Sample catalogue prices:

- System Two computer 1995
- System Three computer 3293
- Z-2H computer 4998

Extra 64K memory 893
3101 visual display unit 1147
3355 daisywheel printer 2297
HDD 11-mbytes hard disc 4022
ANSI Cobol compiler 55
ANSI Fortran IV compiler 55
16K extended Basic 55
Word processing system 55
Database management 55
Macro relocating assembler 55

Prices exclude VAT and delivery

MicroCentre also supply peripherals, applications software, and multi-user timesharing systems; a PROM programmer; analogue-digital interface; and much more. On site maintenance can be arranged throughout the UK.

Computer systems include fast 4MHz Z80A micro, S-100 bus (21 slots), 64K memory, dual floppy discs, peripheral interfaces, etc. CP/M compatible operating system CDOS free with software.

With our in-depth experience and total commitment to the reliable Cromemco range we are Cromemco's leading UK distributor. Rely on us, as many others do, for expert support with your routine or special micro-computer applications.

Photo features Cromemco System 3 computer. 3101 VDU and 3355 daisywheel printer.

Look out for us at Compec '79, stand no. 756

Micro Centre
Complete Micro Systems Ltd.
132 St. Stephen Street,
Edinburgh EH3 5AA.
Tel: 031-225 2022.
CONTENTS

COMPUTERS FOR THE RADIO AMATEUR
Updating the first electronic hobby ................................................................. 60

REVIEW I
Vincent Tseng examines the Rair Black Box ..................................................... 67

REVIEW II
Tecs is the system if you want to be a pioneer .................................................. 70

ARTIFICIAL INTELLIGENCE
Mark Witowski on the problems of making computers learn ............................. 76

PROGRAM OF THE YEAR
Microaid, the winning entry in our competition ................................................. 120

FINANCIAL MODELLING
An up-to-date look at corporate planning ......................................................... 84

FILE-HANDLING TECHNIQUES
The hard-sectoring approach under examination ............................................. 90

SOLVING CHIP PROBLEMS
The process of testing for failures .................................................................. 94

ALL THIS AND MORE
FEEDBACK ........................................... 53  BOOK REVIEWS ................................. 111
PRINTOUT ......................................... 59  DIARY ............................................. 115
SOFTWARE ON DISC ................................ 72  TANDY FORUM ......................... 117
STRUCTURED PROGRAMMING ......................... 80  PET CORNER ......................... 119
PET IN THE REAL WORLD ...................... 87  COMPUTABITS ......................... 136
GAME ............................................. 101  BUYERS' GUIDE ......................... 143
STATISTICS ON A MICRO ......................... 106  GLOSSARY ......................... 151
PEEK n' POKE ..................................... 108  ADVERTISEMENT INDEX .................. 181
SOFTWARE

This is how your business appears on the screen.
Approx 60 entries update require only 1-2 hours weekly and your entire business is under control.

* PROGRAMS ARE INTEGRATED
1 = ENTER NEW NAMES/ADDRESSES
2 = * ENTER/PRINT INVOICES
3 = * ENTER PURCHASES
4 = * ENTER A/C RECEIVABLES
5 = * ENTER A/C PAYABLES
6 = ENTER/UPDATE STOCKS REC'D
7 = ENTER ORDERS REC'D
8 = EXAMINE/UPDATE BANK BALANCE
9 = EXAMINE SALES LEDGER
10 = EXAMINE PURCHASE LEDGER
11 = EXAMINE INCOMPLETE RECORDS
12 = EXAMINE PRODUCE SALES

SELECT FUNCTION BY NUMBER
13 = PRINT CUSTOMER STATEMENTS
14 = PRINT SUPPLIER STATEMENTS
15 = PRINT AGENTS STATEMENTS
16 = PRINT QUARTERLY TAX STATEMENTS
17 = PRINT WEEK/MONTH SALES
18 = PRINT WEEK/MONTH PURCHASES
19 = PRINT YEAR AUDIT
20 = PRINT PROFIT/LOSS ACCOUNT
21 = UPDATE ENDMONTH FILES
22 = PRINT CASHFLOW ANALYSIS
23 = ENTER PAYROLL
24 = RETURN TO BASIC

WHICH ONE (ENTER 1 TO 24)

EACH PROGRAM GOES IN DEPTH TO FURTHER EXPRESS YOUR REQUIREMENTS.
FOR EXAMPLE (9) ALLOWS: a. list all sales; b. monitor sales by stock code; c. invoice search; d. amend ledger files; e. total all sales.

BUSINESS PROGRAM VERSION 1 ............ £275
(VERBOSE SIMPLE LANGUAGE AND UNITARY FILE HANDLING)
BUSINESS PROGRAM VERSION 2 ............ £375
(MORE INPENETRABLE VALIDATIONS AND PROTECTION)
MULTI-MODE 1, MULTI-FUNCTION, 12 STRING HANDLER ............ £50

BUSINESS PROGRAM VERSION 3 ............ £475
(SPACE SAVING AND MULTI MODE AND FUNCTION PROGRAMS)
BUSINESS PROGRAM VERSION ............ £575
(INCLUDING PAYROLL, YEAR AUDIT, PRO' LOSS; CASHFLOW)
MULTI-MODE 2, MULTI-FUNCTION, 12 STRING HANDLER & NUMERIC COMBINER ............ £100

HARDWARE

• PET 2001 SERIES
PET Computer 2001 32K .......... £795
PET Printer 3022 Tractor Feed .......... £645
PET Floppy Disks 2040 .......... £795
PET IEEE Cables .......... £ 45

• TERMINALS
Hazeltine 1510 .......... £895
Interlube Video Terminal .......... £595
Soroc IQ120 .......... £695

• PRINTERS
Teletype 43 Printer .......... £895
Centronics 779 Printer .......... £950

• COMPUTERS
Intertec Superbrain
Dual Z-80A Vector Interrupt, 64K RAM
pws 1K 2708 PROM Bootstrap, Two Double-Density 5in. Floppy Disks
 .......... £1,950

Industrial Micro Systems Z-80 System
48K Expands to 594K; Twin D/D Disk included. Expands to 10 Meg and programs are CPM compatible .......... £2,500

Smoke Signal 6800 System
32K Expandable + Twin D/S
Discs .......... £2,500

Please telephone for appointment — Tony Winter 01-636 8210
G.W. Computers Ltd., 89 Bedford Court Mansions, Bedford Avenue, London WC1.

• Circle No. 102

PRACTICAL COMPUTING November 1979
The new Cromemco Z-2H

11 Megabytes of hard disc storage in a fast, new, table-top computer.

- Fast Z80A 4MHz processor
- 11-megabyte hard disc drive
- Two floppy disc drives
- 64K RAM memory
- RS-232 serial interface
- Printer interface
- Extensive software available

Contact us direct or call your nearest Comart dealer

Comart specialists in microcomputers

Comart Ltd., P.O. Box 2, St. Neots, Huntingdon, Cambs, PE19 4NY Tel: (0480) 215005 Telex: 32514

- Circle No. 103

PRACTICAL COMPUTING November 1979
Super software from the world’s leading microsoftware supplier.

**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 systems including North Star, Helios II, Microcom, ICOM (all systems) and Altair. Supports computers such as Socreren, Horizon, SOL System III, Versatile, Altair 8800, COMPAL-80, DYNABYTE DB/2, and ICOM AttaChe. Specify desired configuration. £75/£15
- MAC — 8080 Macro Assembler. Full Intel macro definitions. Pseudo Ops include RPE, 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
- 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, user entered and another program from the console £30/£7

**MICROSOFT**
- Disk Extended BASIC — 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-B80. Also linkable to FORTRAN-80 or COBOL-80 code modules £195/£15
- FORTRAN-80 — ANSI 56 (except for COMPLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes Macro-B80 (see above) £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 — 8080/8088 Macro Assembler. Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included. £75/£10
- 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

**XITAN (software requires Z80** “CPU)”

**Z-TEL — Text editing language.** Expression evaluation iteration and conditional branching ability. Registers available for text and commands. Macro command strings can be saved on disk for re-use £40/£12

**ASM Macro Assembler — Mnemonics per Intel with Z-80 extensions.** Macro capabilities with absolute Intel hex or relocatable linkable output modules. New version 3 with additional features £40/£12

**LINKER — Link-eds and loads ASM modules** £40/£12

**Z-BUG debugger — Trace, break-point tester.** Supports decimal, octal and hex modes. Disassembler to ASM mnemonic set. Emulation technique permits full tracing and break-point support through ROM £10/£12

**TOP Text Output Processor — Creates page-numbered, justified documents from source text files** £40/£12

**A4 package includes Z-TEL, ASM LINKER Z-BUG, TOP** £155/£30

**EIDOS SYSTEMS**
- KISS — Keyed Index Sequential Search. Offers complete Multi-Keyed Indexed Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable library, included in KISS basic, use with FORTRAN-80 or COBOL-80. etc. £275/£15
- BASIC — Microsoft Disk Extended BASIC with all KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS REL as described above, and a sample mail list program £495/£30

**MICROPRO**
- Super-Sort I — 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. Requires user to supply 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 search 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 pagination, page number, justify, center, underscore and PRINT. Edit facilities include global search and replace, read-within other text files, delete move, etc. Requires CRT terminal with addressable cursor positioning £255/£15

**GRAFFCOM SYSTEMS**
- PAYROLL — Designed in conjunction with the spec for PAYE routines by HM 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 gross. Requires CBASIC-2 £475/£15
- 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 NAD system. Requires CBASIC-2 £425/£15
- STOCK CONTROL — Maintains stock records, monitors stock levels to ensure optimum stock holding. Details include stock desc., product code, unit price, quantity on hand/line order/derrenium. Stock analysis reports can be weekly, monthly, quarterly etc. Interfaces with Order Entry invoicing system. Requires CBASIC-2 £325/£15
- ORDER ENTRY & INVOICING — Performs order entry and invoicing function. Handles invoices for services and consumable items, batch orders and order dates. Sales Analysis report shows sales movements and trends for user-defined period. Interfaces with Stock Control, NAD and Company Sales systems. Requires CBASIC-2 £325/£15
- NAD — Complete control of all your names & addresses including suppliers, clients, enquires etc. Add your own coding system and select all output via the report generator. Will print anything from mailing labels to directories. Requires CBASIC-2 £225/£12

---

EFFECTIVE 1 OCTOBER 1979
SOFTWARE SYSTEMS

CBASIC-2 - Disk Extended BASIC - Non-interactive BASIC with pseudo-code compiler and runtime interpreter. Supports full file control (e.g. include, output, integer and floating point precision variables etc.) £75/£10

STRUCTURED SYSTEMS GROUP

QSORT - Fast sortmerge 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. Parameter file may be generated with CPM assembler utility £50/£12

GRAHAM-DORIAN SOFTWARE SYSTEMS

APARTMENT MANAGEMENT SYSTEM - Financial system for receipt and security deposits of apartment projects. Captures data on vacancies, revenues, expenses, etc. for annual trend analysis. Daily report shows late rents, vacancy notices, vacancies, income lost through vacancies, etc. £300/£25

INVENTORY SYSTEM - Captures stock levels, costs, sources, sales, ages, turnover, markup, etc. Transaction information may be entered for replacing the display screen, status, type of sale, date of sale, etc. Reports available both for accounting and decision making. Requires CBASIC. Supplied in source code £300/£25

CASH REGISTER - Maintains sales on daily sales. Files data by sales person and item. Tracks sales, overruns, refunds, payouts and total net deposits. Requires CBASIC. Supplied in source code £500/£25

MUTROFOCUS

COBOL - Version 3 is ANSI 74 subset with extensions which offer powerful interactive screen formatting and built in cursor control. Version 4 additionally offers full level 1 ANSI for Nucleus, Table Handling, Sequential Relative and Indexed I/O. Inter-Program Communication and Library £295/£25

FORMS - Interactive utility to create COBOL source code to perform CRT screen handling and application programs. Supports full request text, protected fields and input validation against data type and range expected £65/£10

When purchased with COBOL £55/£10

OTHER

tiny C - Interactive interpretive system for teaching structured programming techniques. Manual includes full source listings £45/£30

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 classification. £65/£10

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 features plus many powerful extensions including string handling and disk address access via symbolic references. £110/£12

Z80 Development Package - Consists of: (1) disk file controller for direct on-line access to 8080 RAM. (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities. (3) linking loader producing relocatable loadable disk file for CPM LOAD, DTR or SID facilities. £500/£12

Z80 Debugger - Trace, break and examine registers with standard Zilog/Mostek mnemonics displays. Facilities similar to DDT £20 when ordered with Z80 Development Package £30/£7

DISTEL - Disk based assembler to Intel 8080 or TDL Xenon 256 source code: listings and cross-reference files. Intel or TDL/Xenon pseudo options optional. Runs on 8080. Standard CPM and TRS-80 CPM versions available £35/£7

DISLOG - TEL to Zilog/Mostek mnemonic files. Runs on 280 only £35/£7

TEXTWRITER II - 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 fragment files on other files. Ideal for contracts, manuals etc. £45/£3

WHATSTI? - Interactive database 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. £165/£15

SMALL80 - Structured Macro Assembled Language - Package of powerful general purpose text macro processor and SMALL structured language compiler. SMALL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE-DO-END, BEGIN-END constructs £40/£10

Selector II - Data Base Processor to create and maintain single Key data bases. Prints formatted, sorted reports with numerical summaries. Available for Microsoft and CBASIC (state which). Supplied in source code £105/£12

Selector III - Multi (i.e. up to 24) Key version of Selector II. Comes with applications programs including Sales Activity, Inventory, Payables, Receivables, Check Register, Expenses. Appointments, and Client/Patient. Requires CBASIC. Supplied in source code £165/£12

Enhanced version for CBASIC-2 £185/£12

CPM/374X Utility Package - Has full range of functions to create or re-name an IBM 3741 vol. display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CPM files £125/£7

Flippky Disk Kit - Template and instructions to modify single sided 5½" diskettes for use of second side in single sided drives £6

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

Add VAT to orders for software (not manuals alone). Add 50p per item postage and packing (minimum £1). All orders must be prepaid (except COD or credit card). Make cheques POs etc. payable to Lifeboat Associates.

Manual costs are deductible from subsequent software purchase.

The sale of each proprietary software package conveys a license for use on one system only.

Lifeboat Associates, 32 Neal Street, London WC2H 9PS, 01-379 7931 • The Software Supermarket is a trademark of Lifeboat Associates

PRACTICAL COMPUTING November 1979

• Circle No. 104

7
## Computing Books

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginners Guide to Computers and Microprocessors</td>
<td>Adams, C.</td>
<td>£5.50</td>
</tr>
<tr>
<td>With Projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Computer Games</td>
<td>Ahl, basic</td>
<td>£5.25</td>
</tr>
<tr>
<td>For Home Computers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic for Home Computers</td>
<td>Albrecht, B.</td>
<td>£4.95</td>
</tr>
<tr>
<td>Illustrating Basic</td>
<td>Alcock, D.</td>
<td>£3.60</td>
</tr>
<tr>
<td>Microprocessors</td>
<td>Altman, L.</td>
<td>£10.65</td>
</tr>
<tr>
<td>Applying Microprocessors</td>
<td>Altman, L.</td>
<td>£12.00</td>
</tr>
<tr>
<td>Introduction to Microprocessors</td>
<td>Aspinall, D.</td>
<td>£5.50</td>
</tr>
<tr>
<td>Z-80 Microcomputer Handbook</td>
<td>Barden, W.</td>
<td>£7.75</td>
</tr>
<tr>
<td>How to Buy and Use Minicomputers and Microcomputers</td>
<td>Barden, W.</td>
<td>£7.85</td>
</tr>
<tr>
<td>How to Program Microcomputers</td>
<td>Barden, W.</td>
<td>£7.25</td>
</tr>
<tr>
<td>Microprocessors</td>
<td>Barna, A.</td>
<td>£8.60</td>
</tr>
<tr>
<td>Microprocessors in Instruments and Control</td>
<td>Bibbero, R.</td>
<td>£8.60</td>
</tr>
<tr>
<td>Microprocessors in Instruments and Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microprocessors</td>
<td>Bohnke, R.</td>
<td>£7.75</td>
</tr>
<tr>
<td>Microprocessors</td>
<td>Bohnke, R.</td>
<td>£7.75</td>
</tr>
<tr>
<td>Microprocessors</td>
<td>Bohnke, R.</td>
<td>£7.75</td>
</tr>
<tr>
<td>Microprocessors</td>
<td>Bohnke, R.</td>
<td>£7.75</td>
</tr>
<tr>
<td>RPG and RPGII Programming</td>
<td>Bux, W.</td>
<td>£11.80</td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£8.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>£7.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please note that all prices include postage and packing. Please make cheques, etc. payable to Technical Book Services (payment in U.K. currency only please).
What is a microprocessor?

If you are considering buying a Microcomputer, Development System, or just want to learn more about this exciting technology, then this short introduction to Microprocessors is for you. Comprising of a 72-page book keyed to over two hours of cassette tapes the many aspects of Microprocessors are explained, including Binary and Hexadecimal counting, Internal structure, Operation, Programming Techniques. Devising a program, etc. Learn at your own pace with this valuable addition to your reference library.

£10.75

Semiconductor Guides.

THT '77
Data and comparison table for thyristors, tetrodes, trigger diodes, triacs, unijunction transistors (JFTs) and programmable UJPs (PUTs) 250,000 entries. Order No. 20.
Order No. 11
Data and comparison table for integrated op amps and comparators. 2nd edition, DIN A6 compact format. 288 pages, types, functions, applications, 152 connection drawings, 48 case drawings.
Order No. 30 ISBN 3-88109-010-X
THT '78 Vol. 1: A...Z
Transistor comparison table. Lists more than 25,000 equivalent types for approx. 5,000 transistors. 9th edition. 292 pages, 11 illustrations, 137 connection drawings. In handy compact format DIN A6, wipe-clean cover.
ALSO AVAILABLE
Diode Equivalent Book £ 2.30
Diode Data Book £ 2.30
Diode Comparison Table £ 2.30
Transistor Comparison Table £ 2.30

Diode Equivalent Book £ 5.50
Diode Data Book £ 5.50
Diode Comparison Table £ 5.50
Transistor Comparison Table £ 5.50

TVT '78 Vol. 2: 2N...
Transistor comparison table. Lists more than 25,000 equivalent types for approx. 7,000 transistors.
2N... - 2SA...
2SB... - 2SC...
3N... - 3OB...
408 pages, 11 illustrations, 141 connection drawings. In handy compact format DIN A6, wipe-clean cover.
TVT '78 A-Z £ 4.00
TVT '78 2N £ 4.00
THT '77 £ 4.00

SEND TO: TECHNICAL BOOK SERVICES, PC11 PO BOX 79, MAIDENHEAD, BERKSHIRE SL6 2EG A division of Strathearn Publishing Ltd.
ACULAB 735, a fully self-contained interface for IBM 735 output golfball typewriters.

- Parallel model accepts 7-bit ASCII data via Centronics compatible connector.
- Serial model accepts RS232/V24, Baud rate selectable. (Parallel model may be retro-fitted with serial board).
- Programmed for 7 different typehead layouts, covers all common golfballs and an ASCII ball, switch selectable.
- Stop/Go switch, Online/Offline switch, also Online/Offline under software control.

Parallel: £155.00 + VAT
Serial: £205.00 + VAT

aculab Ltd.
24 Heath Road, Leighton Buzzard, Beds.
LU7 8AB

For further information, telephone: 0525-37193.
OUR NEW EXTENDED RANGE OF PROFESSIONAL GRADE SYSTEMS

SYSTEM MZ
Z80 4MHz CPU, 48K Ram, 630K bytes disc storage, Serial port & two parallel ports, prom rad board with monitor, 18 slot motherboard (S100), MDOS operating system, Z80 assembler, Basic interpreter

SYSTEM B
As MZ plus Vector mindless terminal, 24x80 flashwriter board, MZOS North Star compatible DOS. CP/M configured by Almarc:

£2300.00

SYSTEM BG
As System B plus 240x256 graphics board, 8K memory, 10" monitor.

£2850.00

SYSTEM BF
As System B plus Fast Fortran 80 compiler with hardwired floating point system which includes board and interface software for Fortran. This system uses the A.M.D. chip and provides breathtakingly fast floating point manipulation

£3240.00

SYSTEM BFG
Combines BG & BF plus 'Glib' graphics package for use with Fast Fortran 80 and 240x256 graphics board

£3595.00

We also sell a wide range of S100 boards and C/PM compatible software.

WE ARE THE SPECIALISTS
When you spend £2000.00+ on a microcomputer system you're entitled to support from people who understand the equipment and your problems. At ALMARC we don't sell systems from many different manufacturers, we specialise in Vector Graphic systems and supporting hardware & software. So if you want to just buy different makes of hardware then don't come to us, but when you decide that Vector Graphic is for you then contact ALMARC.

ALMARC DATA SYSTEMS LTD., 29 CHESTERFIELD DRIVE,
BURTON JOYCE, NOTTINGHAM. Telephone: 0602 248565

PRACTICAL COMPUTING November 1979
C.P.W. Electronics

Tandy TRS-80 Business System. Requires Level 2 32K computer, at least 2 mini floppy disk drives and one line printer. Uses the superb TRIDATA software for stock control, payroll and multiple ledger.

Price from £2,500 for hardware.

Based on the 32K Exidy Sorcerer computer, micropolis duel drive double density disk system, and high resolution monitor. Choice of printers, word processing available. Stock control and multiple ledger available now. Price from £3,000 for hardware.

Compucorp 600 series computer featuring minimum 40K on board, single 160K disk 80 x 20 CRT and S10 with Texas Instrument 810 printer.

Software available now includes multiple ledger, insurance, window design, engineering spares, and mail shot.

Price from £6,000 for Hardware.

Gamma Poseidon DEC LSI-11 system. Features multi-user, multi-task, high capacity fast access storage, OKI printer and Hazelline visual display terminal. Masses of software including RT11, NET11, DIBOL, FORTRAN, BASIC and APL.

Minimum 64K LSI-11, 10 meg disk subsystem, 180 ch/sec printer and VDU.

Price from £12,100 for hardware.

WE GIVE FIELD SERVICE ON ALL OUR COMPUTERS

S10 Kit systems

We supply 8080A and Z80 based 100 systems with full documentation. If you want to build your own computer we can help and advise. GPW S100 expansion box includes Motherboard, PSU and cooling fan. Price £145 + VAT.

Books

Stock includes the highly recommended Adam Osborne and Rodney Zacs series.

Components

6504 CMOS £15; 2114 (450 STATIC) £4.50; Z-80 CPU £9.00; 5101 (450 CMOS) £4.50; TMS 4003 MOS £1.50; 2708 £7.40; 2712 £15.45. We can supply most micros, please include Post and Packing. Please ask VAT CWO Access or Barclaycard.

PRACTICAL COMPUTING November 1979

Circle No. 111
If your Accounts are a problem - the solution could be on your desk.

You could use your telephone to call Comma Computers on Brentwood (0277) 811131. Or you could use a pen and envelope to complete and return the coupon to us. Later on, you could have a free copy of our 'no jargon' brochure on your desk from which you could see how Comma Computers have used advanced micro-processor technology to make business computers easy to understand, use and afford!

Still later, but not much later because Comma Computers are quick and simple to install, you could have a Comma Aquarius, Aries or Leo business system on your desk - a complete system with computer, printer, keyboard, display, installation, 12 months maintenance and software to perform Payroll, Accounts, Invoicing and Credit Control applications and provide instant management information including Profit and Loss Statements and all from less than £6000.

Butchers, bakers, candlestick makers . . . can all, at last, enjoy the benefits brought to business by the silicon chip and increase the efficiency of dealings with customers and suppliers as well as accountants, auditors, HM Collectors of Taxes and Customs and Excise.

Comma Computers Ltd.
West Horndon Industrial Park,
West Horndon,
Essex CM13 3XJ

Name
Position
Organisation
Address
Postcode
Telephone

To: Comma Computers Ltd,
West Horndon Industrial Park,
West Horndon, Essex CM13 3XJ

* Circle No. 112
OHIO SCIENTIFIC from the UK’s specialist importers

A complete minidisc system for less than £1000

Discs allow fast, even automatic, program loading and running plus use of data files under program control. So really a single disc system has 100k on-line for programs and data — and exchange of disks makes even more data readily available. Once you’ve used a disk you’ll never be satisfied with a cassette again! An 8K program will load in less than a second. However the C1P range starts with a 4K RAM, 8K BASIC-in-ROM system, fully expandable to disk later, for only £290.00 (needs TV and audio cassette). All TV and video output modified for 50 Hz giving steady display.

- 6502 CPU, ultra fast floating point 9 digit BASIC. Full disc operating system with random access and named files.
- TV or monitor output, QWERTY keyboard, upper/lower case, graphics.
- Expandable to 32K, dual discs, printers etc.

