you to listen to your messages from anywhere in the world. Uses standard cassettes. Comes complete with mains adaptor, microphone, remote bleeper, base unit, cassette with 30 sample pre-recorded messages.

HITACHI PROFESSIONAL MONITORS

9" — £129 £99.95
12" — £199 £149

- Reliability Solid state circuitry using an IC and silicon transistors ensures high reliability.
- 500 lines horizontal resolution Horizontal resolution in excess of 500 lines is achieved in picture center.
- Stable picture Even played back pictures of VTR can be displayed without jittering.
- Looping video Input Video input can be looped through with built-in termination switch.
- External sync operation (available as option for U and C types)
- Compact construction Two monitors are mountable side by side in a standard 19-inch rack.

TEAC DISK DRIVES



- TEAC FD-50A has 40 tracks giving 125K Bytes unformatted single density capacity.
- The FD-50A can be used in double density recording mode.
- The FD-50A is Shugart SA400 interface compatible.
- Directly compatible with Tandy TRS80 expansion interface.
- Also interfaces with Video Genie, SWTP, Heathkit, North Star Horizon, Superbrain, Nascom, etc, etc.
- Address selection for Daisy chaining up to 4 Disks.
- Disks plus power supply housed in an attractive grey case.

40 TRACK
Single Disk Drive £225 + VAT Double Disk Drive £389 + VAT
77 TRACK
Single Disk Drive £299 + VAT Double Disk Drive £499 + VAT



SHARP PC1211

£79.90 + VAT

COMPUTER POWER THAT ONCE FILLED A ROOM CAN NOW BE CARRIED IN YOUR POCKET!
● Programs in BASIC ● "QWERTY" Alphabetic Keyboard ● 1.9K Random Access Memory ● Long Battery Life.



"Europe's Largest Discount Personal Computer Stores"

Delivery is added at cost. Please make cheques and postal orders payable to **COMP SHOP LTD.**, or phone your order quoting **BARCLAYCARD, ACCESS, DINERS CLUB or AMERICAN EXPRESS** number.

MAIL ORDER AND SHOP:

14 Station Road, New Barnet, Hertfordshire, EN5 1QW (Close to New Barnet BR Station — Moorgate Line). Telephone: 01-441 2922 (Sales) 01-449 6596 Telex: 298755 TELCOM G

OPEN (BARNET) — 10am - 7pm — Monday to Saturday

NEW WEST END SHOWROOM:

311 Edgware Road, London W2. Telephone: 01-262 0387

OPEN (LONDON) — 10am - 6pm — Monday to Saturday

● IRELAND: 80 Marlborough Street, Dublin 1. Telephone: Dublin 749333

● COMP SHOP USA, 1348 East Edinger, Santa Ana, California, Zip Code 92705. Telephone: 0101 714 5472526

CREDIT FACILITIES ARRANGED — send S.A.E. for application form.

TELEPHONE SALES

OPEN 24 hrs. 7 days a week
01-449 6596



• Circle No. 396

intracept

USER-DEFINED GRAPHICS

For Nascom 1 & 2 (or similar Microcomputer)

- * 64 Defineable characters (16x8 dot matrix) – expandable to 128
- * No soldered connections to Nascom 2 – simply plug in. (Details given of minor modification required for Nascom 1).
- * May be used in conjunction with existing graphics ROM. (Software options allow 256 characters to be displayed from all three sources [i.e. Alpha-numeric, Graphic ROM & user-defined] at the same time).
- * Bus expansion NOT required. (May be used on unexpanded Nascom 1!) – characters are programmed through the parallel ports.

USER-DEFINED COLOUR GRAPHICS

- * Used in conjunction with above, enables each of the 256 characters (including alphanumeric) to be INDIVIDUALLY programmed with 16 foreground and 16 background colours.
- * On-board expansion to maximum 128 user-defined characters. Price to be announced.



INTRACEPT ELECTRONICS LTD
(Dept PC3) 203 Picton Road, Liverpool
L15 4LG.
Tel: 051-733 3042. Extn. 143

• Circle No. 397



GAMES

Hi-Res SOCCER:

The only real-time action SOCCER game for your Apple. All tackling, goal kicks, throw-ins, corners, are shown in full Hi-Res graphics. Fully animated players.

£22.95

Allen Rain:

The aliens swoop down from all sides in swift attack. Formerly sold as Apple Galaxian.

£12.95

Snoggle:

You are Snoggle, wending your way through a maze of ghosts who will eat you if they catch you. You must be quick and bold. Please note, the upper levels of this game are very difficult.

£12.95

Space Eggs:

A terrific arcade-style game. You will be hatching little spiders, wolves, liss, & fuzballs!!!

£14.95

The Wizard & The Princess.

In this adventure you must do battle against an evil wizard to save the life of the Princess.

£17.95

Tarturian:

As you explore 160 rooms you gather weapons & treasure for the final battle against the Tarturian.

£14.95

Creation Venture:

You have inherited your Uncle Stashback's mansion. You must rid it of the horrible creatures to find your uncle's buried treasure.

£14.95

THE GALACTIC SAGA:

The Galactic Empire I	£12.95	The Galactic Revolution III	£12.95
The Galactic Trader II	£12.95	Tawala's Last Redoubt	£14.95

Add 15% V.A.T. Postage & Packing Free
Write or phone for full catalogue of available software.
Dealer Enquiries Welcome.

Contact: S. B. D. SOFTWARE

15, Jocelyn Road, Richmond TW9 2TJ. Tel: 01-948 0461
Telex: 22861

• Circle No. 398

TRIDATA COMPLETE BUSINESS SOFTWARE PACKAGES

- | | |
|-------------------|-----------------------|
| * SALES INVOICING | for use on |
| * SALES LEDGER | * TANDY TRS 80 |
| * PURCHASE LEDGER | * TANDY TRS 80 Mk. II |
| * NOMINAL LEDGER | * SHARP MZ-80K |
| * PAYROLL | * PET AND SUPERPET |
| * STOCK CONTROL | * APPLE |

Our business packages are supplied with master diskettes, detailed operating manuals and training procedures. For small businesses and traders with up to 700 employees, 9,999 customers and 9,999 suppliers, our proven programs written by experienced DP professionals provide fast, simple control, with built in security routines for prevention of unauthorised use, abuse or mishandling. Over 550 Tridata business systems are now in use.

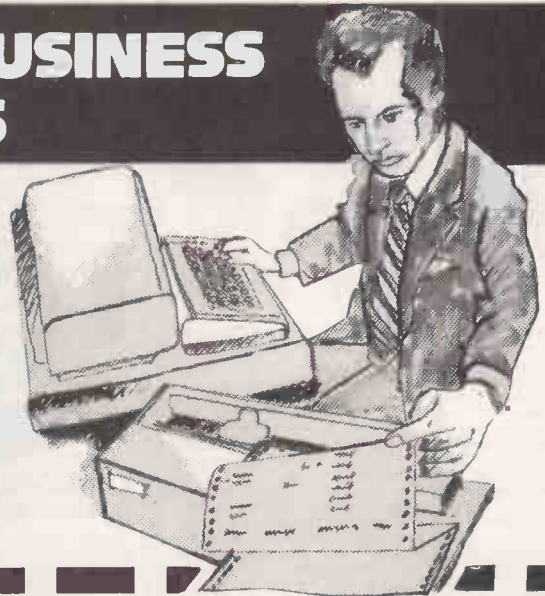
TRIDATA WARRANTY

Every Tridata program has a written 12 month warranty and can be automatically updated to conform to any legislation that may alter your accounting procedures.



SEND THE COUPON TODAY
OR TELEPHONE
021-622 6085

TRIDATA MICROS LTD., Smithfield House, Digbeth, Birmingham



Send me details of the Tridata Business Software Systems. I am interested in

PURCHASE LEDGER	For TANDY TRS 80
SALES LEDGER	TANDY TRS 80 Mk. II
PAYROLL	SHARP MZ-80K
NOMINAL LEDGER	PET
SALES INVOICING	SUPERPET
STOCK CONTROL	APPLE

Name _____ PC7/81

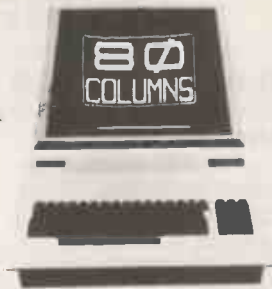
Company _____

Address _____

TRIDATA MICROS LTD., Smithfield House, Digbeth, Birmingham B5 6BS

• Circle No. 399

Commodore official distributors



4008/16/32
8032 - 8050

NEW DAISYWHEEL PRINTER IN STOCK
NEW MATRIX PRINTER NOW IN STOCK
THE RELIABLE VALUE FOR MONEY SYSTEM
WITH FULL AFTER SALES SUPPORT.



48K £695
DISK WITH CON. £383

DISK ... £299
FULL RANGE OF
MONITORS
B/W - GREEN OR
COLOUR.
PAPER TIGERS.

Apple authorised distributors
The sophisticated quality system with
a reputation for advanced design and
innovation.



64K S/D £1650
64K QD £2150
64K +
1.5 MEG £2750
FULLY
INTERGRATED
ACCOUNTS
PACKAGE.

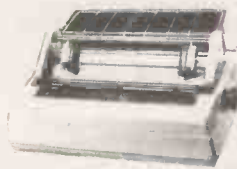
SHARP Z80K

20K £410
DISK DRIVES
PRINTERS ETC.



The incredible computer system
now available ex-stock including the
New Dual Drive Double Sided Floppy Disk.

TOMORROW TODAY at Birmingham Computer Centre



The Nexos Ricoh RP 1600 Daisywheel Printer with the unique Double Daisy. She's tough - and fast. Two characters per petal, plus rugged dual-plastic construction add up to double your printer - 60cps with the excellent print quality you need - for less than you need to pay.