- C1F 4K, 8K BASIC-in-ROM £ 290.00
- CIPSF, single floppy, 20K, OS65D £ 980.00
- CIPDF, dual floppies, 20K, OS65D £1418.00
- OSI recommended monitor £ 99.00

VAT and delivery in addition. Over 60 programs available on mini disc or cassette. Mini data base management package!

SUPERBOARD II software and expansion accessories available.

U-MICROCOMPUTERS

U-Microcomputers Ltd
2 Station Road, Weaverham, Nr Northwich, Cheshire.
Tel: 0606-853390 Telex: 666592

Great news from Heath.

WH-89 All-In-One computer.
The new All-In-One computer from Heath has the power, versatility, and built-in peripherals needed to meet the demands of the business user.
- *Intelligent* video terminal *Z80 microprocessors.
- *Floppy disk storage system.
- *Basic* 16K RAM (expandable).
Easy to program. Simple to operate. It is capable of a multitude of high-speed functions and speaks the language of today's most popular software.

WH-14 serial printer.
With a compact table-top configuration, the WH-14 is designed for a broad variety of uses in both the personal and business computing field.
- *5 x 7 dot matrix impact printing* *96 character ASCII* *upper and lower case characters* *microprocessor-based electronics.*
It combines speed, flexibility and ease of use with any computer providing standard RS-232 C or 20mA current loop interface connections.
For complete specifications of these and all Heath Data System products contact:
Heath (Gloucester) Limited, Dept. (01452) 29451.

Heath data systems

* Circle No. 113
* Circle No. 114

PRACTICAL COMPUTING November 1979
Train your PET in accounting systems

Petal is ACT's way of putting Analysis and Ledgers on your 8K Commodore PET.

- **Sales Ledger**
  with complete Statement/Remittance Advice, Debtors Control List and Overdue Letters.

- **Purchase Ledger**
  with complete P.L. Record/Remittance Advice, Creditors Control List and Credit Transfers.

- **Analysis**
  a powerful analysis system allowing full management reporting.

- **VAT Analysis**
  a purpose built analysis to take away the VAT blues.

**Petal** combines all the advantages of your own Commodore PET together with a low cost Bureau Service.

**Petal** is available from:

Applied Computer Techniques Limited
Graphic House
Telephone Avenue
Bristol BS1 4BS.
Telephone 0272 211733

I am interested in finding out more about Petal. Please send the free copy of our Systems Manual also available from Your Commodore PET dealer.

PRACTICAL COMPUTING November 1979

--

* Circle No. 115
BUILD THE 12,000 ALREADY BOLD KITS IN STOCKS

NASCOM I COMPUTER

British Design 

We are the Bull Approved London Stockist and National Distributor

FREE MODULATOR and B-BUG

FEATURES

Supplied in kit form for self-assembly

Full documentation supplied

Fully screened double-sided printed circuit board

Full 44 way keyboard included

2x 8 Ram

1x 8 monitor program in Eprom

Powerful Mostek 808 CPU

16 x 40 character display interface to any un-modified TV

TV display memory mapped for high speed access

On board expansion to 2K x 8

SOFTWARE

On board expansion for additional 16 I/O lines

SOFTWARE may be expanded to full 60K

FREE MODULATOR and B-BUG

FEATURES

* Supplied in kit form for self-assembly

* Full documentation supplied

* Fully screened double-sided printed circuit board

* Full 44 way keyboard included

* 2x 8 Ram

* 1x 8 monitor program in Eprom

* Powerful Mostek 808 CPU

* 16 x 40 character display interface to any un-modified TV

* TV display memory mapped for high speed access

* On board expansion to 2K x 8

* Expansion buffer board £32.80

* Memory kits (inclusive all hardware)

8K £86

16K £140

32K £500

1U box with decoders and

in hardware interface 234 with

access up to 3 PIO, 1 TV and

1 UART £35

OTHER HARDWARE

* 3A power supply for up to 32K expansion £19.90

* 3A power supply for up to 32K expansion Mk II £23.90

* 8A power supply for larger than 32K expansion £60.00

* 2K expansion £20.00

* 16K expansion £30.00

* 1 PROM £4.00

* 1 FORTH £4.00

* Keyboard cabinet £7.50

* Programming manual £4.00

* VAT 15% ALL ITEMS EXCEPT BOOKS

* DEMONSTRATIONS CONTINUOUS DAILY

* WE WELCOME EXPORT EDUCATIONAL AND INDUSTRIAL ENQUIRIES

* FREE BROCHURE SEND SAE 91 STAMP 120

New Phone (01) 723 1008

All mail to

Henry's Radio

404 Edgware Rd

London W2

Circle No. 117

OPENCOM COMPUTING

November 1979

16

Circle No. 119

PRACTICAL COMPUTING

November 1979

16

Circle No. 117

PRACTICAL COMPUTING

November 1979

16

Circle No. 119

WORD PROCESSOR

COMPLETE WITH PRINTER

FOR £1,195

Based on TRS-80 Level II, 12in. wide screen, 64 characters (A4) wide, upper/lower-case, superb Electric Pencil software, Anadex 8000 dot matrix printer or Qume daisywheel printer (option).

General business software also available to run on the above system

Complete with Anadex printer 16K £1,195

As above 48K & 2 disc drives £1,995

Qume daisy printer in lieu Anadex £995

Dual floppy disc drives £575

All prices ex. VAT.

Phone/write for further details or demonstration.

LONDON COMPUTER STORE

43, GRAFTON WAY, LONDON W1.

Tel. 01-388 5721.

Circle No. 119
Terodec are the sole U.K. Distributor for Delta Products. Delta are the Californian Manufacturer of S-100 and S-44 (Delta's own bus for Industrial Control) microcomputers.

A newcomer to Britain, Delta has an established record in the States for delivering a wide range of quality products and providing solutions other manufacturers cannot. Systems with Flexibility and capacity at sensible prices. Delta has a continuing policy of Technical innovation, the latest is a reliable double-density disc controller using latest LSI technology.

Terodec offers Delta's wide range of products: CPUs, Static Memory, Disc Controllers, Terminal Simulator, Serial and parallel interfaces, tape controllers and many more. All products are designed to operate with CPM so a wide range of applications software can be used.

- Professional Word Processing System: 64K RAM, 2Mbytes of Disc Storage, Diablo 1650, High-Quality VDU, CPM 1.4 Word-star, Z-80 CPU, Attractively-styled Work Station .......................... £6,218
- Systems: 64K RAM, 4MHz Z-80 CPU, 2 serial and 3 parallel ports, 1M bytes of Disc Storage High-Quality VDU CPM 1.4 ........... £2,815
- 64K RAM, 4MHz Z-80 CPU, 2 serial and 3 parallel ports, 2M bytes of Disc Storage High-Quality VDU 150 cps 132 character printer ......................................................... £4,560
- S-100 Boards and Mainframe: DP-CPU 4MHz Z-80 2 serial and 3 parallel Ports Monitor ...... £184
- DP-DISK Double-Density Disk Controller ........................................ £218
- S-100 Mainframe 12 Slot Mth/B PSU and Cabinet ............................... £225

32K Static RAM with Bank Select .................................................. £427
- Disc Drives with PSU and Cabinet: DP 1000K 1Mbyte of Disc Storage ................... £966
- DP 2000K 2Mbyte of Disc Storage .............................................. £1,209
- DP 4000K 4Mbyte of Disc Storage .............................................. £1,953

- S-44 Industrial Control System Designed for Rugged Environments: DP-Z-80A 4MHz Z-80 CPU 2 Parallel Ports Monitor DP-DISK 2A Double-Density Disc Controller ................................ £255
- DP-16KA 16K Static RAM ......................................................... £230
- DP - EPA Front Pannel Traps Trace and more ................................ £56
- DP - MTH 15 15 Slot Mth/B Kit .................................................. £51
- DP - PWRA Power Supply for S-44 Kit ........................................ £58.30
- DP - CHSA S-44 Card Cage Kit .................................................. £30

- All boards and Systems are supplied assembled and tested.

SOFTWARE

OSBORNE & ASSOCIATES
CBASIC-2 Version. Runs either on CP/M or CDOS 1.07
- Accounts Payable & Accounts Receivable .................................. £80
- General Ledger ........................................................................ £80
- Payroll with Cost Accounting .................................................... £80

MICROPRO
- 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, centre, underline and PRINT. The most complete, totally-integrated, word-processing system software you’ve ever seen on a microcomputer .......................................................... £295

We also supply CP/M C BASIC-2, Inventory Control UCSD
PASCAL COBOL FORTRAN and DATABASE

TERODEC supply a full range of hardware and software that represent the best in quality, price and delivery. Our product range includes the CROMEMCO CS-2 and CS-3, printers from DECISION DATA, VDUs from TVI and SOROC and MICROMATION’s Double-Density Disc Controller, Z-Plus and Megabox-I.

We can arrange on-site maintenance on all the above equipment.

All prices are correct at the time of going to press and do not include delivery or VAT. Office hours 9-6 Mon-Sat. Please phone for appointment. 24 hour answering service.

OEM & Dealer Enquiries Invited.
21L02 450ns B3p
21L02 250ns 100p
2114 450ns 525p
2114 250ns 575p
4116 300ns 790p
4116 150ns 840p
2708 450ns 750p
Floppy Discs by VERBATIM £27-50 box of 10
We keep a full range of products
Large quantity of 74 LS stocked along with many other components. Free lists sent upon request.
We also trade in Texas IC sockets, Solder tail, Wire wrap, etc.
Gold plated S100 edge connectors £3-25 each 3/£9-50
4,7 & 8 way DIP switches, all at 85p. We keep a full range of wire wrapping equipment: Wrap-Strip-Unwrap tool £5-97
50 foot reel of wire £1-64 just-wrap tool with 50 wire £12-21
We've got Euro connectors, Education & Government orders welcome Min £10

Shop open ten until six Access & Barclaycard
Prices inc VAT, orders below £10 add 25p p & p

19 Bevois Valley Road, Southampton, Hants. SO2 0JP Tel: (0703) 39267

**Circle No. 121**

---

**GODBOUT Computer Products**

Alpha Micro/Altair/Cromemco/Imaas/North Star/Polymorphic, etc. S-100 Bus computer compatible memory and other products.

**SOME PRODUCTS FROM OUR CATALOGUE**

**Econoram 2708, 16K EPROM# (No EPROMS)**
- Kit £45
- Ass. £65

**2708 EPROM1C. 52E na**
- £80
- £99

**Econoram 11a 4MHz, 8K Bytes Interfacer 2 full RS 232 # S100**
- £89
- £125

**Econoram IV, 4MHz, 16K Bytes**
- £150
- £169

**EXTRA LOW PRICES ON QUALITY DISKS**
(Verbatim, Scotch, Memorex, etc.) Diskettes stocked for most micro-computers:
- Apple, Cromemco, Tandy, Vector Graphic etc. (soft sector mini)
- North Star, Polymorphic, Wang etc. (10 sector mini)
- Altair, Micropolis etc. (16 sector mini)
- DEC, Cromemco, Prime, etc. (soft sector floppy, 8in.)
- Pack of ten disks, £19. Carton of ten packs (100 disks), £175

All prices given include postage and packing (overseas add £10). Just add VAT (presently 15%). Send 9p stamp for details.

Quantity discounts available on application. Credit terms (nett 30 days) given to large companies and government establishments.

Mail Order 'phone: 01-828 1785

LTT ELECTRONICS
8 Waldegrave Road
London SE19

**Circle No. 122**

---

**TAKE YOUR PICK!**

**OPERATING SYSTEMS**
- CP/M
- PASCAL
- MULTI-USER, MULTI-TASKING
- CAP MICROCOBOL BOS

**WORD PROCESSING SOFTWARE**

**HARDWARE**
- Z-80 Processor
- S-100 Bus
- Memory Management to 512KB
- 5 1/4" Floppy Discs (dbl. density)
- 8" Floppy Discs (dbl. density)
- Cartridge Disc Drives (to 40MB)

**MAINTENANCE**
- Nation-wide servicing facilities available.

---

**EQUINOX**

**COMPUTER SYSTEMS LTD.**

**Circle No. 123**

---

**PRACTICAL COMPUTING November 1979**
MSI 6800: At the root of every good system.

Strumech Engineering Electronic Developments Limited
Portland House, Coppice Side, Brownhills, Walsall, West Midlands. Telephone (279) 4321

* Circle No. 124
The following is a list of source modules compatible with PDS:

- favouring Inter-type mnemonics
- PDS Program Development System for 8080 or Z80 computers. PDS supports full Z80 code

More software products are being continually added to our range so please enquire about software products not listed above.

The store is open 6 days a week from 9-5.30 with demonstration systems always in operation. We offer a professional standard of advice and after-sales support and we're ready to discuss your application any time.

**Another Crofton First**

**10” Metal Cased Industrial Video Monitor**

Video Bandwidth 8MZ (3db down).
Ideal for Computer Terminal or General Video Monitor.
Complete With Own Power Supply.
Input Sensitivity IV Composite.

The unbeatable CROFTON 6800 MICRO is probably the best value for money today.

POWER SUPPLY £20 EXTRA + VAT & P/P

**KIT** £220

+ VAT & P/P

**CROFTON** Electronics Ltd.
35 Grosvenor Road, Twickenham
Tel: 01-891 1923

**CAMBRIDGE COMPUTER STORE**

We can help you select the right system for your application. Here in Cambridge your choice won’t be limited — we’ll demonstrate as comprehensive a range of microcomputers as you’ll find anywhere in the U.K.

**TANDY TRS-80**
**COMMODORE PET**
**APPLE II**
**N-S HORIZON**
**CREMOCOM**
**SORCERER**
**ACORN NASCOM-1**

Stop Press: dramatic reduction now in prices of TRS-80, APPLE II and HORIZON systems. Where possible we deliver off-the-shelf, to any location.

The store is open 6 days a week from 9-5.30 with demonstration systems always in operation. We offer a professional standard of advice and after-sales support and we’re ready to discuss your application any time.

**CAMBRIDGE COMPUTER STORE**
1 Emmanuel Street, Cambridge (0223) 68155

PRACTICAL COMPUTING  November 1979
Then come to the number one micro-computer centre

If you’re wondering if a micro-computer can help you, we are here to advise you.
At Lion House—London’s leading centre for micro-computers—you’ll find

* Experts who’ll explain the equipment in a way you can easily understand, showing how and where it applies to your work.
* Demonstration areas where you can get immediate experience of using micro-computers yourself.
* Probably the biggest range of software in the UK.
* Programmes can be tailored for your particular commercial needs by our In-House Analysts and Programmers.
* Total service—including the availability of full maintenance after you’ve bought an installation.
* Leasing and H.P. facilities immediately available.
* A computer book section with publications that give you new insight into the world of micro-computers.

How will micro-computers help you? In thousands of ways—only a few can be mentioned here.

**MICRO-COMPUTERS FOR BUSINESS**

For business and professional, the versatility of compact micro-computers means that all the benefits of big computers are made available to all at low cost. The businessman can now computerise his accountancy, his stock control, his records and much more—cutting his overheads and improving his efficiency.

**MICRO-COMPUTERS FOR THE HOME**

Budgeting, investments, controlling heating or security, storing information on things like recipes, designing complex and fascinating games, education...

Come and see. We invite you to visit us and investigate the possibilities and the potential. If you’re too far away, phone or write and we’ll send you more information.

You need a micro-computer. We can supply it.
Computers R.R.P. Our Price
Pet 2001 - 8K £550 £485
Pet 2001 - 32K £795 £699
Floppy Disc £795 £699

Printers
Pet 2023 £550 £485
Pet 2022 £645 £565

SPECIAL OFFER

Comprint 912 Printer a reliable low cost, full width, electronic printer with a speed of 225 characters per second. Compati-
ble with PET. SPECIAL PRICE £395

Electrosensitive paper available from ourselves.

External Cassette
Decks £55 £48

Cables
IEEE to PET £20 £17.50
IEEE to IEEE £25 £22.00

TECS: FEATURES

* VIEWDATA AND PRESTEL DATABASE ACCESS
* FULLY EXPANDABLE COMPUTER SYSTEM
* MEMORY-MAPPED TV DISPLAY RAM
* 24ROW * 40 CHARACTER, ALPHANUMERIC AND GRAPHICS (224 Individual symbols) DISPLAYED IN SIX COL-
OURS PLUS B&W, ON UNMOD-
IFIED COLOUR TV.
* EXPANSION TO FULL 64K MEMORY
* SUPPORTS BOTH 5 1/4" and 8" FLOPPY DISCS
* RS232 PORT AS STANDARD
* 3K TECs MINI-BASIC,
* 8K TECs BASIC; FULL FLOAT-
ING POINT VERSION
* TECsBUG: POWERFUL MACHINE CODE MONITOR
* TECsOFT RANGE OF SOFTWARE TO EXPLOIT THE FULL POTENTIAL OF THE TECs SYSTEM
* FULL FACILITY TELETEXT RECEPTION (CEEFAX, ORACLE)
* KANSAS CITY STANDARD CASSette INTERFACE
* FULL DOCUMENTATION PACK
* ALL SYSTEMS CAN BE EXPANDED LATER.

SYSTEM T1 TELETEXT, 3K BASIC KIT £895 £1175
4K USER RAM £1115 £1405
SYSTEM T2 TELETEXT, MONITOR, £1115 £1405
8K BASIC 4K USER RAM
SYSTEM T2a AS T2 but -48K RAM £1335 £1635
SYSTEM T2b AS T2 but +32K £1335 £1635
SYSTEM T2c AS T2 but +48K £1335 £1635
SYSTEM T4 'PRESTEL SYSTEM' £1955
TELETEXT, PRESTEL, 4K RAM, 3K BASIC
* MEMORY CASSETTE INTERFACE
* SUPPORTS BOTH 5 1/4" and 8" FLOPPY DISCS
* RS232 PORT AS STANDARD
* 3K TECs MINI-BASIC,
* 8K TECs BASIC; FULL FLOAT-
ING POINT VERSION
* TECsBUG: POWERFUL MACHINE CODE MONITOR
* TECsOFT RANGE OF SOFTWARE TO EXPLOIT THE FULL POTENTIAL OF THE TECs SYSTEM
* FULL FACILITY TELETEXT RECEPTION (CEEFAX, ORACLE)
* KANSAS CITY STANDARD CASSette INTERFACE
* FULL DOCUMENTATION PACK
* ALL SYSTEMS CAN BE EXPANDED LATER.

COMPUNTEC – 800K Double Density Dual Disc drive for PET 2001-16 and
2001-32 £995

All above prices subject to 15% v.a.t.

We hold large stocks of all the above machines.

MAIL ORDER

Add 15% VAT & 2% for carriage to all the above prices.

I enclose cheque for £
Please debit my Access/Bardaycard
Account No.
Name
Address
Tel No.

E.I.C. Electronics Ltd.
30 Kelvin Ave., Hillington Industrial Estate, Glasgow
Tel: 041-882 1661/2/1166

BIRMINGHAM
COMPUTER CENTRE

Commodore
Authorised agents
PETSOFT DIST.
PETACT
business
programs

Specialists in Commodore
Hardware
ALL MODELS
EX STOCK


All at special discount prices including large keyboard

Floppy dual disk drive — Printers

KIMI BETS1 — KIMSI, etc
Cassette tapes super quality
Diskettes — super quality

Our range of products now extended to include: New Apple II plus auto-start ROM (direct entry) PALSOFT ROM (saves RAM). New low price from £380.

Exidy Sorcerer plug-in ROM cartridge $100 expansion Z-80
CPU word from 760 16K.

Midland stockists of Grama Winter Software.

Camden BD 80 Printer professional business use. 2K character buffer. Now available ex stock £675

Send for free literature
HP terms available

Showrooms open Mon to Sat, 10am-6pm
Camden Electronics (first floor) 462 Coventry Road, Small Heath, Birmingham B10 0UG Tel: (021) 7738240

* Circle No. 130

PRACTICAL COMPUTING November 1979

22
Britain's no.1 micro-computer from

the complete system
full range of peripherals
nation-wide dealer sales and service

In case of difficulty contact
COMMODORE SYSTEMS DIVISION
360 Euston Road, London. Tel: 01-388-5702
WE HAVE ALL THE PIECES!
COME TO CAMBRIDGE AND SEE THE SOLUTION

We can demonstrate practical business systems,
with proven software, for many applications.
Leasing, installation and training available.

PROTECHNIC COMPUTERS LTD.
264 Newmarket Road, Cambridge.
0223-314855

- Circle No. 133

MICROSPEECH
Does your computer speak to you?
'WEHL IHT KAAN DOO WIHTH MEE!'

Features
- Single PCB plugs directly
  into an SWPTc 6800 bus.
- 9 parameter vocal tract
  model.
- Realtime software
  converts any stored
  phonetic code to speech.
- Computer Games.
- External input for special
  musical effects.
- Adds speech output to
  existing BASIC programs.

Microspeech package
- Speech synthesizer board
  (assembled & tested).
- MSP2 Software on floppy
  disc or cassette.
- Hardware & Software
  manual.
- Speaking BASIC software
  option.

TIM ORR DESIGN
CONSULTANT
55 Drive Mansions,
Fulham Road,
London, SW6

- Circle No. 134

SERENDIPITY
SYSTEMS
SOLVE
THE
SOFTWARE
PUZZLE

If you’re puzzled by the lack of good application
software for micro-computers – then puzzle no longer! Great Northern Computer Services are now
the distributors for the Serendipity Systems range of packages and we are looking for dealers.
Stock Control, Ledgers, Payroll, Job Order Control, Professional Client Billing, Appointments and
many more. The Programs conform to British practice and the manuals are user-oriented;
so there is no puzzle there either.
The programs are offered in CBASIC, Cromemco Extended BASIC and North-Star BASIC. There
are also packages for the Apple. Over 1800 packages have already been sold by more than 200
dealers and retailers. So stop puzzling and write or call today!

GREAT NORTHERN Computer Services
15 Wellington Street, Leeds LS1 4DL Telephone (0532) 450667

- Circle No. 135

PRACTICAL COMPUTING November 1979
Micropolis is rapidly becoming the industry standard in 5¼" floppy disc drives; they have been shipping double density drives for over 2 years, thus proving their outstanding reliability and performance.

By completely reassessing the engineering involved in 5¼" floppy disc drives, and using the most modern technology available, Micropolis achieve a formatted density of 315K bytes per single sided unit.

**Starter system**

The 1041/1 Macrofloppy system includes a 143K byte double density drive with $100 controller card, MDOS and BASIC with a comprehensive manual.

This unit will successfully add on-line disc storage to a wide range of $100 computers at an unbeatable price per byte.

Add to your Cromemco, North Star, Vector Graphic, Sol, Poly 88, Sorcerer, etc.

Fully assembled, tested and burnt-in unit

£439.00

Optional regulator for $100 raw power

£14.00

**Also available**

A full range of hardware and software including:

- Mains powered add-on 143K bytes (Also suitable for Tandy expansion interface)
  £399.00

- Single drive 315K byte system
  £663.00

- Twin drive 630K byte system
  £1159.00

- CPM
  £100.00

- **North Star** compatible operating system
  £35.00

Dealer enquiries welcome
Ring Reading 85464 for further details

SINTROM MICROSHOP

14 Arkwright Road, Reading, Berks RG2 0LS
Tel: Reading (0734) 85464
TELEX: 847395 CABLES: SINTROM READING

* Circle No. 136

PRACTICAL COMPUTING November 1979
### DATABANK

**SOFTWARE SERVICES**

**PROGRAMS GALORE!!**

<table>
<thead>
<tr>
<th>GAMES</th>
<th></th>
<th>GAMES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost in Space</td>
<td>£8</td>
<td>Take your poison</td>
<td>£5</td>
</tr>
<tr>
<td>Star Trek-1</td>
<td>£6</td>
<td>Battleships 1</td>
<td>£7</td>
</tr>
<tr>
<td>Star Trek-2</td>
<td>£8</td>
<td>Nim</td>
<td>£4</td>
</tr>
<tr>
<td>Drag racer</td>
<td>£4</td>
<td>Spook</td>
<td>£4</td>
</tr>
<tr>
<td>Noughts &amp; crosses</td>
<td>£6</td>
<td>Crips</td>
<td>£5</td>
</tr>
<tr>
<td>Hangman</td>
<td>£4</td>
<td>Space wars</td>
<td>£8</td>
</tr>
<tr>
<td>Richman</td>
<td>£4</td>
<td>Pondoon (21s)</td>
<td>£5</td>
</tr>
<tr>
<td>Take your poison</td>
<td>£5</td>
<td>Jet fight-1</td>
<td>£5</td>
</tr>
<tr>
<td>Battleships-1</td>
<td>£7</td>
<td>OGRE</td>
<td>£3</td>
</tr>
<tr>
<td>Nim</td>
<td>£4</td>
<td>Card Dealer</td>
<td>£4</td>
</tr>
<tr>
<td>Nim</td>
<td>£4</td>
<td>Ticktackoe</td>
<td>£4</td>
</tr>
<tr>
<td>Space wars</td>
<td>£8</td>
<td>Craps</td>
<td>£5</td>
</tr>
<tr>
<td>Pondoon (21s)</td>
<td>£5</td>
<td>Race car</td>
<td>£5</td>
</tr>
<tr>
<td>Jet Fight-1</td>
<td>£5</td>
<td>Racing car</td>
<td>£5</td>
</tr>
<tr>
<td>OGRE</td>
<td>£3</td>
<td>Lunar lander</td>
<td>£5</td>
</tr>
<tr>
<td>Card Dealer</td>
<td>£4</td>
<td>Mastermind-1</td>
<td>£5</td>
</tr>
<tr>
<td>Ticktackoe</td>
<td>£4</td>
<td>Spook</td>
<td>£4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EDUCATIONAL</th>
<th></th>
<th>EDUCATIONAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary Maths</td>
<td>£5</td>
<td>Advanced Maths</td>
<td>£7</td>
</tr>
<tr>
<td>Adv. Integration</td>
<td>£6</td>
<td>Adv. Integration</td>
<td>£6</td>
</tr>
<tr>
<td>Vector analyze</td>
<td>£6</td>
<td>Vector analyze</td>
<td>£6</td>
</tr>
</tbody>
</table>

All programs on cassettes for: PET, TRS-80, SORCERER, APPLE 2 & NASCOM. Otherwise we can supply printouts. Please state which when ordering.

S.A.E. now: for catalogue with details of over 100 programs. Prices include Post and Package.

Cheques/Postal orders to: DATABANK.
66, QUEENS ROAD, LOUGHBOROUGH, LEICESTERSHIRE LE11 1DH.
(Mall order only).

---

### SLOUGH MICROSHOP

**We stock:**

- Commodore PET
- Exidy Sorcerer
- North Star Horizon

*Full demonstration equipment available now.*

**Extra services include:**

- A complete hardware maintenance service
- A software service; tailor-made or packaged software available

**Call in at our shop**

120 High Street, Slough, Berkshire

Tel: Slough 22855

---

### 3D Design & Development

**43 Grafton Way, London W1P SLA**

Tel: 01-387-7388

**PRINTER INTERFACES FOR THE NEW SHARP MZ-80K MICRO COMPUTER**

* **PARALLEL PRINTER INTERFACE (PPI)**
  This interface will drive most parallel printers, such as the Centronics 730, 779, Anadex DP8000, etc. Supplied boxed complete with ribbon cables and connectors for the Sharp MZ-80K and the printer.

* **SERIAL PRINTER INTERFACE (SPI)**
  This interface provides both RS232C and 20 mA Current Loop outputs. Switch-selectable crystal-controlled baud rate in the range 50 - 19,200 baud. Supplied boxed complete with power supply, ribbon cable, and connector for the Sharp MZ-80K, and D-type connector for printer, VDU etc.

* **3 D SPECIALISES in microcomputer interfaces for industrial, medical, and educational applications.**

Wide range of analogue and digital input/output Interfaces are available for microcomputers with IEEE-488 Bus. These include digital data acquisition system, analogue data acquisition system, D to A converters, etc.

Range of custom interfaces supplied:—

- Stepper motor, Spectrophotometer, Transient recorder,
- NC Tape Generation System, BS4421 to IEEE-488,
- Floppy Discs, Noise-Level meters, etc.

Quotations supplied against customer’s specification.
The portable brain

Amazing it may be, but that should come as no surprise since the 'Portable Brain' comes from Sharp, who produced the world's first equally amazing Portable Desk Top Calculator. Who else would you expect to be first again with the 'Portable Brain' - a micro-computer with some very remarkable features, made just by Sharp. Find out about the National Sales & Services Network which has been built-up by Sharp to look after this very special piece of advanced technology. Find out more about what it can do for you, by filling in this coupon right away!

Trust Sharp to make it.

I would like to know more about the 'Portable Brain.' Send me the full facts now about how it can help me!

Name

Address

Tel:

Sharp Electronics (UK) Ltd., 107 Hulme Hall Lane, Manchester M10 8HL. Tel: 061-205 7321

PRACTICAL COMPUTING November 1979

Circle No. 140
LEASE A PET OR A COMPLETE SYSTEM FROM £5 A WEEK (+ VAT)

FOR AIMS

INTERFACES TO PETITE MEMORY £120 + VAT

FOR FET

INCOMPLETE RECORDS ACCOUNTING £750 — £2,900 + VAT
SOFTWARE & HARDWARE

C12 TAPES £4 FOR 10
DISKETTES £34 FOR 10 INC. VAT
+ 50p P&P

WIDE RANGE OF BUSINESS PROGRAMS

8 STATION PARADE
SOUTHGATE LONDON N.14
882 5104

ANNOUNCING

S100 Teletext Format. Colour VDU card with keyboard. Port to operate with colour monitor: from the company that designed and built the BBC Ceefax formatting terminals.

KITS £149, BUILT AND TESTED, £209 + VAT

S100 OFF AIR RECEIVER AND MODULATION CARD
To operate with VDU card and enable OFF AIR reception and display via a TV set.

Available from October. Enquiries from dealers welcome
LEENSHIRE LTD.
13 Cathedral View,
Winchester, Hampshire
SO23 8PR
Tel: 0962 3675

COMPUTER SYSTEMS
the micro division of Software Aids International Ltd.

COURSES
at the weekend for busy people.
INTRO to MICROSS
1. For businesswomen (non technical) w/e 27-28 October.
2. For beginners (general) w/e 3-4 November.
3. For mainframe programmers w/e 10-11 November.
4. For beginners w/e 17-18 November.
5. For programmers w/e 24-25 November.
BASIC
6. For beginners w/e 1-2 December.

Take first day only if you prefer.
LOCATION: Central London
COST — 1 day £25.00
2 days £50.00 (+ VAT)

EARLY BOOKING ESSENTIAL

Please book me on Course No. No. of days (1 or 2) (Remittance enclosed)

PACKAGES
by professionals
We pride ourselves in our
a) package consists of application features.
b) comprehensive documentation for easy use.
c) backup in training, implementation assistance etc.

Systems include:
ORDER PROCESSING
INVOICING
SALES LEDGER
SALES ANALYSIS
PURCHASES LEDGER
NOMINAL LEDGER (with Budgetary Control)
JOB COSTING
PAYROLL
Available in COBOL or BASIC

Your suggestions welcomed for development of package prices.

PROGRAMMING
for your machine
in
COBOL — The professional language for commercial applications on machines where CP/M is available we can advise).
BASIC — For the smaller machine, in any variant.

SYSTEM DESIGN — Undertaken by well qualified Consultants.

We are quite happy to work evenings and weekends to leave your machine free for your daytime use.
Regrettably, due to demand, we can only offer this service in the London and Home Counties areas.

Please allow our principal consultant (a qualified accountant) to visit you and discuss your requirements.


Please book me on Course No. No. of days (1 or 2) (Remittance enclosed)

Please send me details of

Package(s) for Programming Services in COBOL BASIC (Please Tick)

Name
Company
Address

PRACTICAL COMPUTING November 1979
Unleash your Pet* to its full capability.

Two ways to 32K.
Add on or add in.

One way: Petite memory system.
- Self-contained peripheral for any Commodore Pet.
- Plugs into mains and Pet.
- No modifications required.
- No demands on Pet power supply.
- No extra heat dissipation within Pet cabinet.
- No warranty problems.

The Other: Inpet memory board.
- Mounts onto Pet processor board.
- Built in PSU.
- Simple to fit.
- Complete with all connectors.
- Low cost version.

* Trademark of Commodore Business Systems.

One way or the other you get a reliable memory from Plessey Microsystems, Europe's leading memory manufacturer. Either way you get a memory to make your Pet more like a powerful business computer.

Available from authorised distributors of Plessey Pet peripherals.
Send for full information and the address of your nearest distributor.

Plessey Microsystems Limited, Water Lane, Towcester, Northants NN12 7JN Telephone: Towcester (0327) 50312 Telex: 31628
A.P. Ltd

Hardware
The MAPLE, our own micro-APL computer. Also APL VDUs, terminals.

Software
Word processing, financial modelling, graphics, statistics, etc. Custom-written software is our central function — our analysts produce stable APL systems in a small fraction of the time that anyone else can, using conventional languages. Own your own APL interpreter — we have source code for a micro-APL implementation.

Courses
APL language — a thorough grounding;
APL implementations — an overview of practical APL;
Writing an APL Interpreter — for the serious micro-systems programmer.

Books
We have a wide selection of APL books.

For details on any of these areas, telephone Chester (0244) 46024 /21084 between 10am-8pm weekdays, or write to A.P. Limited, FREEPOST, Chester CH3 5YZ.

ABEL COMPUTER SYSTEMS LIMITED
5 HANLITH-WILNECOTE-TAMWORTH-STAFFS-B77 4BP
BLANK SHORTPLAY DATA CASSETTES
10 Quality Cassettes with Library Cases £5.10
BLANK DISKETTES Single-Sided — Soft-Sected (Suitable for APPLE, PET, Etc.)
Certified Diskettes of the Highest Quality by a Renowned Manufacturer £3.15 EACH
APPLE-II SOFTWARE ON DISKETTE
Games pack Vol.1: 8 games for £10.00
Integer Basic Utilities — Renumber, Merge, Cross-reference, Name Finder, etc. £10.00
Symbolic Assembler with comprehensive instruction manual £20.00
APPLE-II SOFTWARE ON CASSETTE Games Pack Vol.1: 8 games on 2 cassettes (Minimum 16K APPLE) £9.30
CASSETTE DUPLICATION S.A.E. for details

LAST MONTH AT INTRODUCTORY PRICES PRICES INCLUDE VAT. Add 30p to total order for packing/postage

ROCKLIFF
2 RUMFORD STREET LIVERPOOL L2 8SZ

P.E.T. APPLE I.T.T. HEWLETT PACKARD KIM

PRINTERS
TELETYPE 43 £795
CENTRONICS 779 £795
ANADEX 8000 £580
C.B.M £645
PR40 (for PET) £250

DISC DRIVES
C.B.M £795
COMPUTHINK £840
APPLE £398
PET MEMORY £320

APPLE INTERFACES
HIGH SPEED SERIAL £110
PARALLEL C.R. £110
CENTRONICS CARD £132
COMMUNICATIONS £132
CLOCK CARD £140
HEURISTICS SPEECH £127
A1/O2 DATA ACQUISITION £170
ALF SYNTHESISER £215
PASCAL & LANGUAGE £295
INTEGER FIRMWARE £110
EUROCOLOUR £69

PET INTERFACES
RS232 UNI £89
RS232 BI £140
RS232 8i 20ma £180
UMF TV £25
JOYSTICK £25

ACCESSORIES
10 C60 CASSETTES £3.50
10 C60 CASSETTES £3.50
10 5 1/4 Floppy Discs £30
10 PR40 ROLLS £6
1000 8x12 Listing £6
1000 11x9 Listing £5

HEAD DEMAGNETISER £5

OVER 400 BOOKS AND PROGRAMMES AVAILABLE (ASK FOR OUR PRICE LIST)

PLEASE ADD 15% VAT TO ALL PRICES 051-521 5830

PRACTICAL COMPUTING November 1979
WE SUPPLY SYSTEMS — LOOK AT THESE TYPICAL CONFIGURATIONS!

System A  32K Commodore PET + Commodore model 2040
- Dual floppy drives and cable.
- £1,610

System B  NORTH STAR HORIZON, 32K RAM, dual
- double-density drives, 2 serial, 1 parallel port,
- DOS and BASIC, high-quality brand name 24 x
- 80 char VDU
- £2,065

System C  CROMEMCO System 2, 4MHz Z-80, 64K RAM,
- dual minifloppies, 21 connectors, 1 serial, 1
- parallel printer port, CDOS 1.07 and Extended
- Disk BASIC High-quality brand name VDU etc
- £2,735

System D  CROMEMCO Z-2, 4MHz, 1 megabyte floppy disk
- storage, 64K RAM, 3 serial ports, 2 parallel ports,
- CDOS 1.07 and BASIC, High-quality 24 x 80 char
- VDU
- £4,600

System E  CROMEMCO System 3 (the “Rolls Royce”) 64K
- RAM, 4MHz, 1 megabyte floppy disk storage, 1
- serial and 1 parallel printer port, high-quality
- brand name 24 x 80 char VDU etc, including
- CDOS and BASIC
- £5,130

2-2H 10Meg hard disk systems now available.

We supply Centronics, Teletype 43 and Diablo Printers, plus the normal range of
ancillary equipment. CPIM for Cromemco and Horizon systems is available from
us, as well as Microsoft Fortran, Tex etc.

23 Cumberland Place, Southampton SO1 2BB.
Tel (0703) 38740 Tues-Sat

* Circle No. 148
MICRO TASK LTD.

HAS BEEN FORMED TO PROVIDE SYSTEMS AND TECHNICAL ADVICE TO BUSINESSES CONSIDERING THE USE OF MICROCOMPUTERS —

- To help you to decide if a MICRO would be of use to you
- To help you design an effective system
- To help you negotiate with your computer and software suppliers

MICRO TASK LTD, COMPUTER CONSULTANTS, 11 DUNLIN CLOSE, SOUTH WOODHAM FERRERS, CHELMSFORD, ESSEX CM3 5SA. Tel: Chelmsford 322055.

EQUINOX 300

A powerful multi-user multi-tasking multi-language 16-bit microcomputer time-sharing system supporting
- BASIC
- LISP
- PASCAL
- Floppy discs
- Hard discs

including a powerful Text Formatter, Assembly Language Development System and disc-based Sort utilities.

Priced from under £5,000

Write or phone for further information.

EQUINOX COMPUTER SYSTEMS LTD “Kleeman House” 16 Anning Street, New Inn Yard, London EC2A 3HB.
Tel: 01-739 2387/9. 01-729 4460.

MICROCONTROL — THE INTERFACE EXPERTS

224 EDGWARE ROAD LONDON W2 Tel 01-402 8842

MICRO CONTROL have been building specialised hardware and writing software, since Apple first came into the country. We can interface your Apple to anything with a custom designed card for a reasonable price. We can also provide Business Systems for Apple II and Micro Star to your requirements.

Centronics Printer Card £140.00
Apple disk drive £375.00
with controller card £425.00
Micro Hush Printer + Apple Interface £266.00
Thermal paperroll for Micro Hush £2.00
10in b/w monitor £132.00
12in b/w monitor £210.00
Apple Pascal £296.00
MicroStar £4,950.00
Printers VDU’s ITT Apples Software & one-off’s P.O.A.
COMING SOON:—
Colour board for Apple. Have your text in colour! Clean Lores hires colours £147.00
Micro Con. Real Time Clock. Date/Hr/Minute £90.00
4-Channel Mains Controller £140.00
4-Channel Mains Dimmer £175.00

4-Channel A/D cards 12-bit £174.00; 8-bit £127.00
4-Channel D/A 12-bit £149.00; 8-bit £110.00
16K Add in 150ns £58.00
Apple II 16K £810.00
High Speed Serial Card £110.00.
Com. Card £140.00
Integer Firmware Card (inc. Mini-Assembler) £110.00
Symtec light pen (for Apple) £165.00.
Apple Voice recognition Card £165.00.
Micro Products Eprom burner £140.00.
Box of 10 diskettes £30.00.

MICROCONTROL have been building specialised hardware and writing software, since Apple first came into the country. We can interface your Apple to anything with a custom designed card for a reasonable price. We can also provide Business Systems for Apple II and Micro Star to your requirements.
The properties of the space in which the hint is conducted are defined. The objective is the names and natures of the searchers, their antagonists, and the context is that of a search for a defined object, typically Atlantis or the Holy Grail. HUNT is a new concept in fantasy simulations which has achieved wide acclaim.

PHOTOGRAPHY TUTOR is a comprehensive course developed by a professional photographer, making full use of PET's dynamic graphics capabilities to demonstrate and explain the mysteries of exposure, aperture, shutter speeds, interchangeable lenses, depth of field, etc. The theory and practice of photography are explored interactively and progress tested. Multiprogram pack containing eight 7K lessons. Available in Disk.

6502 FORTH. FORTH is a unique threaded language that is ideally suited for systems and applications programming on a PET. The user may have the interactive FORTH Compiler/Interpreter system running hand-alone in 8K to 12K bytes of RAM. The system also offers a built-in incremental assembler and text editor. Since the FORTH language is vocabulary based, the user may tailor the system to resemble the needs and structure of any specific application. Programming in FORTH consists of defining new words, which draw upon the existing vocabulary, and which in turn may be used to define even more complex applications. Programs written at FORTH are compact and very fast.

CRYPTO PACK GI This is the complete kit for all those interested in cryptography. It includes Cryptosub General Cipher Cryptanalyser and New Cipher programs particularly useful where an 'Open Choice' in subjects is offered to pupils. The program monitors and provides a simple dialogue with the relevant class, to which pupils are allowed to respond and from which a list of those pupils and their requests and allocations is printed. This information gives the scheme a realistic value, as it can be used as a guide to the relative value of a job based on the thinking of the company or department responsible.

STOCK CONTROL ON DISK is a fully operational stock point system which plugs into the leftmost empty socket inside the PET. Price £55 plus VAT.

When ordering, please quote the catalog number and VAT rate applicable to that employee. Update service available.

The trainer is designed and written to meet the needs of small businesses. Up to 400 employees per disk are catered for. A 32K PET 2001-32 equipped with dual floppy, an Ansios DPMX or defence 1 printer is required.

Facilities provided include Holiday Pay, Sick Pay, Bonus payments and two rates of overtime, as well as allowing a 'standard week' to be specified for each employee. Weekly and monthly summaries are provided and are adjustable by the user, because of a budget (e.g., increasing employee's tax code) is made very easy.

Each week a wage slip is printed for each employee, following an analysis of the amounts requested for these employers paid as cash (payments by cheque and credit transfer are also allowed for). Tax and NI are computed automatically from a knowledge of the tax code and N I rate applicable to that employee. Update service available.

COURSES HANDLER is a user for桫和TVMs. The program handles all the administration relevant to creating a 4th, 5th, or 6th year Option Scheme, and is particularly useful where an 'Open Choice' is offered to pupils. The program monitors and provides a simple dialogue with the relevant class, to which pupils are allowed to respond and from which a list of those pupils and their requests and allocations is printed. This information gives the scheme a realistic value, as it can be used as a guide to the relative value of a job based on the thinking of the company or department responsible.

PET SOFT PROGRAMMERS TOOLKIT

"10 Powerful New Commands for your PET!"

The Toolkit is a machine language program which is provided in a 2 kilobyte ROM chip. Just plug it in — no tools are necessary — and your PET's BASIC has a whole new and very useful repertoire of commands, including:

AUTO RENUMBER DELETE FIND APPEND DUMP HELP TRACE and STEP.

For the new 16K and 32K PETs, the toolkit consists of a single ROM chip which plugs into the leftmost empty socket inside the PET. Price £35 plus VAT. For 8K and older ROM PETs, a small printed circuit board is attached to the memory expansion and 2nd cassette ports of the PET. Price £75 plus VAT. Send for a free Data Sheet.

Recommended by Commodore
£1 a day keeps your Apple in play

A 48K Apple II microcomputer will cost you less than £1 per day under our lease or lease/purchase facilities

£28.84 per month for 48K Apple II

Software not Soft Talk

During the last 18 months many Accountants have profitably used Padmede's Disc-Based Incomplete Record Accounting System. Many unique features are included e.g. analysis by Nominal Ledger and Account Codes, input direct from bank statement, selective code reporting, multiple runs of final accounts, etc. Hardware and software price £4,250.

Other software developed and installed with users includes:
- Time and Cost Recording
- Stock Control
- Payroll
- Job Costing
- Order Processing
- Sales Ledger
- Word Processing

For more information contact:
Padmede Ltd., The Tuns, High Street, Odiham, Nr. Basingstoke, Hants.
Tel. Odiham (025-671) 2434.
NEW LOW PRICE FOR
LEVEL II BASIC 16K

TRS-80 Microcomputer
the world's biggest selling personal microcomputer

This is a fantastic opportunity
to own a TRS-80 personal
microcomputer. Designed and
built by TANDY, the TRS-80 is
the world's biggest seller, with
over 100,000 in use.
The 'silicon chip' revolution is
here, now, at your nearest
TANDY store. If necessary you
simply add-on extra modules to
suit your individual require-
ments. See a TRS-80 at your
Local TANDY today.

£519 26-1006
VAT
Total £596.85 Old price £752.81
inc. VAT at 15°

TRS-80 Expansion is easy!—Just add the units to suit your needs.

<table>
<thead>
<tr>
<th>Old Price incl. 15% VAT</th>
<th>New Low Price (less VAT)</th>
<th>New Low Price incl. VAT</th>
<th>SAVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 1120 ROM</td>
<td>£84.12</td>
<td>£73</td>
<td>£16.61</td>
</tr>
<tr>
<td>26 1101 16K Upgrade</td>
<td>£137.36</td>
<td>£105</td>
<td>£120.75</td>
</tr>
<tr>
<td>26 1003 16K Level I</td>
<td>£668.69</td>
<td>£480</td>
<td>£552.00</td>
</tr>
<tr>
<td>26 1004 4K Level II</td>
<td>£615.45</td>
<td>£448</td>
<td>£515.20</td>
</tr>
<tr>
<td>26 1006 16K Level II</td>
<td>£752.81</td>
<td>£519</td>
<td>£596.85</td>
</tr>
<tr>
<td>26 1140 Expansion Interface</td>
<td>£243.84</td>
<td>£199</td>
<td>£228.85</td>
</tr>
</tbody>
</table>

Offers subject to availability. Access, Barclaycard and Trustcard welcome. Instant credit available in most cases. Check your telephone directory for your nearest store. OVER 170 STORES AND DEALERSHIPS NATIONWIDE. KNOWN AS RADIO SHACK IN THE U.S.A. MAKERS OF THE WORLD'S BIGGEST SELLING MICROCOMPUTER TRS-80.

BRINGING HIGH TECHNOLOGY DOWN TO EARTH

Please send full details and new low prices of TRS-80 systems.

NAME
ADDRESS
PHONE
TANDY CORPORATION, BILSTON ROAD, WEDNESBURY, W. MIDLANDS, WS10 7JN.

PRACTICAL COMPUTING November 1979
WE OFFER A COMPLETE SERVICE!

When you buy a computer from us — we don’t give you the box and wave goodbye.

We realise this is a major purchase for a Company and take the time to find out your requirements, design your computer system and write the software, or if you prefer to write your own, we will always be available to advise you.

You can buy a wide range of fully-documented packages — Word Processing/Purchase & Sales Ledgers/Stock Control/Incomplete Records/Medical Systems/Teaching Programs etc. on Microcomputers such as —

APPLE II from £810
(16K)
A complete business system 48K
Apple, 2 Disk Drives, VDU &
Printer £2,650

MICROSTAR from
£4,950
Multi-user/Multi-task
1.2/2.4 or 4.8 mb.
A complete system with 2 VDUs
& Printer £7,000

ALPHA MICRO from
£9,950
From 1 to 32 terminals.
From 10 mb. to 90 mb. disk
storage.
16-bit processor, Multi-user
operating system.

e.g.
LOW COST
PRINTER
matrix printer £695
LEAR SEIGLER
200A matrix printer £1,650
QUME Sprint 5
daisywheel printer £2,115.

We stock a full range of VDUs, Printers,
Computer Stationery, Diskettes, Disk Boxes etc.

all prices ex VAT.

Come and see us to discuss your requirements and have a demonstration.

MICROSOLVE
Microsolve Computer Services Ltd.
125 /129 High Street, Edgware, Middlesex.
Tel: 01-951 0218

M1 junction 4 /20 mins from Central London.

INNOVATIVE
TRS-80 SOFTWARE

NEW!! INFINITE BASIC NEW!!

“Infinite Basic” adds over 70 new commands to your Level II or Disk Basic. Furthermore, these are modularised so that any combination may be loaded at any time, which makes the package very memory efficient. A sampling of the additions includes complete string functions, left & right justify, truncate, rotate, text justification, reverse strings, verify, string searches etc., etc. Complete Matrix functions are also included with inverse, transpose, simultaneous equations, multiply scalars, vectors; reshape, expand and delete arrays; change arrays in mid-program, zero and move arrays etc., etc.

“Infinite Business” is an add-on package to the above and includes multiple precision-packed decimal arithmetic, eliminating round-off errors with a 127-digit maximum accuracy. Also includes binary search of sorted arrays, automatic page headings and more!

Infinite Basic ... £29.95. Infinite Business ... £16.95. Both plus VAT & 50p p&p.

Send large SAE (12½p) for our current catalogue of TRS-80 Software.

A.J.HARDING (MOLIMERX)
28 COLLINGTON AVENUE,BEXHILL-ON-SEA,E.SUSSEX.
TEL: (0424) 220391

PRACTICAL COMPUTING November 1979
DPS-1 MAINFRAME

Introducing the DPS-1 the full IEEE S100 bus computer system from Ithaca InterSystems — the S100 experts.