SCRIPTA

£950/RO £825



The SCRPTA RO (receive only) model and the SCRIPTA KSR model which incorporates a full electronic typewriter keyboard, including auto corrector facility. Both models are available with IEEE, RS232 Serial and Parallel Interfaces. So if you have a COMMODORE, APPLE, TANDY, SUPERBRAIN, NORTHSTAR HORIZON, CROMENCO, SORCERER, SHARP 3807 etc.

£420



MPI 88G

- Full dot addressable graphics
- 1K buffer standard, 2K optional
- Tractor, Paper roll or single sheet feed
- Bidirectional 100 cps. impact printing
- ASCII, 20m/A loop, RS232, IEEE
- 80, 96 and 132 ch per line
- 96 ch ASCII. Upper, lower case + NLQ 11 x 7.



DOLPHIN BD-80P

£525

- Full 96 character ASCII character set with 7 x 9 matrix.
- Plus 64 graphics characters with 7 x 11 character font.
- PLUG IN INTERFACES FOR SERIAL (RS232), PARALLEL (CENTRONICS), IEEE (PET), V24 (20 m.a. current loop)

CAMDEN ELECTRONICS LTD

MICROCOMPUTER SYSTEMS

462 COVENTRY ROAD · SMALL HEATH · BIRMINGHAM B10 0UG
Telephone: 021-773 8240 or 021-772 5718 · Telex: 335909 (Camden G)



• Circle No. 400

COMPUTERS

From as little as £20 per week for your own business system with video screen, keyboard, twin floppy disk unit and printer. Choose any of the software programs available i.e.:

- ★ Word processing
- ★ Payroll
- ★ Invoicing
- ★ Stock control
- ★ Book-keeping
- ★ Incomplete records
- ★ Time recording
- ★ Information retrieval
- ★ Cash flow
- ★ Projection analysis

And when you've finished your easy days work we've got a few games for you to relax to including Space Invaders.

We have first hand experience in dealing with businesses and can offer you expert advice in setting up your very first system.

We can also offer installation, training and maintenance contracts.

NOW IS THE TIME

EXTRAS & OPTIONS

Floppy disks
Continuous Stationery
Daisywheels
Automatic sheet feeder
Tractor feed
Daisy wheels
Printer ribbons

Special desk work station

Lockable disk boxes
Payslips
Sound boxes
HARDWARE
CBM 3032 Computer
CBM 3040 Floppy
CBM 3022 Printer

Call into the

CBM 8032 Computer (new model)

CBM 8050 Floppy (New model)
Qume Springs Daisy Wheel Printer
SERVICES
Installation
Training
Maintenance
After Sales Service

DA VINCI COMPUTER SHOP

65 High St., Edgware, Middx.

Tel. 952 0526

Open Mon-Fri. 9.5.30. Sat 9.30-5.00
or send for details



BARCLAYCARD

VISA



Floppy Discs £2 each + VAT.

Qume sprint 5 £1,595 + VAT.

CBM 8026 Daisywheel Printer inc Keyboard
£995 + VAT.

• Circle No. 401

CROYDON COMPUTER CENTRE

Part of the Zero One Electronics Ltd Gp.

YOUR BEST BUY FOR PRINTERS!

Just look at these prices:

OKI MICROLINE 80 £299

Pin, centronics interface complete with paper rack. Quiet and reliable.

OKI MICROLINE 82 £399

Bidirectional built in RS232 & centronics.

OKI MICROLINE 83 £799

120 cps big brother of best selling 80 and 82.

All OKI printers designed for NO routine maintenance.

SEIKOSHA GP80A £199

The cheapest on the market, centronics interface pin feed.

ANACOM 150 £695

High speed (150cps) 9 x 9 dot matrix with centronics interface. 3-15' tractor feed.

All printers serviced on our premises.

Many more Summer offers, eg Video Genie £299, Superbrain from £1950, Sharp from £600. We will be happy to quote for all your computing requirements, machines printers paper etc. Please send SAE for details or call in.

All prices exclude VAT and carriage.

CROYDON COMPUTER CENTRE

29A BRIGSTOCK RD, THORNTON HEATH, SURREY CR4 7JJ

01-689 1280

Unsure of what to buy?

Why not hire and try?

• Circle No. 402

IBM SELECTRIC GOLFBALL PRINTERS

AND

INPUT, OUTPUT 735 TYPEWRITERS

PRINTERS FROM £195.00

735 TYPEWRITERS FROM £245.00

WIRING AND COMMISSION TO SUIT

ACULAB INTERFACE £ 48.00

ACULAB INTERFACES EX STOCK £155.00

ALSO AVAILABLE IBM 71, 72, 82 typewriters

Full workshop facilities for rebuilds and servicing.
Keyboard ASCID-ASCII, 10-12 pitch, language conversions undertaken.

11", 13", 15" platen lengths, split platens pin feed

platens. Operational keylever repeats fitted on request.

Full IBM range of 10-12* pitch heads including language, symbol and metric.

Language keybuttons blue or grey.

WE BUY SELL OR EXCHANGE ALL IBM SELECTRIC TYPEWRITER MODELS

FOR FURTHER DETAILS PHONE **STUART KIRBY OR LOUIS BAKER**

KEYTRONICS

SAUL LODGE SAUL GLOUCESTER GL2 7JE
TEL. 0452 740 612

PRICES EXCL VAT @ 15%
& CARRIAGE & PACKING
CALLERS BY APPT ONLY PLEASE

• Circle No. 403

The unique Computer Supermarket brings you computer hardware at cash-and-carry prices

SHARP, COMMODORE, TEXAS, TANGERINE EQUIPMENT

Fully tested before despatch, or collection complete with instruction manuals, tapes, fitted 13amp plugs.

SHARP EQUIPMENT

Model	User Ram	exc VAT	Inc VAT
MZ80K	20K Ram	399.00	458.85
MZ80K	36K Ram	435.00	500.25
MZ80K	48K Ram	499.00	573.85
MZ80FD	Floppy Disc	589.00	677.35
MZ80P	Printer	385.00	442.75
MZ801/0	Input/Output Unit	87.00	100.05

FREE LEDGER & STOCK CONTROL PROGRAM WITH EVERY COMPLETE SHARP SYSTEM, i.e. 48K Sharp, Twin Floppy Disc, Printer & I/O Unit.

PC1211	95.00	109.25
CE122	70.00	80.50

COMMODORE EQUIPMENT

Model	User Ram	exc VAT	Inc VAT
4008	40 Col. PET 8K Mem	378.00	434.70
4016	40 Col. PET 16K Mem	462.00	531.30
4032	40 Col. PET 32K Mem	585.00	672.75
8032	80 Col. PET 32K Mem	755.00	868.25
4040	347K Disk	585.00	672.75
8050	1M Byte Disk	755.00	868.25
4022	Printer	357.00	410.55
8024	Printer	975.00	1,121.25
8026	Printer	835.00	960.25
C2N	Cassette	47.00	54.05
VIC	Personal Computer	160.00	184.00

TEXAS EQUIPMENT

TI-99/4	345.00	396.75
---------	--------	--------

(New lower price NOW for PAL European version)

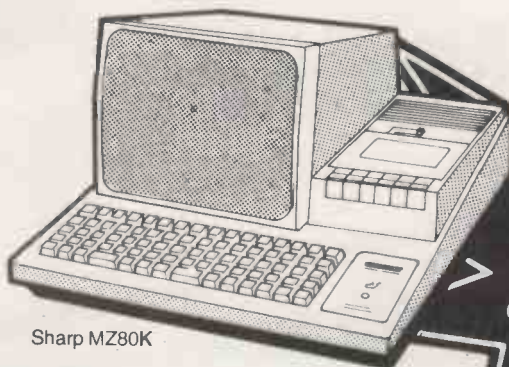
TANGERINE EQUIPMENT

Tantel Prestel Adaptor 170.00 195.50
Full colour output. Connects to any TV. Full British Telecom approval. Requires British Telecom 96A jack plug. Gives access to massive home computer base. Information from Mortgages to Theatres, Stocks to Holidays.

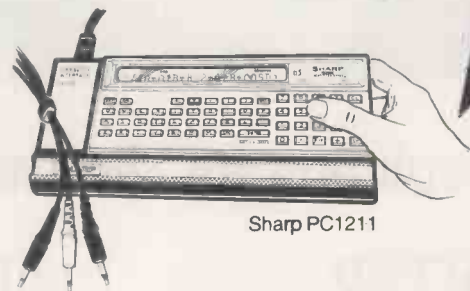


Telephone us for further information on ease of installation. Credit facilities are readily available.

OPEN SOON New 1,500 sq. ft. Computer Supermarket premises opening shortly. Oakley Hay Industrial Estate, Corby.



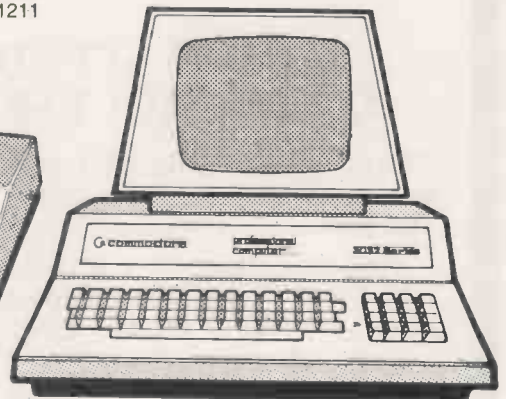
Sharp MZ80K



Sharp PC1211



Tantel Prestel adaptor



Commodore PET4032

FREE
Sharp 'Talking Clock'
free with VAT
inclusive sales over
£550 value.
(Only one per customer. Offer subject to availability - similar value gift may be substituted.)