FOR EDUCATION, INDUSTRY, RESEARCH and all professional uses, including hardware and software development, low cost OEM systems, teaching applications etc.

A MINI COMPUTER using MICRO technology at a ridiculous MICRO Price!!! The front panel with a backplane and power supply accepts S100 bus boards from many manufacturers.

SOFTWARE
for your S100 system

PASCAL/Z The new language for Micros
CP/M Version £165.00
K2 Version £131.25

Runs under K2 operating system.
• Compiler that produces 280 macro assembler code
• NO NEED for slow run time P-code interpreter
• Comes complete with Macro assembler
• Produces binary object modules — small and fast
• Modules are re-entrant and can be put into ROM
• IMBED, TRACE and ERROR debug facilities
• Recursion

K2 OPERATING SYSTEM £56.25

8" disk based operating system — distributed on Shugart compatible 8" floppy disk
• TEO — 52 command character orientated text editor with macros
• FEP — File and directory handler
• ASMIBLE — Full 280 assembler
• MDT — Hex debug tool
• OCI — Utility overlay/command decoder
• SYSGEN — System builder
• COPY — disk to disk file copier
• DUP — disk duplicator

ASMIBLE/Z 280 Macro assembler £37.50
• Full 2 pass Macro Assembler
• IF and ELSE — 255 nesting levels
• Produces symbol table.
• Relative jumps.

OEM S100 boards
from the experts!

New products from Ithaca audio!

5K Static RAM board (45ns) £123.75
8K Static RAM board (250ns) £146.25
16K Static RAM board (45ns) £216.00
16K Static RAM board (250ns) £234.00
64K Dynamic RAM board (250ns) £540.00
280 cpu board (4MHz) £131.25
290 cpu board (4MHz) £152.75
2708/2716 EPROM board £83.75
Prototype board (bare board) £18.75
Video display board (64x16, 128x128, ASCII) £108.75

AVAILABLE SOON: ZBC-1 single board computer for OEM market. Available in basic through to fully expanded. 4MHz Z80A, 64K RAM, memory mapped 4K screen buffer, composite video, up to 16K power on EPROM monitor, 4 parallel ports, 2 serial ports, 4 channel counter timer. 1 off £895 — please phone for a quote for your needs (quantity discounts available).

All manuals available separately £2.50 each.

PASCAL MICRO DEVELOPMENT SYSTEM

Are you still waiting for one?

ITHACA InterSystems HAVE JUST ANOUNCED AN IEEE S100 SYSTEM WITH A TRUE PASCAL COMPILER FOR RESEARCH AND DEVELOPMENT LABORATORIES AND TEACHING APPLICATIONS

The PASCAL System

• DPS1 Mainframe with hardware front panel.
• Z80A 4MHz Microprocessor.
• 64K Static RAM.
• 8" Shugart Floppy Disc Drive, Power Supply and Controller.
• K2 DOS Operating System.
• Pascal Compiler and Macro Assembler.
• I/O Board with RS232 port and parallel port

While the others are talking about it, we are delivering!

CONTACT THESE UK DEALERS

NEWBEAR COMPUTING STORE (Newbury) (0635) 30505 Tel: 848507
SIRTON PRODUCTS (Surrey) 01-660 5617
DATAVIEW LTD. (Colchester) (0206) 78811
TRANSAM (C.London) 01-402 8137 Tel: 444198
CODIFIED COMPUTER SYSTEMS (North London) 01-226 1319
MICRONEX (Bristol) (027589) 3042

EUROPEAN SUBSIDIARY

58 Crouch Hall Road, London N8 8HG. England.
Telephone: 01-341 2447 Telex: 8954665 - Ref: ITHACA

All prices quoted are exclusive of VAT.
Bad Cloud?

If you encounter persistent program loading problems in spite of cleaning the record/playback head, and experimenting with volume and tone control settings, it could be that the azimuth adjustment is incorrect. This is the case on a surprising number of machines, even when first supplied. The azimuth adjustment alters the angle of the record/playback head, and the correct setting is precisely perpendicular to the motion of the tape. If it is incorrect, the high frequencies suffer drastic attenuation, which is the reason for many program loading failures, particularly with pre-recorded tapes which were not made on the same machine.

The adjustment may be easily made on most machines with the aid of our special high frequency test tape. Instruction sheet supplied.

**PRICE**

£4.60 inc. VAT and postage

Callers by appointment only please.

Alan Ford + Company

PHOENICE HOUSE, GREAT BOOKHAM, SURREY

---

AIM 65

£249.50 + VAT

FEATURES INCLUDE:

* 20 COLUMN PRINTER
* 20 CHARACTER ALPHANUMERIC DISPLAY
* FULL 54 KEY TERMINAL-STYLE KEYBOARD
* TTY INTERFACE
* TWIN CASSETTE INTERFACE
* RAM — 1K TO 4K OPTIONS

OPTIONAL EXTRAS INCLUDE:

8K 'BASIC' INTERPRETER ROM

£70.00

4K ASSEMBLER ROM

£59.50

POWER SUPPLY

£41.83

CASE (Including Power Supply)

£78.00

EXPANSION MOTHERCARD

£136.50

AIM 65 comes to you fully built and tested with a full alphanumeric keyboard, 20 character display and a 20 column printer — for keeping a permanent record of all your work. Available in 1K- and 4K-byte RAM versions, AIM 65 is designed around the 6502 CPU, which has 64K address capability with 13 addressing modes. This is the microprocessor at the heart of many other, more costly, systems such as PET and APPLE.

AIM 65 has a 4K ROM-resident monitor program for all peripheral control and user programming functions. Spare sockets are included for expanding on-board program memory via user PROM-based programs and/or Rockwell assembler, text editor and BASIC interpreter plug-in options. AIM 65 has a connector for external access to system bus for memory and

I/O expansion, a separate connector for interfacing a teletype and two cassette recorders. There is a user-dedicated Versatile Interface Adaptor, featuring three 8-bit, bidirectional ports (two parallel, one serial) and two 16-bit interval timer/counters — thus allowing the user to interface his own system, without extra interface devices in many cases. AIM 65 is probably the most effective, low-cost microcomputer development system available — an invaluable educational aid to first time users and an ideal general purpose micro-computer for the engineer.

AIM 65 is available in the UK from PELOCO ELECTRONICS LTD at £249.50 + VAT, complete with User’s Manual and Schematic, R6500 Programming and Hardware Manuals and a handy pocket reference card.

---

Sigma Technical Press

the UK software publisher

NEW — from SIGMA for NASCOM: Z80 INSTANT PROGRAMS: Machine code routines for NASCOM-1 and other Z80 systems by J. Hopton (G3WMP).

36 fully tested programs from delays through displays to games for the simplest NASCOM-1 or similar Z80 systems. Test your system and build your confidence! Book £7.50 Complete NASCOM - 1 Cassette £10.00

AND — our catalogue of books and software is one of the best in the UK. Ask for your copy or start by ordering these:

- Computer Programs That Work! (24 BASIC Programs) £3.15
- Consumers Guide to Personal Computing & Micro's £5.30
- Basic BASIC: an Introduction to Programming £5.90
- Game Playing with BASIC £4.70
- How to build a Computer Controlled Robot £5.30
- The Mind Appliance: Home Computer Applications £4.70
- BASIC with Style: Programming Proverbs £4.10
- Microprocessor Basics (wide survey) £7.10
- Microprocessor Data Manual (30 sources) £5.30
- Microprocessors: New Directions for Designers £7.10
- How to Profit from your Personal Computer £5.30
- The Systems Analyst: How to Design Systems £7.10

Prices include postage & packing in Europe and VAT where applicable. Official orders accepted from UK only for orders over £5.00. Outside UK, payment required in advance in Sterling on UK bank.

Sigma Technical Press: FREEPOST, 23 Dippons Mill Close, Tettenhall Wood, Wolverhampton WV6 7BR.

---

Pelco (Electronics) Ltd

Enterprise House 93/65 Western Road HOVE East Sussex BN3 1JF

Tel: Brighton (0273) 722155

Buy it with your Access or Barclaycard

---

PRACTICAL COMPUTING November 1979
NASCOM-2
Our nomination for the best microcomputer board in the world.

In about the same area as this advertisement, we have designed a microcomputer with 20K of addressable memory ON-BORD. With Kansas City standard cassette interface ON-BORD. With TV/monitor interface ON-BORD. With control decoding ON-BORD. With all bus lines fully buffered ON-BORD.

We call this microcomputer Nascom-2. And for under £300 this is what it has:

**Microprocessor**
Z80A. 8 bit CPU. This will run at 4 MHz but is selectable between 1/2/4 MHz. This CPU has now been generally accepted as the most powerful, 8 bit processor on the market.
The software library for the Z80, with its base around the 8080, has rapidly expanded with the increasing use of its more powerful instruction set.

**Hardware**
12" x 8" Card
All bus lines are to the Nasbus specification.
All bus lines are fully buffered.
PSU +12v, +5v, -12v, -5v.

**Memory**
On-board, addressable memory:
- 2K Monitor - Nas-Sys 1 (2K ROM)
- 1K Video RAM (MK4118)
- 1K Work space/User RAM (MK4118)
- 8K Microsoft Basic (MK36000 ROM)
- 8K Static RAM/2708 EPROM

**Interface**
New expanded 57 key Licon solid state keyboard especially built for Nascom. Uses standard Nascom, monitor controlled, decoding.

**TV**
The 1 v peak to peak video signal can drive a monitor directly and is also fed to the on-board modulator to drive the domestic TV.

**PIO**
There is also a totally uncommitted Parallel I/O (MK3881) giving 16, programmable, I/O lines. These are addressable as 2x8 bit ports with complete handshake controls.

**On-board decoding**
The NASCOM-2 makes extensive use of ROMS for on-board control decoding. This reduces the chip count and allows easy changes for specialised industrial use of the board.

**Link options** are on-board to allow the Reset control to be reassigned to an address other than zero.

**Character Generators**
The 1K video RAM drives a 2K ROM character generator providing the standard ASCII character set with some additions, 128 characters in all. There is also a socket for an optional graphics ROM on-board.

**Documentation**
Full construction article is provided for those who buy a kit and an extensive software manual is provided for the monitor and Basic.

We think no other board has quite so much on it for £295 (plus VAT).
Business systems available now for the TRS 80

Sales Ledger (Open Item/Debtors Analysis/Statements/Invoices/VAT/Daybooks etc.) from £150

Purchase Ledger (Open Item/Creditors Analysis/Remittance Advice/VAT/Daybook etc.) from £150

Invoicing (Updates Sales Ledger/Downdates Stock/Maintains Back Orders) £75

Stock Control (Issues/Receipts/Movement, Usage, Valuation, Re-order Reports etc.) £200

Payroll (Weekly, Monthly, Casual Staff/Bonus Schemes/CDIN Analysis/Payslips etc.) £200

Nominal Ledger (Available shortly)

12 Month Warranty on all packages - Tailored systems to your requirements

For the best in professional micro business software contact us direct or call your nearest Tridata dealer for a demonstration.

Cambridge Computer Store (Cambridge) 0223 68155
Computer Development Services (Swansea) 0292 29065
Electron Systems (Sandy, Beds.) 0167 81195
A. J. Harding (Bexhill, E. Sussex) 0424 220331
Katanana Management Services (Chelmsford) 0245 76127
Optronics (Twickenham) 01 892 8455
Datasource Computer Services (Portsmouth) 0705 816991/8
GPM Electronics Ltd (Portsmouth) 0705 693341

Tridata Micros Ltd.
Smithfield House
Digbeth
Birmingham B5 6BS
Tel: 021 622 1754

Research Resources Ltd.
Microcomputers for education, science and technology

- PET, Vector and SWTP
- Fortran, Pascal, Cobol, CBasic, Multi-user PILOT
- Exclusive to RRL: Lab-Basic, SAM (Statistical analysis) A-to-D, D-to-A converters.
- Showrooms at 40, Stonehills, Welwyn Garden City, Herts. Tel: Welwyn Garden 26633 (24 hours).

* Circle No. 164
* Circle No. 165
BI-DIRECTIONAL
MATRIX PRINTER

The B080 is a low-cost, 80-column line printer with microprocessor control to provide excellent availability and performance. 95% of dot matrix Full Assembler Test. 10 Char. per inch 10 Lines/sec Paper Advance 6 Lines/inch 112 Char./sec Fully Cased 400 Char. Buffer 82 Lines per minute

A UNIQUE PRINTER
FAST AND RELIABLE

SWITCH-SELECTABLE BAUD RATE FROM 110 TO 9600 ON A STANDARD V24 AND RS232 INTERFACE. SEND SAE FOR FURTHER DETAILS. IDEAL PRINTER FOR TRITON OR ANY SYSTEM REQUIRING HIGH-SPEED, RELIABLE HARD COPY. WE CAN SUPPLY CONSUMABLES.

S1000 BOARDs

8K Static RAM board (£555) £123.75 8K Static RAM board (20MHz) £26.50 8K Static RAM board (30MHz) £21.50 2K EPROM board (£111) £166.25 2K EPROM board (blank) £15.75 16K EPROM board (£111) £151.25

100k Board £110. Other options are available.

ITHACA

Pascal/Z

Build your own Pascal MICRO DEVELOPMENT SYSTEM. IEE-SIDO out of kit mainframe. Support of K2, Pascal/Z and Pascal/Z on disk.

TRAP!

Triton resident assembly language package. Links via the LE monitor and new scientific basic to make Triton a stand-alone development system. Trap is an 8K package in EPROM and resides on our EPROM card. Slot of 8K-208I only £81 including document.

EDITOR
ASSEMBLER
SINGLE STEP
SYMBOL TABLE
PROGRAM SAVE
MONITOR

See catalogue for further details.

HOME COMPUTING CATALOGUE

If you're in town, visit our showroom in Chapel Street, next to Edgware Road tube station. We have Tritons on display plus a comprehensive range of components and accessories, specifically for personal computer users. Books, maps, tapes, data, cables plus much more. Showroom open 6 days a week. (Half Day Thurs from 1.30 pm)
A personal computer that opens the world of programming to your own fresh ideas!

SHARP MZ-80K

78 Keys
ASCII standard
Alphanumeric, capital and small letters
Graphic symbols

CRT Display
This unit is equipped with a 25cm (10") monochrome CRT for up to 1.000 letters (60 letters x 25 lines). Processing results can be displayed on the CRT and it is possible to program and edit (addition, deletion, etc.) while watching the operation for confirmation.

Built-In Clock and Sound Circuits
Clock circuit time is displayed according to program
Sound circuit: 3 octave sound signals for aural confirmation according to program

Options
- RAM: 16K bytes
- Disk: 4K bytes
- Machine Language tape
- Assembler: Editor, Loader and Debugger

(All the above will be available in due course)

Assembler, Editor, Loader and Debugger
Machine Language tape
16K bytes

Available from
H B COMPUTERS LTD
22 NEWLAND STREET, KETTERING NORTHANTS.
Tel. (0536) 83922 & 520910 Telex 341297

• Circle No. 167

WE MEAN BUSINESS

Complete teak-mounted business systems ready to go
(With software, stationery and staff tuition).
Leasing and deferred terms available.
All Commodore hardware and compatible peripherals stocked

Plus our own Professional Software for the Commodore PET.

Our best seller — “T.V. Rentals”
(May be used for any equipment rental) — £80 plus vat.

39 ALBERT ST. KIRKWALL, KW15 1HQ.
Phone (0856) 3140.

Thistle Computers
39 Albert St., Kirkwall KW15 1HQ.
Phone (0856) 3140.

• Circle No. 168

NEWBEAR MAIL ORDER: 40 Bartholomew Street, Newbury, Berks. Tel: 0635 30505
NORTHERN SHOWROOM: 220-222 Stockport Road, Cheadle Heath, Stockport Tel: 061 491 2290

NEW BOOKS
Microprocessors & Microcomputers Huggins £ 4.95
Computers & Commonense Hunt & Shelley £ 3.50
Business Data Systems Clifton £ 2.75
Finance for the Small Business R. Ragan £ 7.20
The Best of Computer Faires Vol. 3 £ 9.50
Reducing COBOL Complexity Wooldridge £ 8.85
through Structured Programming McClure £11.30
Microprocessor and Microcomputer Systems Rao £19.85
Encyclopedia of Computer Science Raiston £48.60
Computer Approach to Introduction College Maths. Scalzo £11.30
Microcomputer Handbook Sippl £16.15
Data Communications Dictionary Sippl £16.15
Handbook of APL Programming Weidmann £ 6.50
Computer Output Design Wooldridge £ 9.70
Computer Input Design Wooldridge £ 8.85

INTRODUCTORY BOOKS
Vol. 0 The Beginners Book A. Osborne £ 5.95
Vol. I Basic Concepts A. Osborne £ 5.95
Vol. II Some Real Products A. Osborne £18.95
Vol. III Some Real Support Devices A. Osborne £11.95
A Consumers Guide to Personal Computing £ 5.65

BASIC
Basic Basic J. S. Coan £ 5.00
Advanced Basic J. S. Coan £ 5.50
Illustrated Basic D. Alcock £ 2.25
Basic with Business Applications £ 5.56
The Users Guide to North Star Basic Rogers £10.00
Basic and the Personal Computer Dwyer £10.36

MICROCOMPUTERS
Microprocessors C201 R. Zaks £ 7.50
Interfacing Techniques C207 R. Zaks £ 7.50
Best of Byte Scelbi £ 8.50
Scelbi Byte Primer £ 9.95
A Dictionary of Microcomputing P. Burton £ 0.00
Small Computer Systems Handbook £ 5.10
The Cheap Video Cookbook £ 5.10
TV Typewriter Cookbook £ 3.50
Active Filter Cookbook £ 3.50

PROGRAMMING
Top-Down Structured Programming Techniques £12.76
Assembly Level Programming for Small Computers £ 7.26
How to Programme Microcomputers Barden £ 6.95
6800 Programming for Logic Design A. Osborne £ 5.95
8080 Programming for Logic Design A. Osborne £ 5.95
8080 Assembly Language £ 6.95
8080 Assembly Language Programming A. Osborne £ 6.95

GAMES
62 Basic Programs for the Pet £ 9.95
Chess & Computer £ 7.16
Chess Skill in Man & Machine £ 11.84
Basic Computer Games AHI £ 8.50
Game Playing with Computers D. Spencer £10.20
Game Playing with Basic D. Spencer £ 4.10

SEND FOR COMPLETE BOOK & MAGAZINE LIST.

• Circle No. 169

PRACTICAL COMPUTING November 1979
Why wait for a kit computer when you can buy a fully built & tested Superboard II off the shelf?

Ohio Scientifics

Superboard II

Full 8K basic and 4K user RAM Built and tested

Now only £188 + VAT

We are passing on our savings from the rise in the £

(Delivery within 7 days)

The machine can be economically expanded to assist in your business, remotely control your home, communicate with other computers and perform many of the tasks via the broadest lines of expansion accessories in the microcomputer industry.

This machine is super easy to use because it communicates naturally in BASIC, an English-like programming language. So you can easily instruct it or program it to do whatever you want, but you don’t have to. You don’t because it comes with a complete software library on cassette including programmes for each application stated above. Ohio Scientific also offers you hundreds of inexpensive programs on read-to-run cassettes. Program it yourself or just enjoy it, the choice is yours.

Features

- Uses the ultra powerful 6502 microprocessor
- 8K Microsoft BASIC-in-ROM
- Full feature BASIC runs faster than currently available personal computers and all 8080-based business computers.
- 4K static RAM on board expandable to 8K
- Full 53-key keyboard with upper/lower case and user programmability
- Kansas City standard audio cassette interface for high reliability
- Full machine code monitor and I/O utilities in ROM
- Direct access video display has 1K of dedicated memory (besides 4K user memory), features uppercase, lower case, graphics and gaming characters for an effective screen resolution of up to 256 by 256 points. Normal TV’s with overscan display about 24 rows of 24 characters, without overscan up to 30 x 30 characters.

Extras

- Available expander board features 24K static RAM (additional mini-floppy interface, port adapter for printer and modem and OSI 48 line expansion interface.
- Assembler/editor and extended machine code monitor available.

Fully built and tested. Requires only +5V at 3 amps and a videomonitor or TV and RF converter to be up and running.

What the magazines say

“The Superboard represents good value with plenty of potential”
Practical Computing June ’79

“Certainly one of the most exciting (computers) on the present market”
Practical Electronics June ’79

“A useful machine..................represents value for money”
Computing Today June ’79

Dealer Enquiries welcome at Morgan St address

Lotus Sound
4, Morgan Street,
London E3 5AB
Tel: 01-961 3993

PRACTICAL COMPUTING November 1979 43
PET INTELLIGENT TERMINAL SOFTWARE PACKAGE

- A software package which, in conjunction with an interface, enables the PET to operate as an intelligent terminal.
- £100

TV/VIDEO MONITOR INTERFACE

- Video and UHF output (plugs into TV aerial socket)
- £35

IEEE 488/CENTRONICS TYPE PARALLEL INTERFACE

- Low cost unit without IEEE address decoding
- £100
- Also suitable for Anadex DP 8000 Printer
- £45

TV/VIDEO MONITOR INTERFACE

- Built-in mini-floppy disk drive
- £35
- RS-232 N/O port for serial printers, etc.
- £1,058

NEW CUSTOM CHIP INTERFACES

- Custom chips allow any character codes
- Option to print U/L case as PET Screen
- Parallel versions for PR40, ANADEX, CENTRONICS etc
- Fully addressable for PET Disc compatibility
- Custom Character Sets — One week delivery
- Parallel — £106 Serial — £120

PET MEMORY BOARDS

- Internally mounting memory boards — also available
- EPROM sockets: 24K — £328; 32K — £432

IEEE 488/RS232 SERIAL INTERFACE TYPE B

- Fully Bidirectional — PET Disc compatibility
- Switch selectable and Crystal Controlled Baud Rates
- Lower case printing
- Full operating instructions and sample programs supplied
- Boxed units complete with connectors £186

Available now:

COMPUCOLOR II MODEL 3

- 13" B-Colour CRT, 8080 Microprocessor
- 16K extended disk BASIC in ROM
- 71-key detached keyboard
- 8K RAM memory for user programs
- 64 characters per line by 32 lines per page
- Special graphics package with 128 x 128 point plotting
- Built-in mini-floppy disk drive
- 50 pin bus
- RS-232 N/O port for serial printers, etc.
- £1,058

TERMS: All prices Ex. VAT. Please make C.W.O. Cheque payable to: SMALL SYSTEMS ENGINEERING LTD. Post and package (includes SECURICOR delivery): £5

All goods supplied under 90 days’ warranty.
isher-woods offer a professional service, tailor made to fit your personal requirements

With the help of Commodore Systems and the PET® Computer, isher-woods can offer both the technically minded and the business man ready made or tailored solutions to most of your particular problems.

The Commodore PET® comes in 4 different memory sizes and is priced from as little as under £500 (ex VAT) for the 4K version. We can supply 8, 16, and 32K versions from stock, fully tested and guaranteed, together with Commodore, Floppies and Printers.

If you have a PET® or are considering buying one then we can look after it for you. Our in-house maintenance department makes a fixed price labour charge of £20 + parts at list price + VAT: just deliver to our door and we’ll put it right.

If you just want the parts then we can supply them from our “CHIP SHOP”. A comprehensive stock of Commodore and Petsoft tapes are always available. Ring PAM for further information.

isher-woods
Computer Systems Group
110/112 Leagrave Road, Luton Tel: (0582) 424851/39570
Sellers of PET® and other fine computer systems.

* Circle No. 173
BOOKS - BOOKS - BOOKS

BOOKS Our most popular titles:

- Introduction to Personal Business Computing. £5.45
- Microprocessors Chips to Systems. £7.95
- Microprocessors - Interfacing Techniques. £3.75
- Introduction to Microcomputers. £5.95
- Vol 1 - The Beginners Book. £5.95
- Vol 1 - Application Techniques. £6.30
- Microcomputer Primer. How they work for beginners. £6.35
- 280 Microcomputer Handbook. £6.95
- 280 Assembly Language Programming. £6.95
- 280 Prog. for Logic Design. £6.30
- Illustrating Basic. £2.25
- How to Profit from your Personal Computer. £5.50
- 6502 Applications Book. £8.95
- Programming the 6502. £7.95
- Instant Basic. The fun way to learn. £7.20
- Basic Basic. One of the most widely sold. £6.50
- Advanced Basic. £6.00
- How to Program Micros. Assembly Language for 8080. £6.95
- 6800 & 6502. £6.95
- How to Build a Working Digital Computer. £4.60
- How to Build a Computer-Controlled Robot. £5.95
- Nut/Butter & Jelly Guide to Micros. £6.45
- Small Computer Systems Source Book, for newcomers - practical knowledge. £6.10
- Cobol with Style (proverbs) £5.40
- Practice Problems in Number Systems, Logic and Boolean Algebra. £4.95
- Some Common Basic Programs, 76 programs, finance maths etc. £6.45
- Scelbi 6800 Gourmet Guide. £7.95
- Scelbi 8080 Gourmet Guide. £7.95

Send s.a.e. for full list. Prices correct at going to press. Add 12p insurance on books if required.

*Phone in your Access/Barclaycard No. 0742-585490 or complete this order form*

**COMMODORE BASIC**

31743 BYTES FREE

READY.

PAM is a self-contained add-on memory unit for PET computers. It is available in 8K, 16K, 24K and 32K versions. 8K cards are available to augment all but 32K versions at a later date.

Operation is simply by plugging-in to PET's memory expansion port, using the high-quality, protected connector provided, and to the mains. PET power consumption, temperature and warranty are unaffected.

The standard, 24K version upgrades PET's memory to the full 32K addressable in BASIC, giving over 4 times the capacity of the standard 8K PET.

All units are guaranteed for 6 months and are supplied with full instructions.

PRICES - 8K £154 (ex VAT) 16K £232 plus £4.50 carr.
- 24K £310 and insurance
- 32K £367
- 8K plug-in card £78 plus £2.50 carr. and insurance

Prices are correct at time of going to press—subject to change without notice.

OMB electronics, Riverside, Eynsford, Kent DA4 0AE Tel: Farningham (0322) 863567

**NEW**

Computer Capers. Tales of electronic theivery, embezzlement and fraud! £8.95
- A Colin Day. Fortran Techniques Spec. ref. to non-numerical applications. £2.25
- Murray Laver. Intro to the Study of Computers. £2.95
- Donald M. Monro. BASIC. Not to be confused with J. Coan's title. A must! £2.00
- Martin Whitbread. Microprocessor. Applications in Business and Industry. Must for decision makers. £10.00

Send s.a.e. for full list. Prices correct at going to press. Add 12p insurance on books if required.

**SARGON meets the Nascom-1 — D. Smith**

SDC. The First Nascom-1 Available. £15.95

**SARGON meets the Nascom-1 — D. Smith**

SCORPION for the 8080. £10.95

**SARGON meets the Nascom-1 — D. Smith**

SMOKE for the 8085. £10.95

**SARGON meets the Nascom-1 — D. Smith**

TDM meets the Nascom-1. £10.95

**SARGON meets the Nascom-1 — D. Smith**

**First issue includes: SARGON meets the Nascom-1 — J. Haigh**

Pascal and the PET — J. Stout.

Programming practices and techniques — Dr. M. Beer.

I'm Pilot, fly me — D. Straker.

Letter from America — D. Smith

Apple pips — C. Phillips.

Send s.a.e. for full list. Prices correct at going to press. Add 12p insurance on books if required.

**SOFTWARE GAZETTE**

LIVERPOOL

**LIVERPOOL SOFTWARE GAZETTE**

First issue includes:

SARGON meets the Nascom-1 — J. Haigh

Pascal and the PET — J. Stout.

Programming practices and techniques — Dr. M. Beer.

I'm Pilot, fly me — D. Straker.

Letter from America — D. Smith

Apple pips — C. Phillips.
EXIDY – Main Dealer

The Sorcerer Business System £2999 + VAT
32K Computer with 8K BASIC Rom Pac
80 Column Printer
9” Monitor
Dual Disk System – 633 Kb
S100 Expansion Unit
CP/M & CBASIC
Graphics facilities, pre-defined and user defined.
63 key ASCII Keyboard and 16 key numeric pad.
Various disk systems available to over 1 megabyte.
ROM PACS available now – ASSEMBLER, WORD PROCESSING, EPROM
Cooling fan for S100 units £16.75.
Manuals ex-stock.
8K, 16K and 32K machines.

CROMEMCO
Z2 and Z3 Systems.
Outstanding professional machines.
Fast Z80 CPU with 21 card motherboard.
Software support includes COBOL, FORTRAN IV, 16K EXTENDED BASIC, MULTI-USER OPERATING SYSTEMS, DATA BASE MANAGEMENT SYSTEM
Now on short delivery.

PRINTERS – All Ex-Stock
DOLPHIN BD80. The best in its price range.
The 80 column printer with many features. £595.
PRINTERM 879 Matrix Printer 120 cps. £695.
OKI DP100 – 132 column 275 cps 125 Ipm. £2400.

DISK DRIVE UNITS
SHUGART
MICROPOLIS
NORTH STAR
PERSCI

VDU’s
ELBIT DS 1920 £575.
ELBIT DS 1920X. The new improved cost conscious compatible terminal £750.

MONITORS
Professional quality 9” £145 and 16” £175 (ideal for teaching).

SHOWROOM and OFFICES
34B London Road, Blackwater, Camberley, Surrey.
Telephone: 0276 34044. Telex 858893

open Monday - Friday 9 a.m. - 6 p.m.
Saturday 10 a.m. - 6 p.m.
On Main A30

Don’t Be Left Behind
You Too Can Discover microPOWER

COMPUTER BOOKS – We carry a large stock of Micro books.
Orders sent out same day except in cases of very high demand,
when we will inform you of delay.
Extensive catalogue available – Micro, Mini and Mainframe.

SOFTWARE – On cassette and disk and written to customer
requirements.

MEDIA – Floppy Disks 5” from £25 box of 10
8” from £32 box of 10
Library Cases 5” £2.99
8” £3.49
Computer Cassettes C12 £4.00 for 10

BEAR BAGS – AREA DISTRIBUTOR
Build your own 6800 based computer. Active user group.
Bear Bags and PCB’s always in stock.

PRINTER PAPER
12” x 9.25”. Single part plain, tractor feed with tear-off edges.
Ideal for word processing – each page A4 size.
Per box 2000 sheets £14.00.
Other sizes available.
Orders taken for pre-printed continuous stationery, to your exact
company requirements.

WORK STATIONS
Made to fit your hardware configurations.

All prices + VAT and P/P.
Maintenance contracts available.
Leasing and H.P. arranged through leading finance houses.
Feasibility studies to help you decide on the system that is right for you.
Customer support and technical back-up.

ACCESS, BARCLAYCARD and TRUSTCARD.

Personal Callers Welcome.
Please phone first if you require a personal demonstration.
Mail orders and official orders accepted.
Quantity discounts available.
THE NEW GENERATION OF ICOM AMATEUR RADIO TRANSCEIVERS USE MICROPROCESSORS OR L.S.I. CHIPS FOR FREQUENCY SYNTHESIS.

This means that they lend themselves to computer control for such things as automatic frequency scanning, automatic logging and automatic receive and transmit of Morse code and Radioteleprinter data when interfaced with home computers. In fact we have a cassette program for the PET, coupled to an IC-211e VHF transceiver to scan and log the usage of channels over any period of time — (£15 cassette or £20 PET mini floppy).

WHY NOT LET YOUR COMPUTER TALK TO OTHERS?
AMATEUR RADIO IS A GOOD FOLLOW-UP FROM HOME COMPUTING!
WHY NOT TALK TO US ABOUT IT — SEND DATA AND PROGRAMS OVER THE AIR!

Phone, write or put a message on our Ansafone for catalogues and Price Lists.

THANET ELECTRONICS
143 RECULVER ROAD
HERNE BAY, KENT
PHONE (02273) 63859 (2 lines)
TELEX 965179
MAXIMUM CAPACITY COMMERCIAL SYSTEM

INCREDIBLE £1995† VALUE!!

THE PERFORMANCE LEADER!!

THE PRICE LEADER !!!

INTERTEC SUPERBRAIN™

Dual Z80A 4MHz Vector Interrupt
64K RAM plus 1K 2708 PROM Bootstrap
TWO Double Density 5” Floppy Disk
* Yes: That’s the Right Price

YES! THE SUPERBRAIN IS HERE!

See us all at THE INTERNATIONAL BUSINESS SHOW,
Birmingham Exhibition Centre from 23 Oct — 1 Nov

ICARUS COMPUTER SYSTEMS LTD
NATIONWIDE DISTRIBUTOR

£2,000 FREE CONSULTING!

- Via non-returnable government grant 100% of first £2,000 available to:
  Qualified Industries and Manufacturers: Small, Medium, and Large
- You shouldn’t settle for expensive limited function accounting systems £8-12,000
- You probably don’t need a Minicomputer-Mainframe at £15-50,000 + +
- Many firms, large and small, are fully served by flexible microcomputer systems:
  Today's technology at a fraction of mainframe costs: typically only £5-15,000!
- The Government Department of Industry wants you to know the facts by way of:
  A Mapcon registered consultant: non-believers are invited to ring
  Dept. of Industry Mapcon at Stevenage (0438) 3388 for the attention of Mr. Nish

NEWCASTLE UPON TYNE'S OWN

MICROCOMPUTER SYSTEMS HOUSE: MULLER (ANGLO AMERICAN COMPUTERS) LTD.
- CONSULTING: Microcomputer Systems Analysis & Feasibility Studies NATIONWIDE MAPCON
  Registered Consultancy: See above: Why do without the facts?
- SYSTEMS DEVELOPMENT: Integrated Software & Hardware TURNKEY Systems
  Start-to-finish Professional Design, Development, and Maintenance
  Fully-customised Programming and System Integration
  Low-cost Standard Business Software: Specialists in low-cost computerisations
  Give us the TOUGH Jobs: the ones that Increase Business & Profits:
  Automated Estimation-Tendering, Process Control, Production Management
  Distributed Processing (Multiprocessing), Management Information
- EXPERIENCED DEALER: We feature the SDS-200 Maximum Capacity Business System
  See UK Distributor’s Advert AIRAMCO in this and previous issues of Practical Computing.

E FLOOR, MILBURN HOUSE, DEAN STREET, NEWCASTLE ON TYNE (0632) 29593
At Micromedia we are usually asked for Complete Business Systems, here are a few examples.

<table>
<thead>
<tr>
<th></th>
<th>Purchase Price</th>
<th>Lease P/M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting Package Sales Invoicing / Credit Controls Payroll on Alpha Micro, with 10 Megabyte Disk, visual display unit and printer.</td>
<td>17.950</td>
<td>448.75</td>
</tr>
<tr>
<td>Purchase Accounts, Sales Accounts, Payroll on Cromemco System III with work station, visual display unit and 180 c.p.s. printer.</td>
<td>7.950</td>
<td>198.75</td>
</tr>
<tr>
<td>Word Processing, Payroll, Accounts, on North Star Horizon with printer visual display unit and additional monitor.</td>
<td>5.500</td>
<td>137.50</td>
</tr>
</tbody>
</table>

**APPLICATION SOFTWARE**
- Mailing Lists
- Data Base Management
- Accounting Suites
- Stock Controls
- Simplex Linear Programming
- Personnel Records
- Fleet Maintenance Records
- Word Processing
- Pert (Critical Path Analysis)
- Purchase Ledger
- Sales Ledger
- Medical Records

These are a selection from the range please call us to discuss your particular application.

We specialize in systems for Business Industry and Education and have specialist staff to discuss your applications.

<table>
<thead>
<tr>
<th>Visual Display Units</th>
<th>From £</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adds Regent 20</td>
<td>605</td>
</tr>
<tr>
<td>Adds Regent 25</td>
<td>645</td>
</tr>
<tr>
<td>Adds Regent 40</td>
<td>885</td>
</tr>
<tr>
<td>Cifer 2600</td>
<td>600</td>
</tr>
<tr>
<td>Dec VT 100</td>
<td>1100</td>
</tr>
<tr>
<td>Elbit 1920/30</td>
<td>725</td>
</tr>
<tr>
<td>Elbit 1920/30x</td>
<td>750</td>
</tr>
<tr>
<td>Infoton</td>
<td>610</td>
</tr>
<tr>
<td>Lear Siegler ADM 3A</td>
<td>595</td>
</tr>
<tr>
<td>Newbury Lab Range</td>
<td>From 495</td>
</tr>
<tr>
<td>Pericom 6801</td>
<td>985</td>
</tr>
<tr>
<td>Pericom 6802</td>
<td>1085</td>
</tr>
<tr>
<td>Pericom 6803</td>
<td>1285</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Printers</th>
<th>From £</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anadex DP800</td>
<td>575</td>
</tr>
<tr>
<td>SW T P PR 40</td>
<td>250</td>
</tr>
<tr>
<td>OKI E T 5200</td>
<td>485</td>
</tr>
<tr>
<td>Teletype 43 KSR</td>
<td>840</td>
</tr>
<tr>
<td>Dec LA 34</td>
<td>895</td>
</tr>
<tr>
<td>Dec LA 36</td>
<td>905</td>
</tr>
<tr>
<td>Dec LA 120 KSR</td>
<td>1675</td>
</tr>
<tr>
<td>Diablo 1640 RO</td>
<td>2098</td>
</tr>
<tr>
<td>Diablo 1640 KSR</td>
<td>2292</td>
</tr>
<tr>
<td>Texas 743</td>
<td>1195</td>
</tr>
<tr>
<td>Texas 810</td>
<td>1450</td>
</tr>
<tr>
<td>Tally Range from</td>
<td>1895</td>
</tr>
</tbody>
</table>

**Printers**
- Anadex DP800
- SW T P PR 40
- OKI E T 5200
- Teletype 43 KSR
- Dec LA 34
- Dec LA 36
- Dec LA 120 KSR
- Diablo 1640 RO
- Diablo 1640 KSR
- Texas 743
- Texas 810
- Tally Range from

**Odds 'n Sods**
- M22 Paper Tape Reader
- M33 Paper Tape Reader
- M63 Paper Tape Reader
- Sigma Graphic Option
- Servogor Graphic Plotter
- Single side mini Diskettes
- Single side 8" Diskettes
- C12 Cassettes Per 10

Large range of computer books send SAE for list.

**OEM TERMS & QUANTITY DISCOUNTS AVAILABLE WRITE FOR DETAILS**

Circle No. 181
The language dilemma

OVER THE LAST YEAR there has been talk about a wonderful new language called Pascal. It is said, by those who favour it, that it is much better than Basic in every way; that everyone should immediately learn it; and that when they have done so, a new era of light and harmony will settle on the microcomputer would.

It is further suggested that Practical Computing should publish a course on Pascal, as was done for Basic, and that listings in that language should be published exclusively.

If the suggested end-results of peace and harmony were certain, one would have no doubts but that is far from being the case. There is one striking fact about the microcomputing scene — there is far too much of it. There may well be too many types of computer, too many peripherals, and far too many languages — including some 20 dialects of Basic. We could all probably find satisfaction with only two of three of each item, and far fewer languages.

Basic has many faults. It is slow, badly adapted to building hierarchies of program. One can, no doubt, use five lines of Pascal for what it takes 50 lines of Basic to accomplish, and the result will run in one-tenth the time. The supporters of Pascal say that it is elegant, compact, quick, and so designed that it forces habits of clear thought on to the user.

That comparison ignores the best thing about Basic, that almost everyone in microcomputing understands it. It is the lingua franca of microcomputing — pidgin Fortran, perhaps — but a most powerful and welcome unifying force.

That was obvious from perusing the first results of our readership survey. We asked what languages people used and you answered in the following percentages: Basic 74; Fortran 27; Cobol 16; Algol 11; Pascal four; Pilot three; APL two; LISP one; SNOBOL nought; others 20.

So that people write roughly one-and-a-half languages each, of which Basic is the one.

Is it worth sacrificing this surprising degree of unanimity for the sake of yet another language, however elegant? It is as if Caxton, with his first printing press running, was visited by a clever fellow who said he thought Olde Englysshe was a load of rubbish an why not publish books in Sanskrit, which is such an elegant language; and when Caxton replied that his readers and authors all read and wrote Olde Englysshe but did not know Sanskrit from a dog's calling card, his visitor said: "They can learn it and then write their own books."

It is little appreciated at this stage in microcomputer development how like it is to a printing press. People can and do write English in small amounts but they do not expect to be called upon to write their own newspapers, magazines, novels, histories and scientific texts. The point of written language would be lost if they did.

The first requisite for a culture is a common language and, to a large extent, we already have that. Surely we should be more concerned with standardising Basic than with fragmenting our means of communicating with each other?

It is amusing that while everyone admits that the most serious disadvantage to Pascal is the difficulty of learning it, the people keenest about it are academics in computer science. Can it be, one asks cynically, that they are making work for themselves? No doubt they would answer that the hard work needed to learn Pascal is imposed, not by the language, but by the principles of clear thought which it embodies which would be difficult to learn in any guise.

While those habits may be satisfactory for the professional whose failure to think clearly may cost important computing resources, they may prove an insuperable barrier to the lay recruit. Naturally, perhaps, computing professionals under-estimate the second great virtue of Basic, that it is easy to learn. It was designed specifically to free the computer from the custody of professional programmers, and in that it has succeeded to admiration.

The microcomputer provides anyone with a few hundred pounds and a modicum of common sense access to a machine of enormous power. This machine is activated not only by the programs he can write himself but it draws on millions of man-hours of work by people all over the world during the last 10 to 20 years.

The newcomer is wary. He has been conditioned by two decades of ecstatic publicity for the wonder machines and the new breed of supermen who program them and it is hard to shake off the awe. It is vital to the whole development of microcomputing that the first 10 minutes a newcomer spends at the keyboard should be easy, fruitful — and fun.

Basic meets those needs. Turn on any micro, load Basic, and in a few keystrokes anyone should be able to make the machine do something. This first toehold in the edifice of computing is of immense importance.

After that, using Basic, there are few difficult ascents to bar one's progress. In my experience, the hardest single step was understanding disc files but by that stage I was not to be deterred. In retrospect, learning Basic was about half as difficult as learning to drive a car.

Can those who favour Pascal say as much? Can a complete novice write even five lines of program which will run? Because if he cannot the language is not suitable as a lingua franca for micros.

The key test is perhaps the frequency of how one hears people complaining: "If only I had wonderful Pascal, I could write this terrific program, but as it is, I'm stuck with Basic and it's all hopeless."

That does not happen often. There are plenty of things one would like to do which need something better than Basic but they need something more drastic than Pascal, too.

If we must have a second language, what characteristics should it have? It should:

- Do things Basic cannot do, rather than the same things perhaps a little better.
- Be an interpreted language so that inept programmers like me can debug more or less as they write.
- Be available for at least several micros.
- Open a mass of existing but hitherto inaccessible software.
- Do things Basic cannot do, rather than the same things perhaps a little better.
- Be an interpreted language so that inept programmers like me can debug more or less as they write.
- Be available for at least several micros.
- Open a mass of existing but hitherto inaccessible software.
- Do things Basic cannot do, rather than the same things perhaps a little better.
- Be an interpreted language so that inept programmers like me can debug more or less as they write.
- Be available for at least several micros.
- Open a mass of existing but hitherto inaccessible software.

Even though those criteria are loaded slightly, they lead to only one answer — LISP. As those who read Mike Gardner's article in October will appreciate, one can easily do things in LISP which would be a real performance in Basic. Since textual information will increase rapidly in importance, because of the impact of affordable hard discs and Prestel, we need a language to cope with them rather than one to cope slightly better with what we already have.

If there is a vote, mine would go to LISP rather than Pascal. What do you think?

Program of the Year Competition

CONGRATULATIONS to Drs Georgina and Geoffrey Jolliffe on their winning entry, which appears in part in this issue. It was a pleasure to be able to award the prize to an entry which was immaculately conceived, executed and presented, and which uses a microcomputer for an eminently-useful and humane purpose.

P.L.
NRDC and NCC announce the
BRITISH MICROPROCESSOR COMPETITION
A competition for the best invention incorporating a microprocessor

£20,000 total cash prizes
First prize £10,000 ...

... and NRDC will give favourable consideration to investing up to £½ million in any of the winning projects.
The competition closes on 14 December 1979. For full details, including entry form and rules and conditions, complete the coupon and post it to:
British Microprocessor Competition,
c/o The National Computing Centre Ltd,
Oxford Road,
Manchester, M1 7ED.

Sponsored by the
National Research Development Corporation
and The National Computing Centre

To: British Microprocessor Competition.
Please send me full details and entry form for this competition.
BLOCK CAPITALS PLEASE
Name
Address

* Circle No. 182

PRACTICAL COMPUTING November 1979
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.

Text packing

FOLLOWING my letter in the May issue seeking a text packing scheme to reduce the Adventure II data base, I had several interesting replies but only one detailed suggestion from Kay Dekker of Coventry.

In the meantime, I had devised my own simple scheme and programmed it in Fortran IV. It uses four bits for the common characters—Space and the like—and eight bits for the rest, including several common two- and three-character combinations. Applied to the 63K characters of the Adventure II database it gives a mean bit rate of 4½ bits/character, which is probably slightly inferior to Kay's scheme, and reduces the total storage requirements of the program from about 50K 16-bit words to about 37K.

Several people now have this version in regular use, and it appears to run without noticeable disadvantages.

If anyone is interested in my scheme, or better still if they think they can improve on it, I would like to hear from them. I am sure that many bit rates of less than four bits/character can be achieved and possibly even three bits/character, without introducing the unacceptable overhead of a very large word dictionary.

My aim is to promote an improved version of the Fortran subroutines PACKIT and WRITIT used in Adventure II. I am willing to test the efficiency of any version of these routines in packing the Adventure II database, and to include the routines in the program, with due acknowledgment, if they give a substantial improvement.

Incidentally, has any Adventurer yet found the secret of the chalice?

Jack Pike,
Chawston, Beds.

Bugs in the solder

I AM PROMPTED to write by Nick Laurie's comments on home construction in the August issue. Some time ago I had the task of building a Nascom I for a friend and after the problems we had I would hesitate to buy another kit.  

Before soldering anything I took the precaution of checking all resistors, capacitors, diodes, and transistors with a multimeter and battery. That revealed that the 3.3V zener diode for the character generator had no zener characteristics. After replacing it, construction was completed, the soldering checked meticulously, and miraculously on powering-up everything seemed to work.

It was soon obvious, however, that all was not well. Like Laurie's Nascom, ours kept writing its own software throughout RAM. Typically this happened four to five minutes after power-on, just as one had typed-in a program or loaded a tape. We were using the Mark I PSU and although the current being measured was less than 2A, the power transistor became very hot. It was fitted with a much larger heat sink but the problem remained. No other components appeared too hot. The most annoying thing was that although the computer usually failed after about five minutes, occasionally it would work for hours before dying. The symptoms of death were wobbly screen, loss of keyboard response, followed by refusal to re-set and a blank screen. We wrote to Nascom describing the fault last January. Six months later the company replied, apologising for the delay, but with no useful suggestions. In the meantime we eventually traced the fault to the bridge rectifier in the PSU. Although it became warm it had not seemed too hot. When it was replaced by a bigger one on a large heatsink, the problem disappeared. Somehow the voltage on the +5V line must have been jittering enough to upset the CPU when the rectifier warmed-up.

Anthony Short,  
Coulston,  
Surrey

African plea

This is a plea from the barren lands of Africa to the manufacturers of minicomputers. The development of small computers was aimed originally for the markets of Europe and U.S. Another area of great sales potential, however, must be Africa. Low-cost desk machines, such as the Pet series, have enabled many higher education institutions in Africa to buy their own small computers to increase their teaching options and access to research fields.

Users in countries like Sudan are faced with many difficulties, of which manufacturers may not be aware. Will the machine operate reliably under the prevailing atmospheric conditions—high temperatures, constant exposure to dust or high humidity? A low-cost machine becomes very expensive if a sealed, air-conditioned room is required for it.

Who will service and repair the machine in a country with few, if any, electronic engineers? It would be a great help if makers would find out the problems and provide the answers in their sales information.

One very aggravating problem is the mains voltage supply to a machine. Unlike the U.K., many countries do not have a reliable power supply. In Sudan, where the supply is supposed to be 240V, the supply over a 12-hour period fluctuated between 180 and 215V. All areas are subject to irregular power cuts—extremely frustrating if one occurs during programming.

During a recent visit to the U.K. several possible solutions were investigated. They included using a DC supply from car batteries either by rectifying and then feeding direct or passing through a DC-AC inverter, since car batteries are not subject to cuts and fluctuations and can be re-charged from the mains between cuts.

With the former, installation requires electronic expertise and appears incapable of powering a VDU; with the latter high power consumption limits the life of the batteries drastically. Apparently, the problem of power cuts will have to be accepted as part of life, and for the voltage fluctuation we are having to use a voltage stabilising unit at a cost of £150. A substantial amount relative to the cost of our Pet 2001.

It would be a great help to African users, and also a good sales feature, if manufacturers were to produce a simple, optional device to enable a DC power supply to be used to power minicomputers.

Finally, is there a user group for people outside Europe?

Michael Robertshaw,  
University of Gezira,  
Wad Medani,  
Sudan.

Those dialects

YOUR SEPTEMBER editorial referred to the difficulty of moving Basic programs between machines. Although the use of Basic is unavoidable because it is by far the most common language supported on microcomputers, I have often felt that it is a mistake to publish complete programs instead of algorithms.