All goods sold with full manufacturer's warranty and subject to conditions of sale (available on request). ALL MACHINES ARE FULL UK STANDARD. Shipment arranged anywhere in UK

COMPUTER SUPERMARKET

COMPUTER SUPERMARKET LTD (An associate company of HB Computers Ltd)
Registered Commodore and Sharp Dealer
3rd Floor, Douglas House, Queens Square, Corby, Northamptonshire.
Telephone (05368) 62571 Telex COMPSU 341543/4

• Circle No. 404

Σ Sigma (UK)



The perfect solution for the two printer problem.

HIGH SPEED DATA PROCESSING

The new Dual-Mode 200 brings speed and uncompromising print quality to business and professional applications.

Financial statements, inventory reports, labels and more are printed at data processing speeds from 165 cps to 250 cps.

Fully adjustable tractors and a friction feed platen provide precise forms handling for pinfeed and single sheet paper.

Complete "Dot Control" graphics is standard with resolution to 120 × 144 dots per inch.

Interfacing is easy with both E.I.A. RS-232C serial and an ASCII parallel port.

LETTER QUALITY WORD PROCESSING

The Dual-Mode 200 also features letter perfect print you will be proud to use for business letters and reports. Letter Mode speeds range from 42 cps to 60 cps.

The standard Titan 10 pitch font is complemented by an array of optional fonts including Elite 12 pitch, italics, proportionally spaced, OCR-A, scientific and foreign character sets.

Up to 12 font selections may be stored in the printer and interchanged while printing.

The Dual-Mode 200 accepts standard daisy-wheel print commands for word processing system compatibility.

For further details please contact:—

SIGMA (UK), 4 Cromwell Rd., Burgess Hill, West Sussex. Tel: 04446 47676

New release from SD systems

The MS-20

The ideal Low Cost entry into the world of Micro computing for the serious small business person. For £3200 the MS-20 offers 2 MB floppy disk storage, 4 Mhz. Clock, optional CRT terminal 64K RAM and full compatibility with the SD range of equipment. **£100 BOS** will run both **CP/M** and **CAP-PP Microcobl**

O.E.M. enquiries welcome.

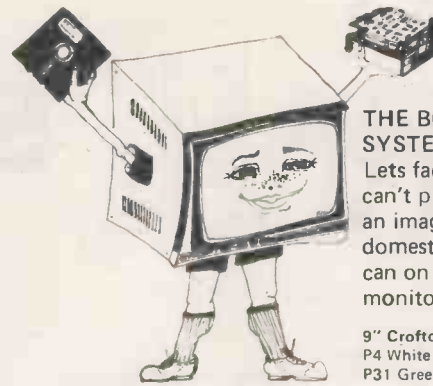


We also supply Texas Instruments OMNI 810 printers with lower case for £1097.00 ex stock.

BARCELLOS Ltd.

Kimberley House, Vaughan Way, Leicester.
Telephone: 0533 26584

• Circle No. 406



THE BODY OF ANY SYSTEM

Lets face it - you can't produce as crisp an image on a domestic T.V. as you can on a Crofton monitor.

9" Crofton Monitors
P4 White £64.97
P31 Green £77.62

SHUGART FLOPPY DISK DRIVES

No case, No Power Supply
SA 400 5 1/4" S.S.S.D. £149.05
SA 450 5 1/4" D.S.S.D. £283.31
SA 800 8" S.S.S.D. £340.52

FLOPPY DISKS - BOXES OF TEN

Single sided 35/40 Track £ 26.45
Double sided 35/40 Track 5 1/4" £ 37.95
Single sided 77 Track £ 41.40
Double sided 77 Track 5 1/4" £ 47.15
Single sided 8" £ 40.25