People tend to become too involved with the trivial details of Basic dialects and the attempts to transfer Basic A on to machine B lead to much tearing of hair and wasted time.

Would it not be more sensible, except in specialist cases, for Pet Corner to publish well-documented, structured algorithms and let interested parties re-write the algorithm in their particular dialect of Basic. This method has the advantage that the coder has thorough knowledge of the solution to the problem, and that a structured algorithm generally will result in better final programs.

I think that your magazine could be much improved if you had more articles on teaching and programming and less on teaching Basic dialects. As Dr Barry says, the details of the final language in which a program is to be coded are probably the least important factors in designing a solution to a particular problem.

Apart from this criticism, I find your magazine very interesting and informative. Keep up the good work.

David Birch,  
Southampton University.

On target

THE EDITORIAL in September is the only thing I can remember seeing in any computer magazine that came close to portraying the "real world." You are to be congratulated, not just because of its good sense, but also because you had the courage to bite the various hands that feed you—the targets for your criticisms presumably being the same people who provide you with advertising revenue.

At least you will be loved by those among your readers who are engaged in trying to do the job properly either as dealers in micros, or in writing software for them. Your analogy to the early 'bangers' can be extended. There is one well-known name which looked set to be the Model T of the micro world and certainly it has sold in vast quantities. Unfortunately, it does not work very well and the manuals issued so far contain so many errors that it is almost better to ignore them.

Those attending a dealers' meeting recently (continued on page 55)
The Sorcerer Computer is a completely assembled and tested computer system ready to plug in and use. The standard configuration includes 63 key typewriter-style keyboard and 16 key numeric pad, dual cassette 1/0, with remote computer control at 300 and 1200 baud data rates. RS232 serial 1/0 for communication, parallel port for direct Centronics printer attachment, 280 processor, 4K ROM operating system, 8K Microsoft BASIC in separate plug in Rom Pac™ cartridge, composite video of 64 x 30 lines, 128 upper/lower case ASCII character set and a 128 user-defined graphic symbols, up to 32K on-board RAM memory, operators manual. BASIC programming manual and cassette/video cables, connection for S100 bus expansion unit.

The Word Processor Pac creates, edits, re-arranges and formats text. Features include auto wraparound, dynamic cursor control, variable line length, global search and replace, holding buffer for re-arrangement of text, right justification, line width and line to line spacing, underlining or boldfacing, text merging and a macro-facility permitting tasks such as form letter typing, multiple column printing or automatic forms entry.

NOW CONTACT YOUR LOCAL DEALER

For further information, please contact your local dealer or send coupon for further information.

Prices

<table>
<thead>
<tr>
<th></th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>8K Sorcerer</td>
<td>650.00</td>
</tr>
<tr>
<td>16K Sorcerer</td>
<td>750.00</td>
</tr>
<tr>
<td>32K Sorcerer</td>
<td>950.00</td>
</tr>
<tr>
<td>630K Dual Disc Drive</td>
<td>1,200.00</td>
</tr>
<tr>
<td>143K Single Disc Drive</td>
<td>500.00</td>
</tr>
<tr>
<td>S100 Expansion Unit</td>
<td>240.00</td>
</tr>
<tr>
<td>Line Printer</td>
<td>850.00</td>
</tr>
<tr>
<td>Video Display</td>
<td>240.00</td>
</tr>
<tr>
<td>Development Pack</td>
<td>70.00</td>
</tr>
<tr>
<td>Technical Manual</td>
<td>8.95</td>
</tr>
<tr>
<td>Datashell type printer</td>
<td>1,900.00</td>
</tr>
<tr>
<td>Word processing pack</td>
<td>80.00</td>
</tr>
<tr>
<td>Video/disc unit</td>
<td>1,500.00</td>
</tr>
<tr>
<td>16K Memory expansion</td>
<td>110.00</td>
</tr>
</tbody>
</table>

Contact information for local dealers:

- **Lancashire**: 051-2272535 MICRODIGITAL 25 Brunswick St., Liverpool L2 1J
- **West Yorkshire**: 0532 65094 BASIC COMPUTING Oakville, Oakworth Rd., Keighley
- **Sheffield**: 0742-567897 E.S. MICROCOMPUTERS 7 Berkshey Place, Ecclesall Rd., S11 8PN
- **North Wales**: 0248-52042 TRYFAN A/V SERVICES 3 Swifts Bldgs., High St., Bangor, Gwynedd
- **Avon**: 0272-252375 ELECTROPRINT 5 Kingsdown Parade, Bristol BS6 2UJ
- **Northants**: 0336-39292 K.B. COMPUTERS LTD., 22 Newland St., Kettering
- **London & Counties**: 071-840 6664 NEWBEAR COMPUTING STORE, 40 Bartholomew St., Newbury RG14 5LL
- **Kent**: 01-300 0380 INFORMEX 61 Harland Avenue, Sidcup, DA15 7NY
- **Surrey**: 0376-364544 MICROBITS 34b London Rd., Blackwater, Camberley
- **Cheshire**: 061-445 8559 MICROPUTE 7 Westbourne, Manchester M20 8JA

• Circle No. 183
were horrified to find that none of the company's staff in this country knew very much about how to use the disc drives which had been released, a situation improved only marginally by subsequent issues of copious notes and amendments. The same criticisms apply to the printers, although you cannot buy the tractor feed printer which has been advertised extensively.

It is as though Henry Ford has started the assembly line before he had found out how to fit the engines and wheels, in the hope that his customers would have the skill and patience to do the work themselves.

Incidentally, the three-way telephone conversation you mention arouses a certain amount of envy. We find that communicating with this particular company could not be more difficult if it was located on the dark side of the moon.

One of many letters to it ended with the exasperated question "Is there anybody there?" After three months there has been no reply and the subject of the complaint still sits lifeless, minus cassette drive and chips.

David Annals
Computer and Design Services Ltd., Grimsby.

Joystick improvements
David Annals' article on home-made joysticks has a version using four microswitches operated by a moving washer attached to a knob. He says that this does not allow for any special codes to be generated, for instance, to produce a "FIRE" command. If the central washer is replaced by a thin square block (see diagrams) the code generated by all four switches being closed can be produced if the knob is rotated.

The first diagram shows the null positions of the switches. The knob can be moved up, down, left, right and diagonally to give the same results as the original design. By rotating the block as shown in the second diagram it should be possible to make all the switches close.

With practice, and a carefully-made device, it may also be possible to make any three switches close. This would be done by moving the knob away from the switch which is to remain open, and rotating it to close the two switches on the sides of the block.

For this to be possible, it may require switches with a large amount of travel to enable the block to move far enough away from the switch which is to remain open, so that it is not closed when the block is rotated.

The third diagram shows the shape of the block. It is a thin square with a cut in each corner into which is placed a small piece of metal or anything else suitable to act as a stop. Otherwise the arms may flip the knob round suddenly when they pass the corners.

When the knob is at rest the springs should be pressing the sides of the block. The flat sides of the block will also mean that the arms press on the sides evenly as the block moves down. This should produce a more even feel, as the original design would have the side pressure lowered as the knob moves down and the arms move round the circular washer.

I have not as yet built this modified joystick and would be interested if anyone manages to make it work reliably.

S. Gudge, Eastbourne.

Rental charges
As a company dealing in both television and microcomputers, I feel well-qualified to provide an explanation on apparent high rental charges on small computers.

First and foremost the quoted charges are for short periods. Our hire models spend up to half their life on the shelf, and a considerable proportion of the cost is in the once-only administration associated with a rental.

In addition to the machine, we provide at no extra cost manuals, text books, demagnetisers, tapes and sample programs, not to mention lengthy demonstrations and advice.

We are always pleased to provide computers for long-term hire on the same basis as television, namely an annual rental of about half the new cost, including full maintenance. Nevertheless, it appears that some firms overcharge and require too high a deposit.

With regard to maintenance, our experience is that microcomputers are more reliable and robust, and easier to repair than TVS — U.K. models anyway.

M. M. Zepler, Super-Vision Southampton.

Know your rights
In several recent issues of your magazine, many readers comment on the computer warranty problems they have encountered. A common complaint is the distance they have to travel to return goods to the retailer.

Your readers cannot be aware of recent Consumer Legislation which is summarised in a retailers' Guide, printed by HMSO.

With bulky purchases it is clear that the consumer does not have a responsibility to return the goods to the retailer. Rather it is the duty of the retailer to provide the service at the house of the purchaser. This legislation has to be interpreted reasonably, but when spending £1,000 or more on a computer, it is not unreasonable to expect the retailer to provide a service over a distance, in return for the very high markups of between 25-60 percent which exist in the trade.

Finally, I would suggest that readers ignore the 30- and 60-day warranties seen on some computers; these statements would not be of any consequence in law.

G.G. Grover, Brighton.

Complexities
I would like to correct a few serious misrepresentations made by Nick Hampshire in the September Practical Computing about the Zilog Z-8000 microprocessor.

His comparison with the Texas 9900 is inaccurate. The Texas machine has a 15-bit address bus and is therefore capable of addressing 32,768 words, each of 16 bits. The Zilog Z-8000 is a byte-addressed machine and can address 8,388,608 bytes of store in each of six possible address spaces, namely for both system and user mode the cpu and an associated memory management unit (Z-8010) can address a code, data and stack storage space each of which would be as much as 8,388,608 bytes.

Thus the total possible memory address space is 50,331,648 bytes (48 Mbytes). The large address space is not, however, linearly addressed; the program counter in the segmented version (Z-8001) of the cpu is divided into a 16-bit offset which points to an even-numbered byte in the code segment of the memory, which is chosen by the segment number which is stored in the HIGH byte of the second word of the program counter. This segment number is of six bits only and chooses one of 128 segments — 64 per memory management unit which, with the aid of the

(continued on page 57)
The microcomputer for those who need more than the minimum. The right processor for business, scientific and educational use. Proven applications include Games, Educational, Word Processing, Invoicing, Stock Control, Sales Ledger, Purchase Ledger, Mailing, Scientific.

**The Horizon computer includes:**

**Specification**
- Zilog Z80A MPU
- S-100 bus (12 slots)
- Solid well-built case
- Up to four Shugart mini-floppy disc drives, 180KB each
- Serial port for CRT or Teletype
- Real-time clock on motherboard
- Optional additional serial port and parallel port
- Powerful operating system and monitor
- Access to wide range of S-100 special application boards

**Languages**
- Powerful Basic including sequential and random access disc files
- Formatted output
- Strings
- Line editor
- Machine language
- CALL
- Many other facilities.

Optional additional software (under CP/M operating system) includes BASIC compiler, FORTRAN and COBOL.

Horizon Z80A computer with 2 double-density disc drives and 24K RAM £1,823 (exclusive of VAT and carriage).

Equinox Computer Systems Ltd.
“Kleeman House”
16 Anning Street,
New Inn Yard,
London EC2A 3HB.
Tel: 01-739 2387/9
01-729 4460.

**P.I.P.S. COMPUTER SERVICES**

North-East England Dealers for a range of Microcomputers and Printers

**HARDWARE:**
- APPLE II
- ZENTEC ZMS-70

**PRINTERS**
- ANADEX
- DIABLO DAISYWHEEL

**SOFTWARE:**
- INVOICING PACKAGE, CASHFLOW PACKAGE, DENTIST PACKAGE

Selection of Software from Keen Computers Ltd
Tel: John Page on (0632) 482359 482984 to discuss your requirements.

**NEWCASTLE-UPON-TYNE**
(continued from page 255)
processor status lines, maps the software address into a physical address.

Also, contrary to Hampshire's assertion, the Z-8000 does not use a pipelined architecture and there is no overlap of fetch and execute cycles of an instruction. For anybody who would like a closer insight into this very powerful processor, the preliminary specification from Zilog or a pair of booklets from Advanced Micro Devices, which is secondourcing the device, are very informative and may clear any confusion in the minds of anybody thinking of purchasing this extremely powerful processor.

The Z-8000 seems to be the kind of processor needed to take personal computing out of the age of expensive toys and allow individuals to realise their own really powerful machines. Zilog compares the power of the Z-8000 to a Digital PDP 11/45 and it has more memory address capability than a PDP 11/70. It also has all the memory segmentation and protection features necessary to run really advanced operating systems and compilers for languages which are more than the bad joke which Basic has become.

It should be possible to implement languages like Algol 68, which is not dissimilar to Pascal but considerably more powerful.

They offer the micro user the opportunity to implement systems much more complex than is possible with today's 8-bit machines.

A R Kidson, Bromley, Kent.

The Z-800 sounds terrific but does it offer any great advantages over 8-bit machines unless it has all that memory to address? Isn't the problem there the old one of hard cash?

Little Sir Echo

ECHOING the complaint of M G Hummel in your September Feedback, I and my colleagues have been attempting to buy a Micropolis dual floppy disc system for use on the Exidy Sorcerer for the last two months.

Among the excuses given for non-delivery have been:

1. We've just sold the last of our consignment!"
2. "Micropolis has just relocated its State-Side factory and supplies are a bit disrupted!"
3. "The demand exceeds supply so we are now ordering on a queue basis!"
4. Yes, Tandy has bought the whole of next year's consignment of these systems and its version of the Micropolis disc system is not Sorcerer compatible!"

I might say we have reached the depth of cynicism when we image that our supplier plucks his excuses from a tombola so that we don't get bored with having the same story twice.

A.C.J. Pepper, ITT Components Group, Harlow, Essex.

North Star game

YOU PUBLISHED my noughts and crosses game and have my 6502 disassembler program. I enclose text of a super game for North Star systems which I have been developing some time. It is definitely an adult game and is difficult to play but it represents a genuine challenge.

D.N. Sands, Intelligent Artefacts Ltd., Orwell Royston, Camb.

Improvement

I was most interested to read your September review of the Anadex DP-8000 printer. To bring your readers up-to-date, however, I should mention that all DP-8000s are now supplied with adjustable paper feed sprockets to accept any paper size up to 9.5in. wide and a self-check facility to print the complete character set, together with a diagnostic routine, is incorporated.

Also, a complete servicing facility is available from our main distributors, Peripheral Hardware Ltd, at East Molesey, as well as from a number of our recognised dealers. In addition, for those customers who require on-site support, a service contract is available from Kode Services Ltd, Calne.

For users who would like to carry-out their own servicing, a maintenance manual is now available from Anadex and we have recently increased our technical staff to make information of this kind more readily available by telephone.

Finally, we have established that it is possible to stand a cup of tea on the DP-8000 — our service people are now insisting on a re-design of the case.

M.S. Hayward, Managing director, Anadex Ltd.

Unhappy

I do not know how many of your readers have encountered difficulties in dealing with firms in the United States but would like to draw attention to my experience.

At the end of February, I sent a bankers' draft for 21 dollars to Jade Computer Products in California. It was for three months' trial membership of its software exchange (20 dollars), plus one dollar for an air mail reply. I would state that postage was not mentioned in the advertisement. I had no reply.

In April I wrote again, enclosing a photocopy of the original letter and a photocopy of the bankers' draft. I still received no reply.

I contacted my bank, which made enquiries on my behalf, and on June 21 received a reply that the draft had been paid to Jade on March 15. On July 10 I wrote again to Jade, stating that the position was unacceptable, and asking for a refund of my money, or details of the library before the end of the month. I have no goods, no money — and no more patience.

It would be interesting to hear if any other reader has experienced similar difficulties.

John D. Lee, Loughborough

Exchange

I INTEND to set up a program exchange, entitled Micro News, it would be a newsletter, of about 10 pages covering programs for computers such as the Superboard, Nascom-1 & Exidy Sorcerer.

Martin Black, 11 Moorland Avenue, Higher Crumpsall, Manchester, 8.

Hearing in mind the national shortage of microcomputer engineers and programmers, we think it may be interesting to publish an article on how people first found jobs in the business.

Since the people concerned know best about that, we would be interested to hear how you did it, whether you were happy with the results, what you think of formal courses as opposed to on-the-job experience, and so on. Please write to 'Getting Started', Practical Computing.
Extra protection now for the customer

THE CUSTOMER for microcomputers looks like having some protection now the Computer Retailers' Association has been formed by 23 microcomputer retailers, including Keen Computers, HB Computers and Microdigital.

The object is to "maintain and improve standards within the industry and to present the industry case to the outside world, including the Government and the lay Press."

Colin Stanley, of HB Computers, who has been involved from the beginning, says it intends to protect the rights of the customer and to "eliminate the type of company which asks for money first and sends the computer later."

Conditions of membership are that firms must be microcomputer retailers; they must have a display area where products can be demonstrated; they must have a constantly manned telephone on their premises during working hours; and they must have "expertise in software and hardware."

The most significant point, is probably that the association will meet the obligations of any of its members who are forced out of business, thus guaranteeing customers of members against loss. It will also continue servicing any machine bought from a company which was in the association and has since failed.

The most significant point, is probably that the association will meet the obligations of any of its members who are forced out of business, thus guaranteeing customers of members against loss. It will also continue servicing any machine bought from a company which was in the association and has since failed.

Micros to make your car tick

THE MOTOR CAR of the future may well have a microcomputer at the heart of its operation. A simulation of things to come was shown on the BBC television programme A Right to Work.

Built by Scicon, it uses a magnetically-coded board with personal identity code instead of an ignition key. Before starting the engine the computer checks the complete car systems and warns the driver of any deficiencies via a single-line alphanumeric display.

The micro also communicates via a radio link to a central computer database to gain information on the best route to take avoiding obstructed roads. Through that link, the driver could also make hotel reservations, book a table at a restaurant, or receive the latest news headlines.

While driving, the performance of the car, road conditions and journey details are monitored constantly and details written on one of the various displays.

All the features incorporated are geared to safer motoring, energy saving and improved communications.

Geared to safer motoring.

Computhink

JOHN BLACKBURN of B&B Consultants, Bolton, says his partner, Peter Binks, has managed to tweak the Computhink drive for the Pet to such good effect that one machine can now control four drives, storing 50MB.

The alteration consists of a piece of hardware and a piece of software. "If you order one now, I can give delivery in two hours", says Blackburn.

B&B Consultants, 124 Newport Street, Bolton, Lancs (0204 26644).

Construction service

A KIT CONSTRUCTION service with charges of around 10 percent of system value for each kit built is being offered by a Truro company.

Logsign will supply or build kits or construct those the customer wishes to supply. It will also complete kits which customers have started to build and with which they have experienced difficulty.

Popular kits, such as Nascom, Compukit and 77/68, will be dealt with and larger systems, such as the Horizon, will cost around 25 percent of the original cost to build.

Enquiries to A. D. Cann, Logsign, PO Box 33, Truro, Cornwall.

Conversion

ACULAB has a conversion box to interface a 7-bit parallel ASCII port to any IBM golf-ball printer. The output is slow but it can be cheap and the printing will look good. The interface will cope with five standard golf-balls.

Aculab Ltd., 24 Heath Road, Leighton Buzzard, Beds, (0525 371393).

PRACTICAL COMPUTING November 1979
Help for CP/M users

WITH disc systems rapidly gaining ground, news about CP/M, the standard operating system for 8080 and Z-80 based machines, if of interest.

Peter Norman, of the Computer Centre, Swansea, says it recently received a new version CP/M 2, which will handle up to 128MB on hard disc. While that is of little use to people who already have CP/M 1 for floppy discs, it will be very useful to those who intend to acquire the 10MB drives.

Norman expects those drives, from DRI, will sell for about £1,500 for the 10MB version and £2,000 for 30MB, with the price falling after two years to about £500 at today's prices.

Incidentally, while the Computer Centre holds the 38 volumes of American software for CP/M, it has also accumulated two volumes of British material.

The Amateur Computer Club has also made an arrangement with Digital Research, owners of CP/M, and will be offering its library with the price falling after two years to about £500 at today's prices.

Petite

Plessey has reduced the price of the Petite and Inpet expansion memories for the Pet, because increased demand has led to volume production. Petite will now cost £289 and the Inpet, an add-in card, £249.

New colour board

The Corvus 10MB disc available from Keen is, at £3,500, considerably more expensive than the promised but not yet available 10MB unit for the Pet.

Keen also has a new colour board for the Apple II, which improves on rather impure colours and defective control signals of the standard board.

The new board is designed for use with a 14 in. Sony, which has to be modified slightly. Two new utilities packs at £50 each are also available, including Sort, Search, Editor, Text Editor, and Super List for Basic programs.

Easier code for Z-8000

Zilog now has a package of programs to make it easier to write Z-8000 code. You need a simple Z-8000 satellite system connected to any Z-80-based microcomputer with discs.

The software suite contains a Z-8000 assembler, a linker, a translator to turn Z-80 Assembler into source files of the assembler, a macro pre-processor, an imager program to produce loadable binary files containing executable Z-8000 code, ROM programming package, and utilities to transfer data between files in the Z-80 host and the Z-8000 satellite.


Impressive winning entry

The Program of the Year award was won by Drs Georgina and Geoffrey Jolliffe, of the Department of Pharmacy at the University of London.

Entries were invited in five categories — business and administration; science and mathematics; computer art; games and simulations; and education projects.

The program which was judged by Jim Wood, a consultant of several years' experience, and the Editor of Practical Computing, to be worthy of the main award is to aid the analytical identification of powdered vegetable materials used in goods and medicines. It would supersede the necessity for lengthy record retrieval by an experienced analyst.

The judges were impressed because the entry was well-thought-out and extremely well-presented, and because the application is a good and useful one.

The prize in the games and simulations category was won by Alan Baylis for his American Election Game, while J J Waters took the laurels in the science and mathematics section for his Analysing Linear Potential Flow problems.

There was no entry in the category for computer art and none of sufficient quality to win a prize in the section for education projects.
Computer aid provides new dimension

tive way of creating a pool of skilled electronics engineers.

It is not surprising that strong links exist between computer buffs and radio hams. Some of the earliest home computer constructors also held transmitting licences; the American magazine *Kilobaud* was spawned from a ham magazine called *73*. In the last 12 months many amateur radio stations have acquired micros with fascinating results.

Perhaps the least significant activity of hams is talking on the air. Given a reasonable amount of money, tolerable competence in setting-up and operating equipment — say a grade or so above soldering together hi-fi components and a modest knowledge of propagation — it is no great achievement to talk to someone on the other side of the world.

Hams explore the edges of what is technically feasible. Can you make contact on only five watts of power, or when conventional wisdom insists that a simple phone call will make that impossible? Is there a speech processor which can be used by the broadcasting professionals?
The picture is compressed into the same bandwidth used for speech — less than 3KHz compared to the 6MHz needed for standard colour TV — and a special slow scan rate used which changes the picture only every eight seconds or so, rather than every 1/25th or 1/30th sec; the mode is called SSTV.

Specialisations

Many of these specialisations can be helped by a computer. In some cases the micro is doing more flexibly and graphically what the calculator did two years ago and what a few years before that was derived from tables, nomographs and slide rules. The amateur station with a micro can perform feats and conduct investigations and experiments which previously were not possible. They fall into the following categories:

- collecting, collating, and recording data which enable an amateur to be aware of advantageous conditions under which to carry-out experiments;
- movement of the various amateur satellites, calculation of doppler shift — amateur satellites are not geostationary so that the appropriate transmit and receive frequencies vary according to whether the satellite is approaching or receding from the operator; forecast of meteor showers, forecast of propagation conditions — which at high frequency or short wave, to give it the older name, vary with time of day, time of year, and time in sunspot cycle;
- driving the station equipment through micro-control. There are now a number of off-the-shelf transceivers advertised as microprocessor-controlled, and though most readers would find such descriptions rather exaggerated, advances in methods of frequency derivation have made the interfacing of micros with rigs much more worthwhile.

Until recently the standard method of generating a radio frequency signal was via a parallel-tuned oscillator consisting of a variable capacitor and a coil, and driven either by a valve or a transistor. Today the basic oscillator remains unchanged but the variable capacitor can be replaced by a varicap diode, a device whose capacitance changes according to a bias voltage placed across it.

The level of the bias voltage is determined by a multi-turn variable resistor — a typical consumer version are the pre-sets on a domestic TV.

More promising

Now it is easy for a micro to deliver measured bursts of voltage, particularly if there is a circuit with a built-in reference voltage and the appropriate 'comparing' logic.

More promising though, is the device of frequency by mixing the results of several oscillators. Dedicated chips perform all the desirable mixing functions — many chips, incidentally were developed for citizen band equipment — and the choice of frequency depends on feeding the appropriate chain of pulses to the correct pins on the chip.

The microprocessor can store frequencies in a 'memory' so that they can be summoned back at will. It can scan those frequencies to see if there is activity on the air. In one popular version, and in a number of mobile transceivers, the equipment runs up and down between two pre-determined frequencies looking for activity. When it finds a 'busy' channel, it stops, giving the operator an opportunity to decide whether to break in or to respond, and then, unless told to do otherwise, resumes scanning.

It is easy for a micro to display on its VDU all the activity within given frequency limits. It would also not be difficult to switch such transceivers into the frequency-hopping mode beloved of clandestine operators, except that the
transmitting and the receiving station, provided it is locked in step, can hear each other because their frequency changes constantly according to a pre-determined cycle. It is not difficult, it is not legal, but it is difficult to enforce.