IKGAMI 12" MONITORS

P 4 White £171.50
P31 Green £184.97

2/3" FULLY INTERLACED C.C.T.V. CAMERAS £149.00

ALL THE ABOVE PRICES INCLUDE V.A.T. AND CARRIAGE



ALL MAJOR CREDIT CARDS ACCEPTED - Small surcharge



CROFTON ELECTRONICS LTD

35 Grosvenor Road, Twickenham, Middx TW1 4AD
01-891 1923/1513

• Circle No. 407

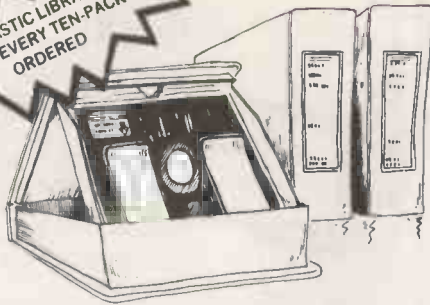
Advertisement Index

A	Act Microsoft 153	Crofton Electronics 217	K	Personal Computers 90
ADDA 198	Croydon Computer Centre 214	Kansas 192	Pete & Pam Computers 172	
AJD 16	Crystal Electronics 20,190	Keating 30	Prentice Hall 27	
A J Harding 45	Cumana 29	Keytronics 214	Printout 48	
Albion 203	D	Kellys 186	Professional Data Systems 177	
Algray 28	Dataplus 104	KGB 56	Pym 174	
Almarc 170	David Richards 164	Kingston Computers 180	Q	
Anglia Consultancy 30	Davinci 214	Kram 36	Qume U.K. Ltd 4	
Arfon Electronics 168	DDP 103	L	R	
Avalon 198	3D Computers 26	Leenshire 26	Rair 54	
A.W. Hawkins 34	Deans 28	Legadata 22, 28	S	
B	Digitus 40	Leicester Computer Centre 162	SBD Consultants 22,190,212	
Barcellos 217	Display Electronics 205	Lifeboat Associates 6,7	Sharp Electronics 19	
Basic Computing 160	D J & A I Systems 150	Llon Micros 20	Shelton Electronics Ltd 87	
BCM Emit 23	D.N. Computer Service 200	Little Genius 202	Sigma UK 216	
Bits & Pcs 186	Drive Technology 38	Llveport 115	Sinclair Research 52,53,87	
Booth Electronics 186	Dyad Developments 35	L.J. Computer Centre 175	Sintron Electronics 171	
Brindwell 200	E	London Computer Centre 157	Sirton 193	
Business Computer 202	EMG 20,32, 204	Lowe Electronics 12,13	Small Systems Engineering 184,208	
Business Software 78	Encotel 201	LP Enterprises 14,15	Software House 148	
Buss Stop 160	Epson 97	Lucas Logic 146	STCS 36	
Butel Business 180	Equinox 64	M	Sun Computer Services 89	
C	Europhonics 218	Magtronics 164	Surrey Micros 182	
Calco Software 198	G	Maplin Electronics 156	Swan Packaging 184	
Calisto Computers Ltd 210	Gate Microsystems 208	Melbourne House 24	Swanley Electronics 194	
Cambridge Collection 184	GP Industrial Electronics 195	Microtech 39	Systems International 160	
Cambridge Computer Store 78, 178	Graffcom 173	Microbyte 191	T	
Camden Electronics 22, 213	Grana Winter 8,9	Microcentre 2	Tabis 116	
Castle Electronics 37	Guestell 209	Microfacilities 182	Tangerine 187	
Centronics 31	Gesbury 154	Micro K Computers 17	Technomatic 183	
Cetronic 34	H	Micronetworks 18,161	Telefusion 23	
Chromasonic 69	Heathkit 26	Microperipherals 70,71	Telesystems 178	
CIL Electronics 24	Hitech Electronics 185	Micropute 117	Tex Microsystems 182	
City Microsystems 178	I	Microsolution 166	This could be fun 176	
Clearstone Computer Consultants Ltd 30	Icarus 152	Microstyle 25	Transam 197	
Co-operative Software 158	Independent Computer Engineering 202	Microtek 33	Transdata 84	
Colt Computers 165	Informex Centralex 200	Microware 192	Tridata Micros 212	
Comart 5	Intelligent Artifacts 155,172	Micro 80 210	TV Johnson 176, 207	
Commodore Business Machines 10,11	Intercept 212	Millbank 176	Twickenham 158	
Compshop 211	Interactive Data Systems 219	Moran 34	V	
Computace 188	Interface Components 136	N	Viscontl 199	
Computech 163	Interface Engineering 134	Nascom 189	Vision Business Systems 43	
Computer Arts 167	Interam 169	Nashua 32	V&T Electronics 24	
Computer Centre 60,61	Intex Datalog 206	Newbear 23	W	
Computers for All 194	Ithaca Intersystems 220	Newtronics 145	Watford Electronics 179	
Computer Interfacing & Equipment 180	ITT 21	Northamber 62,63,78,81	WBM Business Supplies 118	
Computer Supermarket 215	J	NSC 17	West Farthing 190	
Courtman, Commercial Microsystems 204	Jarrogate 32,181	O	Wideband 200	
Control Universal 206	K	Online References 93	Wilkes Computing 149,159	
CPS Data 38,151, 174	L	Onyx Distribution Ltd 51		
Croesco 200	M	Owl Computers 162		

FACTORY FRESH BRAND NAME



5 1/4" MINI DISKS

FREE PLASTIC LIBRARY BOX WITH EVERY TEN-PACK ORDERED



DISCOUNT PRICES PER TEN-PACK

All Disks are Factory Fresh, and incorporate latest manufacturers mods.

	NET	VAT	TOTAL
Verbatim : New Datalife Brand, with hub ring reinforcement			
 MD525 S/Sided, Soft* Sectorred, 35/40-Track	£17-35	£2-60	£19-95
MD550 D/Sided, Soft* Sectorred, 35/40-Track	£26-04	£3-91	£29-95
MD577 S/Sided, Soft* Sectorred, 77-Track	£27-50	£4-13	£31-63
BASF : Typical West German Precision			
 BASF 1 S/Sided, Soft* Sectorred, S/Density	£19-96	£2-99	£22-95
BASF 1D S/Sided, Soft* Sectorred, D/Density	£22-50	£3-38	£25-88
BASF 2D D/Sided, Soft* Sectorred, D/Density	£25-61	£3-84	£29-45

THIS MONTH'S SPECIAL BASF OFFER

So convinced are we, that once you've tried the superb BASF disks, you'll appreciate their high performance, that we are offering a Papermate brushed chrome ballpoint pen worth £5.75 absolutely free.

To qualify, simply order and pay for two ten-packs of any BASF disks by July 31st.

We'll give you the GOLD ballpoint with every five BASF ten-packs.

* All the above, are available in 10 or 16 Hard Sector at the same price, so please specify clearly when ordering, whether soft, 10 or 16 hard sector, and if in doubt, telephone us or name your computer on your order.

DisKInG

Disk Drive Head Cleaning Kit		£18-00	£2-70	£20-70
Disk Directories	(Each)	-83	-12	-95
Disk Directories	(Per dozen; post free)	£8-65	£1-30	£9-95
DiskWriter 'writes with minimum pressure'	(Each)	-40	-06	-46
DiskWriter	(Per dozen; post free)	£4-00	-60	£4-60
Plastic Library Boxes	(Each)	£1-70	-25	£1-95
SuperLuxe Disk Library 'holds twenty disks'	(Each)	£8-65	£1-30	£9-95

If Order Form has ben cut, send your cheque, payable to Cash with order only please.

DisKInG

FREEPOST, Liphook, Hants, GU3 7BR. Tel: 0428 722563.



Order 2 or more Ten-Packs, and we will also give you a free EUROPHONIC Disk Directory and DiskWriter with every pack, so you need never wonder what's on your disks again.

SPECIAL BONUS

FREE Brushed chrome Paper Mate Ballpoint, with 5 to 9 Ten-Packs, 10 or more Ten-Packs, A GOLD Plated Paper Mate Ballpoint.

Except BASF special offer — see under BASF.

SPECIAL BONUS

ORDERING INFORMATION

U.K. DELIVERY, PACKING & INSURANCE (parcel post)

	INC. VAT
Disk Drive Head Cleaning Kits	-75p
Mini-Disks (1-5 Ten-Packs)	each Ten-Pack -95p
Mini-Disks (6 plus Ten-Packs)	each Ten-Pack -65p
Disk Directories	(post free with disks) -25p
DiskWriters	(post free with disks) -25p
Plastic Library Boxes	(post free with disks) -45p
Superluxe Disk Library	-95p

URGENT DELIVERY, PKG. & INS. (first class post)

Mini-Disks first	Ten-Pack	£1-80
Mini-Disks second & subsequent	Ten-Packs	£1-30

Payment by Credit Card

We accept BARCLAYCARD & ACCESS CARD, and make a small surcharge of 6%, on the total order value.

If your order is urgent, you may telephone your card number to us, and we can ship from stock the same day.

Please remember to state clearly, your card number, the holder's name & address, and where you want us to send the goods, & who to invoice.

Payment by Cheque

URGENT ORDERS: Send your order, with a first class stamp on the envelope, and for us to return your goods FIRST CLASS, see the First Class postal rates above. Please mark your order URGENT.

NORMAL ORDERS: Cheques with order, payable to EUROPHONIC Please. If you are a large establishment, and can not raise cheques without an invoice, please post or telephone us your order, and we will return a pro-forma invoice, for your accounts department to pay against.

ORDER FORM

To: **DisKInG**

FREEPOST, Liphook, Hants, GU3 7BR. No stamp required.

Please send me:

	Qty	Total
MEM 1 Ten-Pack at £18-95		
MEM 1D Ten-Pack at £23-45		
MEM 2D Ten-Pack at £26-96		
Verb 525 Ten-Pack at £19-95		
Verb 550 Ten-Pack at £29-95		
Verb 577 Ten-Pack at £31-63		
BASF 1 Ten-Pack at £22-95		
BASF1D Ten-Pack at £25-88		
BASF2D Ten-Pack at £29-45		
Cleaning Kit at £20-70		
SuperLuxe Library at £9-95		
Disk Directories at -95		
DiskWriters at -46		
Please add delivery & insure		
TOTAL Value of Cheque enclosed	£	

Please make cheques payable to **DisKInG**

Name: _____

Address: _____

SPECIAL BASF OFFER ISSUE

PC7/81

"We're impressed with your service!"

"I still cannot understand how you manage to sell at these prices!"

"Many thanks — your service is first class, Tuesday I sent off the order — Thursday 7.15 a.m. goods delivered!"

Yorkshire General Life Assurance, York.
Mr. J. MacBrayne, Glasgow
Mr. T. M. Hunt, High Wycombe

GU30 7BR. Tel: 0428 722563

• Circle No. 408

PRACTICAL COMPUTING July 1981

WOULDN'T YOU LIKE AN OSCAR FOR A SUPERB PERFORMANCE



To a casual glance, we must admit that there are several other computers which superficially resemble OSCAR. However, if you peek under the stylish structural foam housing, with its separate keyboard for better ergonomics, you'll notice the differences.