Plenty of equipment already allows the input of frequency to be executed from keyboard, rather than a tuning knob. Soon-affordable receivers which cover everything, not only the amateur bands, will have similar facilities; items now being offered to the military/diplomatic market have such arrangements already.

The Bearcat VHF/UHF scanner, popular in the States, will scan and search frequencies of a given station and present the listener with the best one; the technical name for this is frequency diversity.

A computer-controlled HF receiver could sample continuously all the likely frequencies of a given station and present the listener with the best one; the technical name for this is frequency diversity.

The other aspect of equipment control is antennae. For individuals concerned with the tracking of celestial objects, pointing the antenna in azimuth and elevation is essential — professionals have been using computer-driven servos for years. Now, prosperous amateurs can think in the same terms. It should also be possible to control the tuning of an antenna from a micro. Antennae used for transmitting need to resonate precisely in sympathy with the radio frequency in use if they are to work at their most efficient — and if the transmitter is not to be damaged, for RF power which does not reach to the ether tends to re-appear as heat in the final stages of equipment.

It is normal practice to vary the electrical 'length' of an antenna by means of a passive tuning unit consisting of two capacitors and an inductance. This is done by hand these days; soon, direct output from a rig will send instructions to an antenna unit — probably placed in the air where it is most used — to tell it how to adjust itself. These developments are just around the corner:

- Using the micro to create an intelligent signal. Besides speech — or telephony, to use the proper name — other methods can be used to send information over the air. The oldest of the alternatives, and one which pre-dated speech, is the encoded stopping and starting of a continuous radio wave — CW. The best-known form of encoding is, of course, Morse, and because of its simplicity and the ability of CW to 'get through' where other transmission modes would be unsuccessful, it is unlikely to disappear for many years.

- There is no need for Morse, which depends on short and long bursts, as well as properly-timed silences, to be generated by hand and one of the more attractive add-ons instantly available to the micro/radio enthusiast is automatic encoding and decoding of Morse.

- The hardware/software device does more than relieve the operator of the burden of learning Morse Code. The micro can generate and decode at speeds beyond the ability of a human operator. The applications for military/clandestine operations have been known for years, but for hams concerned with, say, meteor scatter, where a propagation path may last only a few seconds, a burst of high-speed Morse may be the only way to establish a worthwhile contact, so that both stations know enough about the other — location, type of equipment, power output — to make the exercise worthwhile.

The other frequently-used encoded transmission mode is a radio version of Teletype (RTTY) which uses a 5-bit code of pre-selected high and low tones to signify 'mark' and 'space' or binary 0 and binary 1, known as the Murray/Baudot Code. The 5-bit format is enough to give capitals, numerals and a few punctuation and instruction symbols, but lacks the versatility of ASCII.

On the other hand, in terms of transmission time, it is more economical. People have tried transmitting ASCII but the value for most applications is questionable. In addition to more dedicated RTTY terminals, one of which operates in Japanese as well as Morse, hard & software packages for a variety of micros are available for such popular

(continued on next page)
models as Pet, TRS-80, KIM, Apple/ITT, and Nascom.

There are also micro-assisted devices to detach video for slow-scan television, particularly in association with the Apple/ITT computer. There are a number of experiments in other forms of data transmission, ultimately amounting to the sending, if need be, of computer programs over the air and getting micro to interface with micro by wireless.

Until the American regulatory authority, the FCC, is prepared to relax its restrictions, radio transmission of data — the concern is about encrypted signals which the National Security Agency may not be able to understand — progress in this area may be slow, because both the money and skills needed for expansion are concentrated heavily on the other side of the Atlantic.

Incorporating a micro into a radio station creates a number of difficulties, not all of which are obvious, so I will detail my experiences over the last month or so.

Office test

While most magazines in the business of reviewing expensive hardware or consumer durables would have you believe that their offices are lined with glowing banks of sophisticated measuring equipment and populated by the kind of white-coated, clipboard-clutching laboratory denizens who advise you about headache pills in TV advertisements, that is not always a reality at Practical Computing. Experts are available and so is appropriate measuring gear but some reviewers are consultants or enthusiasts not so far removed from readers.

I wanted to review a small piece of interfacing hardware which links a micro — in this case a Pet, but a TRS-80 variant is available — and a transceiver to provide automatic encoding/decoding of Morse and RTTY signals.

The device is the Macrotechnics M-65 and it is available either as a kit or assembled, together with software on cassette, well-presented and with comprehensive documentation. The device works as it is intended to do, so what follows is not a product review in the ordinary sense of the term.

My first intention was to set up a receiving station at Practical Computing offices in a vain attempt to startle a staff who reckon that, by and large, they have seen most miracles. I arrived with a popular communications receiver covering the short wave bands from 0.5 to 30 MHz — up to 10 metres — known as the Yaesu Musen FRG-7. It had had some fairly standard modifications. There is a digital (A-D) readout, narrow-band filtering for side-band and CW signals, and discriminator for frequency modulation. To feed it with a signal, I erected a Datong active antenna, which while useless for transmission, is excellent for reception because of its short physical length and the lack of need to tune as the reception frequency is altered.

Connections simple

The electrical connections were simple. Mains power for receiver, transformed and rectified low voltage DC for the amplifier in the active antenna, and mains again for the Pet.

The M-65 derives its power from the second cassette interface port on the Pet and the I/O from the unit goes, as one might expect, to the user port. You need some phono connectors to link the receiver audio to the M-65, a connector for a small loudspeaker to check the audio captured by the unit prior to transforming it into a form acceptable to the Pet, and also to act as an audible 'side-tone oscillator' on transmit or for operation of the 'practice' facilities the software also offers.

Yet another connector gives an output for a LED which provides visible indication of reception/capture by flickering in time with the signal. There are also outputs for transmitting, for driving the relays on an electro-mechanical old-style teleprinter and, finally for a Morse key.

So, power up. A great hash of white noise on the receiver audio, and little else. In fact, tuning round the bands, only the most powerful of the broadcast stations, like BBC World Service, was audible. Could it be the neon strip lighting in the office? They were all turned off but the hash remained.

The antenna was taped to a window pointing towards north London; the building was old enough not to have a steel frame, so from where was the noise coming? Answer — the Pet.

Micros need high-speed oscillators to drive their clocks and such oscillators are radio frequency transmitters, operating usually on a number of harmonics as well as a fundamental. In addition, the VDU needs a time-base and you can hear that also, on a receiver. My antenna was all of one metre above the Pet.

Case asset

Radio Frequency Interference — RFI — is a serious problem for the micro/radio enthusiast. In later experiments I was able to tune my receiver around to pick up the various activities of the Pet. In fact, as I executed the usual clutch of commands, I could hear changes in the audio signal. These changes were not audible, as one might suspect, simply when a cassette program was being loaded; LIST and RUN produced characteristic changes in signal.

As it transpires, the Pet is not particularly bad in this respect; its great asset is a metal case which acts as screen. Plated based and open-PCB micros are much worse.

RFI works both ways, for the presence of high-voltage RF signals from a radio transmitter can also upset the micro. Such problems can be solved. Antenna need to be removed from the micro and the feed lines have to be coaxial and well-screened — balanced upon feeders are a definite mistake. All power lines should contain the same kind of filtering recommended for hi-fi equipment used near a radio transmitter.

All audio lines between a micro and a transceiver should be screened, should be as short as possible, and preferably should contain RF traps of standard design, since it is only audio in which the M-65 and similar units are interested. As far as possible all units which either emit RF or could pick it up should be encased in metal. Those requirements are much less horrifying in practice than when set down baldly on paper.

Home solution

Abandoning the idea of Composite Signals Receiving Station (Temporary Location), I moved activity to my home. Partial solutions to many of the problems indicated manifested themselves gradually, though in the special conditions of equipment review when the goodies have to be returned reasonably intact, perfection was not achieved. Moreover, as my receiver began to produce signals in the way to which I was accustomed and the possibility of having something for the micro to decode loomed over, as my receiver began to produce signals in the way to which I was accustomed and the possibility of having something for the micro to decode loomed over, as my receiver began to produce signals in the way to which I was accustomed and the possibility of having something for the micro to decode loomed over, as my receiver began to produce signals in the way to which I was accustomed and the possibility of having something for the micro to decode loomed over, as my receiver began to produce signals in the way to which I was accustomed and the possibility of having something for the micro to decode loomed over, as my receiver began to produce signals in the way to which I was accustomed and the possibility of having something for the micro to decode loomed over, as my receiver began to produce signals in the way to which I was accustomed and the possibility of having something for the micro to decode loomed over, as my receiver began to produce signals in the way to which I was accustomed and the possibility of having something for the micro to decode loomed over, as my receiver began to produce signals in the way to which I was accustomed and the possibility of having something for the micro to decode loomed over.

Amateur radio gear differs from domestic receivers and that produced for military and diplomatic professionals by its multiplicity of knobs. The controls are there to enable you to peak-up various resonant circuits. The domestic receiver has none of them and the professionals have all it done for them almost automatically. Simply to peak-up my modest FRG-7 it is necessary to fix megahertz band, tune and perhaps fine-tune kilohertz knob, peak-up pre-selector, and select transmission mode.

Using a passive antenna, there are two further controls to peak-up its electrical length. After that, there may also be a degree of audio filtering to remove extraneous noise.

Most radio signals, other than very local ones, tend to vary and drift, depending on atmospheric conditions, the stability of the other person's transmitter,
and the sudden appearance of third-source signals.

The M-65 will accept audio signals only of a specific frequency. It is necessary to do this so that the internal logic isn't confused with a multiplicity of noise. The audio is captured by a phase-locked loop (PLL). If there are to be any results at all the radio operator has to deliver the correct audio frequency by adjusting the tuning of his receiver. It would be feasible to design an automatic frequency control (AFC) circuit which would do this, but if there were two signals close to each other — a fairly frequent occurrence — the AFC might be confused and capture first one, and then the other. It is possible to adjust the acceptance frequency of the M-65 by playing with the PLL, but it is not recommended.

Valuable addition

The micro/receiver arrangement can be made to work, though by this stage it was significant that when I had seen the system demonstrated a few months earlier, all that was being decoded was a hand-key plugged directly into the M-65 board.

As supplied, the review sample fell far short of what I would like to set up on a permanent basis. No real blame can be attached to the supplier and my results convinced me that the system works and is a valuable addition to any station. But I would recommend purchasers to seal the board in a metal case, to locate the LED tuning indicator as close as possible to the receiver, and to replace all the leads with screened audio cable. An RF trap between the receiver and the board and the usual precautions on all power cables should decrease RFI considerably.

Because of RFI and ergonomic problems I found it more convenient to record samples of Morse and RTTY on tape — I listened to commercial as well as amateur traffic — and then fed them afterwards into the M-65 and Pet. The software will accept Morse at anything between one and 10 wpm, which is not difficult to accept Morse at anything between one and 10 wpm, which is not difficult to

Encoding easy

Encoding Morse on the M-65 was easy; it is a matter of typing-in text on the micro keyboard. The current software has a forward buffer of only 10 characters, which means that typing and transmission can get out of step, with characters lost if you are not careful. In addition, a transmit buffer, a displayed receive buffer, and an indication over two lines of what is being sent over the air.

There is also a Morse practice facility, which generates either random characters in groups of five, or five-letter words — ideal for preparing for the Post Office Morse test. It works with relentless efficiency.

To become a radio amateur, a Home Office licence is required if you wish to transmit. The present cost is £6.40 pa and you need to have passed the Radio Amateurs' Examination, set by City and Guilds, which should present no problems to those of average intelligence and determination.

That gives you the right to transmit in a number of bands from VHF (144 MHz — 2 metres) through UHF to microwave in a variety of modes, including data, provided that the bandwidth used does not exceed that normally used for speech — about 3KHz.

If you wish to go to the short-wave bands a Morse test at 12 wpm is also required.

Oddities

There are special frequency allocations for amateurs. One of the oddities of the situation is that although Morse can now be generated and decoded automatically, a proper examination pass using a straight key is needed before you can put it on the air-waves.

Most amateurs at one time or another join the Radio Society of Great Britain (RSGB) 35 Doughty Street, London WC1N 2AE. The annual subscription, now £10, brings the monthly magazine Radio Communication, which has articles on micros from time to time.

Two American magazines worth watching are Ham Radio and, when it is obtainable, 73, which is very micro-orientated.

The RSGB publishes a booklet A Guide to Amateur Radio — (£1.71 including postage from RSGB) — and many specialised texts. Its American counterpart, ARRL, has a particularly high standard of publication. Neither has yet produced anything on micros and radio.

There is, however, Amateur Microcomputer Newsletter, at the moment supplied free by a well-known amateur, Graham Knight GM8FXX, who is also a Nascom dealer. His address is 108 Rosemount Place, Aberdeen, Scotland.

Where to buy

At the time of writing the only dealer to specialise in micros and amateur applications is Nicomtech, run by Nigel Huntley, G4CDU, whose address is 212 St Stephens Road, Saltash, Cornwall. A number of the big amateur radio dealers are opening micro departments, including Lowe of Matlock, Radio Shack of West Hampstead, and South Midland Communications of Southampton.

PRACTICAL COMPUTING November 1979 63
**Data on the air**

AT LEAST two methods of data transmission have been available for many years. One is Morse code; the other, a somewhat later development, is Radio Teletype, usually abbreviated to RTTY. Both systems lend themselves very easily to microprocessor control and signal derivation; programs for both are readily available — particularly Morse. Alternatively, commercial programs can be purchased for most types of microcomputer systems.

FSK and AFSK and other methods of data transmission can be super-imposed on the radio frequency carrier in a number of ways. As these forms of modulation are, in general, common to all forms of data transmission, it is as well to look briefly at some of them.

The simplest mode of transmitting Morse code over a radio system is to switch on and off the RF carrier in the appropriate patterns. Thinking in digital terms, we could perhaps consider Morse 'dots' as a simple 1, and 'dashes' as 11; spaces between dots and dashes could be represented by 0 and spaces between letters could be seen as 00.

**Straightforward**

Thus the character '1' could be sent as '00110100', including spaces at each end. In our simple interrupted carrier mode of operation, we consider the 0s as 'carrier off' and the 1s as 'carrier on' — very straightforward and incredibly simple.

As an alternative, we could have the carrier 'up' all the time and switch its frequency by a pre-determined amount. This is referred to as FSK or Frequency-shift Keying. If we think of the two frequencies as \( f_1 \) and \( f_2 \), with Morse we could send 0 as \( f_1 \) and 1 as \( f_2 \).

As an alternative, we could keep the carrier up all the time and impose an audio tone on it — via either frequency or amplitude modulation — and interrupt the tone to represent 0 and 1. This is satisfactory, except that it is subject to errors due to interference, which could confuse tone or the lack of it and thus reduce intelligibility. A useful alternative, therefore, is to use two tones, one to represent 0 and the other 1. This is known as AFSK, or, sensibly enough, Audio Frequency-Shift Keying. Both FSK and AFSK are standard methods for sending both Morse and RTTY over the air.

The transceiver hardware required to interface a micro in either mode is one or two software-controlled tone generators and, on the receive side, a pair of audio-tuned circuits to pick out the tones received and convert them to logic pulses for decoding.

There are internationally-agreed amateur and commercial standards as regards the frequency shifts for FSK and the tones for AFSK. Amateur RTTY, interfaced originally, of course, with mechanical Teletype units, uses a number of standard baud rates — often slow in computer terms — to facilitate sync with the mechanical governors used in such machines.

The elegance of radio data transmission lies in the fact that the hardware needed to add to your computer and transceiver is minimal, leaving you to concentrate more on the exciting possibilities of software to derive the appropriate mode of transmission you want to use.

Thoughts of AFSK, of course, lead us to think about the fact the most of our microcomputers already provide an AFSK-type output — the cassette interface. Why not hook your computer to a transceiver via the cassette interface and type away — given an amateur licence? There is, of course, no reason why you should not. You could set up rather an elegant system whereby you type your message, enter SAVE, and then blast the message into the ether via an ordinary transceiver in any mode — AM or FM — you wish.

A little more software and you could route the keyboard straight to the interface and type vigorously in real-time. Going even further, you could control the system by storing the message temporarily in RAM, clocking it out in short data bursts, switching the transmitter on for the burst and 'resting' in receive mode between times.

That way, a station to which you are talking could 'break-in' or interrupt during the receive part of the cycle, activating the interrupt line on your MPU and bringing-in a secondary interrupt program to decode the message being returned to you. That would facilitate a very fast interchange of information — at least as fast as you could type. Very elegant.

**Language problem**

There is a problem, though; very few micros talk the same language. Apart from the encoding of characters by your machine to be sent to the cassette port, there are so many standards for baud-rates, tone frequencies and so on, that while your Pet could talk to your friend's Pet, and my ITT2020 could talk to your Apple II, could your friend's SWTP 6800 system talk to my ITT2020? I doubt it. Not without a good deal of fiddling. What is needed is a real standard for this type of data transmission; either an existing one, which should be adopted universally, or an entirely new one which does the job and which everyone can agree is satisfactory.

Another option is to use a suitable terminal interface system like RS232 and encode it with tones of an agreeable standard. The point is that, at present, there is no agreeable standard.

There is a standard being offered for amateur use but it is a little more complex than we have so far discussed. In the meantime, you can talk to people who have the same hardware as yourself. If
you feel more adventurous you could, no doubt, utilise a program and a bit of hardware which would load the message blocks into RAM, from wherever source you like, and clock them out, at a software-determined baud-rate, into an AFSK encode/decode unit containing a pair of software-controlled, voltage-controlled oscillators and audio filters whose frequencies are determined by the output of a D/A converter or two.

Add a bit of switching and level/impedence matching to cope with the possibility of switching a microphone and speaker into the system to talk direct, and the possibility of switching a microphone and impedance matching to cope with the frequencies and baud rates — you will have something useful unless conditions are really disastrous.

Contact is possible over very difficult paths in this manner because the operator has to listen for the pattern of audio dots, dashes and spaces. In the same way, a data transmission, consisting of a more complex digital pattern, will be recognised by your equipment far more readily than a variable signal like a voice. There may be the odd error but at least you will have something useful unless conditions are really disastrous.

This leads the way to developing a beautifully-elegant transmission system in which blocks of data are sent and acknowledged if copied at the other end, or repeated if not.

Such a system had been proposed and is already in use by some amateurs. Called AMTOR — Amateur Microprocessor Transmission Over Radio — it has been developed from commercial systems based on CCIR Recommendation 476, by two amateurs, J P Martinez, G3PLX, and Dave Wicks, G3YYD. The former, who has already done pioneering work on MPU applications for RTTY, published a descriptive article in the August, 1979 issue of the RSGB magazine Radio Communication.

In brief, the system is based on a master/slave relationship between the stations in touch with each other. The master station sends three characters of message, after which the slave returns a control character corresponding to characters received or not received. A third control character is used during the change-over of master and slave at the end of an ‘over’, and a further three characters referred to as RQ — Request — Alpha and Beta are also utilised in error-correction and change-over.

The standard teleprinter codes and other characters are translated into a seven-bit digital code with four 1s and three 0s, so an error is detected easily by checking the number of zeros in a character received. A seven-bit code, of course, offers 128 possible variations but as only 32 are recognised as characters, this offers further error-correction possibilities. There are 35 possible variations of a seven-bit code with three 0s and the three which are not teleprinter characters are used as the RQ, Alpha and Beta characters.
ESSENTIAL READING FOR ALL PET USERS

THE PET REVEALED

ALMOST 260 PAGES OF SOLID INFORMATION FEATURING:

PET circuit diagrams — How to use the diagnostic routine — PET ROM subroutines and their entry points — Programming in machine code — Using the IEEE and User Ports — Double-density graphics — Uncopyable programs — Page zero locations and their uses — A TRACE program for Basic program debugging — Disabling the keyboard and/or the Stop key — Adding a repeat key — Line re-numbering — Auto line erasing — Making the PET write its own programs — Printer interfaces — Adding new commands to Basic — Interrupts and multiprocessing. Plus many more fascinating facts about the PET.

commodore APPROVED PUBLICATION

Send cheque for £10.00 made payable to Practical Computing.

PRACTICAL COMPUTING
DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.
Rair Black Box has many virtues

PROFESSIONAL is a term used all too frequently in the field of microcomputers. The Rair Black Box microcomputer has been around for about two years and one of its claims is that it is a professional system with good support. It was refreshing, therefore, to find that Rair in London took what appeared to be a responsible attitude, when I was asked to review it. Rair was the first supplier to suggest that I had a showroom demonstration of this equipment, to avoid any possible difficulty in the use of the computer when it was delivered.

Equipment
The Black Box is a complete diskette-based microcomputer system using the Intel 8085A running at 3MHz. It is configured with memory in 16Kbyte blocks. The version delivered had 64K of RAM.

The operating system supplied as standard has the de facto microcomputer standard disc system, CP/M.

Two minifloppy diskette drives (5½in.) are built into the computer box. This is the minimum number of drives supplied but the system is capable of supporting up to four drives. The recording standard is the IBM soft-sectored format; the version for review had 64K of RAM.

The terminal delivered with the system was a Rair VDU—a Hazeltine 1410.

In use
To start up, the Black Box requires the connection of a VDU and powering-on. In theory it should be as simple as that. The terminal delivered with the system was a Rair VDU—a Hazeltine 1410.

On connecting the cable and powering-on, not very much happened. The cursor on the screen remained in the top left-hand corner and that was all. Neither did the disc drives boot-up as shown in the demonstration. The Load button was depressed, drive A became alive, and a few meaningless characters appeared on the screen. This suggested there might be a baud rate mismatch. Remembering that the Black Box runs at 9,600 baud, which I was told in a letter sent with the review equipment, I thumbed through the Hazeltine VDU manual and found how to set up the baud rate.

Powering-on, the disc drives again remained inert but on Load that time, CP/M identified itself and displayed its prompt on the screen. All seemed well, but not completely. Typing on the keyboard produced nothing on the screen and no apparent reaction from the computer. The RS232 cable was checked and pins 7 and 8 were found to be crossed—Data Carrier Detect was connected to Signal Ground. That was connected and the terminal could receive and transmit. On examining the cable, however, the system worked with pins 2 and 3 not crossed, which is contrary to convention—pin 2 from one end should connect to pin 3 at the other and vice versa.

Dependence
As the Hazeltine VDU had the conventional pinning, I can assume only that the Black Box either has unconventional pinning, on pins 2 & 3 only, which could be awkward when connecting a VDU if that is not apparent, or the version for test had a wiring mistake to the serial socket.

There was some difficulty delivering a review machine, and in the process it had no CP/M system disc. The other discs can be loaded under CP/M but lacked the various system utilities. That illustrates how dependent on discs the machine is, since there is no monitor to work without discs, and without a disc the system is silent.

A full CP/M system disc was sent quickly. A worthwhile note is the importance of copying and backing-up the CP/M system disc, in case of accidents. Even with the CP/M system disc, the computer still did not load on powering-on, and throughout the test it was necessary to use the Load button to start the

By Vincent Tseng

PRACTICAL COMPUTING November 1979
system. As there is supposed to be a power-re-set with an automatic boot load from disc drive. A the review equipment probably had a fault in the power-on-re-set circuitry, in the firmware bootstrap or in the re-start jump address to it. That did not affect the operation of the system it was not pursued.

**CP/M operating system**

To the user who does not wish to write machine code, a computer running CP/M is almost invisible, and the user deals directly with the operating system. I found that CP/M was easy to pick up, perhaps because it bore some resemblance to the Digital Equipment mini systems with which I am familiar. The facilities offered were the proper ones for a disc-based computer, and although it may not be the best operating system in the world, it is certainly more than adequate.

One of the most useful facilities is the ability to create user's own command files by the use of Submit. The Dir — directory-command — was no more than adequate, since it gave only the names of the files on the disc concerned, with no other information. A better method to use would be "STAT *.*" which would give not only the file names but also the sizes and the amount of free space remaining.

Files have no particular attributes — they cannot be write-protected, or individually made "invisible", so that they are not listed-out on a directory command — useful for security of files — or declared as a system file, so that they are copied across automatically on formatting a new disc to be a system disc. Those may be minor points in a home environment but could be crucial for a business application.

The useful Submit command can have external parameters so that versatile user command files can be created. One of those tried was to be able to format a new disc and then copy all the files from the disc in drive A to drive B — a disc back-up command.

**File extensions**

Admittedly this was really trivial and to do it step by step using the already-available commands would not have taken much longer, but it was a useful exercise. The Submit command, however, did not seem to like a Format strung together with a PIP and it would not work. Using Format alone in a submit command, however, does work, which seems strange.

All file interchanges were via the PIP — Peripheral Interchange Program — command. PIP allowed versatile interconnections, such as reading-in from an external device, so long as it is a device recognised in the CP/M repertoire — a paper tape reader or the console keyboard straight into a disc file; or from one device to another — the VDU keyboard on to a printer.