S100 SYSTEM

OSCAR has a 6-slot motherboard, housed inside the VDU housing, with proven IDS S100 cards to international standards for a flexible, easily maintained, system.

4MHz Z80A PROCESSOR CHIP

Possibly the most powerful m.p.u. chip in its class, running at full speed, makes OSCAR more powerful than many mini-computers.

64K DYNAMIC MEMORY

A full sized system for your full sized applications.

DISKETTE OR HARD DISK

The options are yours, starting with twin floppies at 400KBytes per drive or an 11MBytes Winchester located inside the VDU housing.

Maximum size? We're not saying, as we keep on increasing it, but it's unlikely to be too small.

CP/M™ OPERATING SYSTEM

Use of the industry standard CP/M™ Operating System means that a wealth of applications software will run on your OSCAR.

VISUAL DISPLAY UNIT

With the green phosphor recommended by opticians for low eyestrain, the VDU also has a bonded face-plate for extra safety. There is a full character set with real descenders on the lower-case letters. There are 24 lines each of 80 characters.

KEYBOARD

Separate keyboard with full QWERTY and numeric pad for fast entry.

PRINTER OPTIONS

A range of printers is available. Your dealer can help you select the appropriate one for your requirements.

APPLICATION PROGRAMS FREE

Sales, Purchase and Nominal Ledgers plus Stock Control and Payroll are available from your dealer and to avoid the problems of pirating, all you have to pay for are the manuals and the media. If these packages do not suit, your dealer will be able to offer alternatives, although, these are unlikely to be free!

NATIONAL SERVICE NETWORK

It's no good owning the best system if you can't get it mended, so IDS have arranged for a National Service Network to offer maintenance contracts on your OSCAR.

PRICE

An OSCAR with twin floppies costs from £2,495.00 (excluding VAT and printer)

NOW

Cut along this line, complete and post for further details.

Designed and manufactured in the United Kingdom by:-

INTERACTIVE DATA SYSTEMS LTD.

14 Heathfield, Stacey Bushes, Milton Keynes MK12 6HP
Buckinghamshire, England
Telephone (0908) 313997

Please send details of OSCAR and your other S100 products to:

Name _____

Position _____

Address _____

Company _____

PC7/81

• Circle No. 409



Outside of the garden you need a computer that can grow.

For the common or garden hobbyist, a high quality personal computer is a real temptation. But let's face it: in the world of business, engineering and scientific applications, you need a system that has been designed from the ground up to allow flexibility and expansion.

Providing flexibility and expandability today allows the micro to move up to and beyond the level of yesterdays mini. Hard disks for big system memory; more peripherals for big system flexibility; more number crunching capability and programming power can all be added when you need them. And without the feeling that you are turning a good natured toytown machine into a disproportionate monster.

The Ithaca InterSystems DPS1 has the power and flexibility of the IEEE 696 S100 bus with 20 slots of expandability for up to 16 individually addressable DMA devices and up to 1 MegaByte direct addressing from our Z80 board with its unique memory management system.

For really serious computing, our optional hardware front-panel provides a powerful diagnostic tool for debugging and development. Among its many features are the ability to deposit into and examine memory and set hardware breakpoints. Coupled with an oscilloscope, many other activities usually associated with expensive logic analyzers are possible. No wonder it's fast becoming the chosen development system in laboratories everywhere. And the recently announced system without the hardware frontpanel sets new standards for target systems too.

On the subject of standards, Ithaca InterSystems Series II is the most complete line of IEEE 696 S100 boards . . . easily upgradeable to the Z8000 or other 16 bit processors as they become available . . . so you never get locked out of rapid

expansion, or locked into obsolescence, by depending on a single manufacturer.

But beware: IEEE 696 is an 8 bit AND 16 bit standard, not 8 bit only as some would have you believe. True compatibility and later upgrade to 16 bits means you need to stick to the full IEEE 696 S100 standard from the start.

So if you've left the common or garden variety applications behind, come to Ithaca InterSystems and get a system that will grow as big as your next idea. Whether starting out with a basic low cost system or needing a sophisticated full feature multiuser system or anything in between . . . you'll find a solution to your problem with Ithaca InterSystems. With a choice of 5" or 8" drives, hard disks and CP/M or MP/M, and the full range of CP/M compatible software, including the excellent PASCAL/Z native code compiler, we probably have what you need.

Why not contact us to discuss your requirement? Call today for a catalogue of our products which also contains details of the IEEE S100 bus.

Coleridge Lane, Coleridge Road,
London N8 8ED, England.

Telephone: 01-341 2447
Telex: 299568

ITHACA InterSystems (UK) Ltd.

"MAKING MICROCOMPUTERS FOR THE '80s"