In CP/M, files have an eight-letter name, with a three-letter extension which indicates the file type. For instance, all files created by a program in Basic will take the default extension 'BAS'.

File extensions are used to identify the file type for the various compilers supplied and for certain commands. Any extension could be tagged on to any type of file, since the file type was checked only on calling-up the file for use. The extension were also useful as reminders of the file type for the user.

Other CP/M facilities were a text editor "ED" which operated in a fairly basic way but included a string search command "F". There was no line-numbering in the editor. "DDT" is a Dynamic Debugging Technique, a powerful machine-code monitor which included single step and trace, automatic single step and trace to a pre-specified number of steps, and breakpoint setting. There is a single-line direct assembler or mnemonic entry of code, as well as a disassembler for mnemonic display of code in memory. "DDT" is useful for development of further system facilities, or for control programs where timing is important.

There were no line-editing facilities, other than on the current — unentered — line. Once a line is entered there are no facilities to recall the line and modify it, or to repeat the command.

**Software**

The Black Box claims extensive software support. Supplied with the test equipment were minifloppy discs with Fortran, Cobol and the expected Basic called MBasic.

The virtue of CP/M is that the machine can run any of the extensive CP/M software library, which now runs to 40 full diskettes. It is distributed by LP Enterprises of 313 Kingston Road, Ilford, Essex IG1 1Pj.

MBasic is by Microsoft and has an edit command allowing editing by line number. Benchmark runs indicate that this Basic is the same speed class as the Research Machines 380-Z, and slightly faster than the Pet and Apple Extended Basic.

Fortran-80, again by Microsoft, is claimed to be to ANSI 1966 standard with a few extensions added. The compiler seems efficient in compilation time, taking about 22 seconds to compile a 30-line Fortran source, and in the process generated approximately 473 bytes of machine code.

The listings file was good; it gave the Fortran source line statement numbers, listed them and then listed directly underneath the statement concerned the mnemonics of the generated machine code. This type of listing is helpful when debugging a program using "DDT".

**Linking loader**

There is a linking loader program and a Fortran library for routines and functions. L80, the linking loader program, needed slightly more than one minute to link in the library to the above program, which had referenced 19 external calls to the library, and to load the executable code into memory. The memory image can be kept by using the "SAVE" command in the CP/M utilities, giving the saved file the extension of ".COM" for command, so that CP/M will recognise it as an executable file.

Cobol-80, by Microsoft again, is said to be to ANSI-74 standards. It worked in a
similar way to the Fortran compiler. A Cobol source file may be created using the CP/M text editor, be given the extension of "COB", and then submitted for compilation.

Linking loader

The compiler had further overlays and needed approximately one minute to compile 55-lines of source code. Unlike the Fortran compiler, the listing file generated only added line numbers to the source code and there was no display of machine mnemonics, and any indication of program size or external routines referenced.

This type of listing is of little use, except for when there are compile time errors, but once the compile errors are eliminated, one may as well have hand-numbered the source statements. The linking loader is also called L80 and is identical to the one supplied with Fortran. It needed slightly more than one minute to link in the routines from the Cobol library and to load the executable code into memory, for a program with machine-code size of just less than 10Kbytes. Again, the code can be kept as a "COM" file using the "SAVE" command.

Using the compilers revealed the limited capacity of minifloppy discs. For example, there was not enough room on a CP/M system diskette with all the standard utilities and for either of the compilers with its library files and the linking loader. It is therefore fussy to work with the compilers, since one has to change the extension or creating a file. Double-density recording format would probably be a better proposition for more serious use but even that at about 160Kbytes/drive, is only just adequate.

Documentation

Each of the software systems had its own manual. Both the compilers' manuals were brief and to the point and were useful for reference. The CP/M manual was again brief but good, and helpful for those who needed to learn how to use the system as well as being a reference manual.

The MBasic manual is similar but not so good as CP/M. There was no hardware manual supplied. Rair does not supply one usually. At least it could supply a trouble-shooting guide, which should list standard procedures to be tried in the event of problems. This could save time to both customers and Rair in solving some of the more minor problems, as well as giving the user more confidence. Omitted also was any setting-up and getting-started notes; for instance simple instructions on connecting peripherals, making sure that signals and baud rates match. Admittedly, Rair gives potential customers demonstrations at its London showrooms, which is to be applauded, but a note for future reference is always useful.

Hardware

Inside, the Black Box looked neat and tidy. There were only four cards in the 8-slot motherboard. The cards had 86 pins and were not to the S-100 bus standard. There were the CPU card with the 8085A and an 8257 DMA controller, a floppy disc drive controller card, a memory card with 64Kbytes of 4116 dynamic RAMs, and a communications interface card with two UARTs. There was no parallel I/O catered for and the option is not listed in the price list.

Conclusions

* I liked the Black Box. It offers the proper kind of facilities for a small computer. The main criticism is the low capacity of the minifloppy discs — this is common for minifl oppies recording on single-density format and not exceptional to Rair.
* All the software systems worked well and CP/M is a good choice as the operating system. The listing file of Cobol could be improved. I hope Rair will re-consider its policy regarding the supply of hardware manuals, or at least give a trouble-shooting guide as well as setting/connecting instructions.
* The responsible attitude to its equipment deserves praise. Rair was able to offer me four reference sales, as well as applications sold by other companies using the Black Box as the equipment, to support these claims.

Practical Computing evaluation

<table>
<thead>
<tr>
<th>Ease of construction (where applicable)</th>
<th>Yes/No</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of documentation</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dealer support/maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can handle 32K of memory</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality of video monitor (consider resolution and screen size)</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SS-50 Bus</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-100 Bus</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socket for chips</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numeric, calculator-type pad on keyboard</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large amount of removable memory, randomly accessible</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cassette tape recorder capability: Own</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Built-in recorder</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communications capability (can talk to other computers)</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed of instruction cycle</td>
<td>3022</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of expansion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low power consumption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assembly language</th>
<th>YES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic language</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other languages</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compatibility with other systems</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reputation of manufacturer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of software applications packages available</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hobby use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suitability for: Commercial applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to add printer(s)</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to add disc(s)</td>
<td>YES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to add other manufacturers' plug-in memory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ratings

1 = poor; 2 = fair; 3 = average; 4 = good; 5 = excellent.
N/A = not applicable.

PRACTICAL COMPUTING November 1979
Tecs the system if you want to be a pioneer

REVIEWING the Tecs system has proved a nostalgic experience. When we started looking at micro-based computer systems 18 months to two years ago we were more concerned with the potential of the system than its immediate capabilities. We expected the documentation then to be incomplete, the software to be a preliminary release — full of bugs — and some hardware capabilities to be "available shortly".

The challenging part of the review was to assess the capability of the system when it was fully developed, which was likely to be at least six months in the future.

Micro systems have grown-up quickly. We are not impressed now by sophisticated hardware and system software but look also for good documentation, application programs, and hardware and software support. The Tecs system we had for review seemed like the early micro systems because, despite it not being fully developed — and this is particularly true of the Software — it offers a very exciting new application in linking viewdata and Teletext with low-cost computing.

Tecs is "a micro-processor-based Teletext/viewdata recorder with powerful local computing facilities". The Tecs is two separate systems based on a common microprocessor:

● Teletext/viewdata receiver;
● A 6800 microcomputer.

The system is housed in a low cabinet similar to that used by the Sol computer. The keyboard, which follows the Post Office preferred layout, contains normal QWERTY keys together with a numeric pad and, optionally, the function keys required for editing data on Prestel. Taking the top off the box reveals two sets of boards; on the left-hand side are those required for interfacing to Teletext and viewdata and on the right-hand side are the 6800 processor, memory, and I/O controllers for the computer peripherals.

The system which we had for review had the following components on the left-hand side:

Modem, for interfacing via a Post Office telephone to Prestel. This uses the Datel 1200 service which gives 1,200 baud transmission from the Prestel system and 75 baud to it.

Teletext Reception Card/Teletext Display Board, used for displaying both Teletext and viewdata as they use common formats.

TV interface card, which outputs the display to a normal television set and allows software control of TV channel change.

On the right-hand side were the computer cards, plugged into a Tecs bus. The bottom slot was occupied by the processor card which contains the 6800, 4K RAM, an RS232 interface and 4K PROM. The next slot was occupied by the Prestel card which contained the modem interface and 1K PROM containing the software required for handling the Prestel data.

That left four spare slots which could be occupied by the following boards:

General purpose interface card which occupies two slots and provides: RS232 interface; floppy disc controller; Kansas City cassette interface; 4-bit audio interface; two parallel ports and 240-byte bootstrap in ROM.

Memory board which can hold 16, 22 or 48K RAM with 8K, PROM or 56K RAM.

That leaves one spare slot for further expansion.

Technologics chose the 6800 for the system because at the time when the original development was undertaken it was found to be faster than the 8080 for the Teletex software and the Z80 was too new and expensive to be considered as an alternative.

That limits the range of "standard" software available, as the 6800 has lagged behind the 8080 in popularity and therefore in available software.

The software now available is an editor/ assembler and two versions of Basic, 3K and 8K. A special feature of both those versions of Basic is that they provide full Teletext colour display functions which allow 24 rows of characters, cursor control, six colours, double-height characters, 80 x 72 resolution graphics in black and white or colour, and any mixture of graphics and characters.

The 2K Basic is a "tiny" Basic with integer arithmetic and 26 variable names. The 8K Basic provides floating-point arithmetic and the normal range of functions. The only disc software available allows display pages to be saved and loaded. Technologies have not decided whether to adopt one of the standard 6800 operating systems or to develop its own.

The system also contains a monitor in PROM which can be used for machine-code programming; that, as is traditional on 6800 systems, is called TECBUG. Finally, the Teletex information is

PRACTICAL COMPUTING November 1979
TECS system box and keyboard. Also needed are a TV set, printer and, at some time, floppy discs.

Potential market must lie in combining those capabilities. It could therefore be used to prepare information to be entered into Prestel — that would interest people who supply information, known as Information Providers; store and process information extracted from Prestel/Teletext; run programs extracted from Prestel/Teletext. This is known as telesoftware.

**Limitations**

As an editing system for an IP the system has some limitations, for example, the lack of a comprehensive disc operating system, but as this is obviously the most important initial market for the system, Tecs is putting most of its software development effort into this area, and the deficiencies should soon be eliminated.

The second area of use, storing and processing information extracted from Prestel/Teletext, is a little more difficult to define. One important difference between the two services is that while Teletext is free, Prestel is not. Prestel charges are based on an amount per page displayed — this can be from 1/10p upwards and 15p is not uncommon plus the cost of a telephone call.

As anyone who has ever used a time-sharing system knows, it is very difficult to control those kind of charges — they mount at an alarming rate.

Information is located in the Prestel system by working through a series of directories until the detail required is reached. There is a charge for each directory page, so using the Tecs system to store the directory structure, or the identity of the detailed page, would reduce the costs of accessing the data.

That would work only if you knew what you wanted to look at and if the information structure remained stable.

**Conclusions**

- It is interesting to compare the capabilities of Tecs, Prestel and Teletext of the IPs, there are no fully-developed with a new, low-cost service of combining the Prestel/Teletext called the Source, which was launched at the NCC in New York in June.
- The Source provides off-peak, low-cost Sunshine ways in which the cost of access ($2.75 per hour connect time) time-sharing. As well as programming in Basic, excellent basis for developing software to Fortran IV and Cobol, Source allows a link the two areas.
- The Post Office Prestel service is a widely-used low-cost way in which the Tecs system can be a peripheral for the Apple but we have no information on when it will be available.
- In its present state the Tecs system offers access to Prestel and Teletext, together with reasonable basic computing capabilities.
- The computing side the major outstanding problem is the lack of a disc operating system, which hopefully Tecs will resolve by adopting one of the available 6800 operating systems. If you want to become a pioneer in linking Prestel/Viewdata with microcomputing, Tecs is the system for you.

As far as storing information is concerned, the easiest way would be to attach a printer and print pages of information as required. Obviously only textual, as opposed to graphics, can be stored this way. The next step would be to store the information on a floppy disc for retrieval as required. To do this effectively, more comprehensive disc software than is available would be needed.

The Tecs system enables programs to access the 1K display buffer and therefore to process data extracted from Prestel/Teletext. One problem is that the pages of data are designed for visual presentation and so make use of the graphic display capabilities to maintain the user's interest. The format of the displayed information is unlikely to remain constant over a period and this will make it difficult to develop programs to extract and process the displayed data.

**Standards**

The concept of telesoftware — the ability to obtain programs from Prestel/Teletext and execute them in the receiver — is relatively new and at present there is no telesoftware available for the Tecs system.

At first sight, telesoftware seems to be a good idea. The distribution of programs via a widely-used information utility seems to be attractive, but it raises at least as many problems as it solves. In particular, it requires a widely-accepted set of standards covering programming languages, transmission formats and, most important as far as the potential user of the Tecs system is concerned, the characteristics of the receiving system. Those standards do not exist.
MUCH microcomputer software is advertised by manufacturers and a number of microcomputers use the same processor. For example, the Cromemco systems have Basic, Fortran and a Z-80 macro assembler on mini-floppies at £85 each. They should be sold only to owners of Cromemco computers, and it is a breach of copyright to transfer them to other machines.

Should you attempt to do this illegally, you would be unlikely to succeed. Cromemco uses either IBM-format 8in. floppy discs or 5 1/4in. soft-sectored floppies and though the latter are the same size as on the Horizon, North Star discs are hard-sectored.

The discs look the same, except that the hard-sectored floppies have a series of 10 holes near the centre which mark the beginning of each sector; and since the North Star Horizon reads and writes information to the discs by sectors, it cannot use soft-sectored discs — which store information in concentric rings on the disc.

An additional complication is that the newer disc control boards may store information on the disc in single-density, double-density, or even quadruple-density formats. So ensure that the software you buy is stored on the correct size of disc, with hard or soft sectoring as required, and written at the appropriate density.

Most general-purpose computers, as opposed to dedicated micro-processors, require a program called the operating system to allow interaction between input device(s) — keyboard, disc, cassette, or paper tape reader; the central processor unit and memory; and the output device(s) — printer, cathode ray tube, disc, cassette, or paper tape punch.

Until the operating system is loaded into memory and the CPU is set to read the program, the computer cannot function. The Horizon computer is provided with the North Star Disc Operating System, which supports North Star Basic. While this is a robust operating system, it supports few other languages — Pascal is on the way — and relatively few software packages are available to run under this system.

The first step in implementing software from other manufacturers is to replace the operating system by CP/M, a Control Program for Microcomputers, which was written by Digital Research.

Becoming established

In much the same way as the $100 bus has become the de facto industry standard for hardware interfacing, CP/M is establishing itself as the standard operating system for microcomputers. A version of CP/M which has been adapted specially to run on any North Star disc system — the Horizon, or the Sol with North Star disc controllers — costs £130 from The Byte Shop or £145 from Lifeboat Associates in the U.S.

CP/M is supplied on a diskette and Horizon users must remove the case from their computer and re-locate the memory before attempting to use the diskette. For example, a Horizon with 24K of memory running North Star Basic has its memory (RAM) starting at address 2000 hex (8K) and continuing up to 8000 hex (32K).

CP/M requires that the switches on the memory board(s) be changed so that the RAM starts at address 0 and continues to 24K. Once you have made this change, on flicking the bootstrap switch CP/M is read from diskette into memory. CP/M is divided into four main parts:

- the basic input output system (BIOS).
- the basic disc operating system (BDOS).
- the console command processor (CGP).
- the transient program area (TAP).

BIOS is machine-dependent and so it is essential that this part has been tailored for a Horizon with hard-sectored mini-floppy discs in single- or double-density as required. A consequence of the modification for North Star is that though CP/M is supplied and labelled as a 16K program, it needs 4K more than the nominal size — 20K of memory on a Horizon.

BDOS manages the disc drives which contain independent file directories and provides for dynamic file construction with the minimum movement of the disc-heads across the disc. It can search for a named file, open or close the file, re-name it, or read or write information from or to it.

CCP allows the user to access various parts of the CP/M system by means of a set of built-in commands which list the file directory, type the contents of files, and save, re-name or erase files. The CCP also has a set of standard transient commands, which load and execute a named file which is part of the CP/M disc.

The working part of the memory used for these programs is called the transient program area. The fact that only the required parts of CP/M are held in memory at any given time is a simple and clever way of saving core. Supplied on the CP/M disc are the following standard transient programs:

- ASM — an 8080 assembler.
- DDT — dynamic debugging tool.
- DUMP — file dumping program.
- ED — text editor.
- LOAD — a hexadecimal loader.
- NSYSGEN — produces a new disc copy of CP/M either from an existing disc copy or from the version of CP/M in memory.
- NRELOC — used to change the size of CP/M to fit the available memory, i.e., to make the transient program area as large as possible. Remember that a 28K version of CP/M requires 32K on a Horizon.
- STAT — assigns devices, gives statistical information about file storage, and reports the amount of free space on the disc.
- PIP — copies, re-names and moves files.
- SUBMIT — a batch mode utility.

In addition, CCP will load and execute any users' transient programs you have written or purchased. Examples of such users' programs include Basic, Fortran, Cobol, word processing, accounts, data-bases and the like.

CP/M is undoubtedly a powerful and sophisticated operating system for micros. I have three minor criticisms. Firstly, it is a pity that the assembler has only 8080 mnemonics rather than the extended Z-80 set.

Reasonably powerful

Secondly, I found the editor reasonably powerful but it was a little difficult to get used to it. It works by having an imaginary line pointer, and a second imaginary character pointer which may be moved along a line. If it showed with a flashing cursor on a VDU it would be satisfactory, but without it, it is easy to get lost with two imaginary pointers. I prefer an editor which allows you to find the appropriate line and then exchange character strings.

Thirdly, I found the CP/M editor manual difficult to follow. It...
did not explain or clarify all my problems. It is well worth reading the manual for the Cromemco editor which explains the CP/M editor functions more fully. This manual can be obtained from LP Enterprises.

My version of CP/M — North Star, single-density, version 1.41 — appears to contain a bug. The transient program NRELOC was used to produce a 20K version of CP/M on my 24K Horizon. The version so produced claimed to be 20K but a check on the amount of free space indicated that it was only 3K bigger than the 16K version supplied. This proved to be disastrous to me, since I was trying to load CBASIC, which required a minimum of 20K. Lifeboat Associates proved to be friendly and helpful, and are working on it.

A powerful text processing program called TEX has been written by Digital Research to run under CP/M. It turns a Horizon with a Diablo printer into a sophisticated word processing machine for standard letters, reports or books. Text is split automatically into pages of any specified size. They are numbered and may carry a heading. Paragraphs may be indented optionally and the spacing of a line may be adjusted to right-justify the lines. The various commands are inserted into the text file using the editor before running TEX. The cost is £55 from The Byte Shop ($85 from the States).

Minor criticisms of TEX are that you are obliged to number pages from the bottom rather than having the option of top or bottom; and you cannot print two columns of text on a page without using scissors and glue.

For word processing

The Electric Pencil is a word processing package and is produced by Michael Schrayer Software Inc in the U.S. at prices up to £300, depending on the computer and the printer used. It is debatably the best word processing system for microcomputers, because it runs interactively. It will left- and right-justify typed lines, handle any paper size required, indent paragraphs, and number pages, as do a number of other word processors.

Unfortunately, there is a catch — money. You need a memory-mapped VDU board, Two which display 24 lines of 80 characters are the Imsai VI0C board at $465 and Flash Rider II at $320. The Processor Technology VM1 board, which displays 16 lines of 64 characters, is less expensive, and though it may still be available it is debatable the best word processing system for microcomputers, because it runs interactively. It will left- and right-justify typed lines, handle any paper size required, indent paragraphs, and number pages, as do a number of other word processors.

Unfortunately, there is a catch — money. You need a memory-mapped VDU board, Two which display 24 lines of 80 characters are the Imsai VI0C board at $465 and Flash Rider II at $320. The Processor Technology VM1 board, which displays 16 lines of 64 characters, can sort and extract customers by names or addresses. It costs $95 and requires Software Systems CBASIC.

Micropro also has the Word Master text editor for $150. It works in either of two modes. The first uses a super set of the CP/M ED commands, allowing global searching and replacement either forwards or backwards in file. The second is video mode and provides a full screen editor for users with a serial addressable-cursor VDU.

CORRESPONDER is a mailing list system which can generate letters and can sort and extract customers by names or addresses. It costs $95 and requires Software Systems CBASIC.

ISAM is a useful-sounding system with triple-level index filing which meets the full ANSI level II Cobol capability; it costs $145.

The American software house, Structured Systems Group, offers four programs — General Ledger for $995, Accounts receivable for $750, NAD (a name and address selection system) for $79, and QSORT (fast sort/merge) at $95. All four require CBasic.

WHATSIT is a very interesting interactive base data system which retrieves information by subject. It requires CBasic and costs $125. The Byte Shop offers a base data enquiry system also called WHATSIT; it works on a standard Horizon computer with North Star DOS and costs £45.

SOURCE is an 8080 or Z-80 disassembler which converts a binary disc file into mnemonics which may be used with MAC or their Xitan ASM assembler. It costs £70.

ZASM is a disc-based assembler for mnemonic Z-80 which creates output in absolute hex addresses and costs £45.

Several business programs are available from The Byte Shop. Among them are INVENTORY-I, a stock control program for retailers; up to 1,000 lines may be stored. The package keeps track of items running low, slow-moving items, profitable lines. It costs £85.
Solving printing problem for Cromemco users

All computer users at some time will want a printout capability. For those with a Cromemco Z2-D but not fortunate enough to have a parallel printer, printouts will prove something of a problem.

There are now many relatively cheap serial printers on the market. They can be used with the Z2-D system with a few minor changes to CDOS, leaving all its intrinsic commands unaltered; more important, this can be done without hardware changes.

To add any type of printer to an existing Z2-D system with, say, a disc driver board, 32KB of memory and a processor board, an I/O port, will have to be added. This can be done easily by adding a TUART board to the system. The Cromemco board has two universal asynchronous receiver transmitters, hence the acronym.

by Andy Mead

Each UART has a serial and parallel I/O port. CDOS uses one of the UARTs set at a base address of 50 hex to communicate via the parallel port to a parallel printer. By modifying CDOS, the serial port of that UART can be used to provide printouts. The remaining UART on the TUART board can be set to some convenient base address, which does not clash with any of the I/O ports present in the system. I assumed a value of 60 hex, since this is an easy value to remember.

Two features of the TUART board must be taken into account by changes made to CDOS when incorporating a serial printer into the Z2-D system:

- Serial baud rate selection by software;
- Base address-swapping between UARTs by software.

The second facility can be disabled by one of the switches on the TUART board. If the sway facility is not disabled, the addresses of the two UARTs can be reversed when the system is turned on. That can give the unwary many headaches if not spotted quickly!

When any computer communicates with its user, it does so via a driver routine. CDOS is no exception. To add a serial line printer, the parallel printer driver routine in CDOS should be replaced by a serial routine.

Swap facility

The baud rate and the swap facility of the TUART must be included in the initialising routine of CDOS. Since we only need to execute those once, they can be included in the initialising routine of CDOS.

<table>
<thead>
<tr>
<th>Baud rate</th>
<th>Open-stop bit</th>
<th>Two-stop bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>81</td>
<td>01</td>
</tr>
<tr>
<td>150</td>
<td>82</td>
<td>02</td>
</tr>
<tr>
<td>300</td>
<td>84</td>
<td>04</td>
</tr>
<tr>
<td>1,200</td>
<td>88</td>
<td>08</td>
</tr>
<tr>
<td>2,400</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>4,800</td>
<td>A0</td>
<td>20</td>
</tr>
<tr>
<td>9,600</td>
<td>C0</td>
<td>40</td>
</tr>
</tbody>
</table>

Figure 2. The baud rate byte for TUART.

CDOS uses a jump table to find the routines it needs to communicate with the outside world. A jump table is a list of jump instructions which tells the computer where to find a particular routine. The original jump table used by CDOS is shown in figure 1. Following the jump table is the CDOS initialising routine INIT, which sets up all the I/O ports used by the Z2-D.

We then have all the information necessary to make the changes to CDOS. The first thing to be done is to set the addressing mode of the TUART to the normal state, followed by the baud rate of the serial port. Those additions can be done using the DEBUG program with most Cromemco software packages.

Additions

Normal addressing mode is selected by outputting 01hex to the parallel port with based address 60 hex. The baud rate of the serial port is selected by outputting one of the bytes corresponding to the baud rate.
Figure 3. Modifications to the CDOS initialisation routine.

Figure 4. New CDOS jump table shown in figure 2, to the serial port with base address 0. Those additions to the initialising routine, together with that routine, are shown in figure 3.

When making the additions to CDOS, all the routines below INIT should be moved down over the parallel driver routine, leaving INIT and the routines below the paper punch output routine unaltered. That, of course, means that some of the entries to the jump table will be altered. The new entries are shown in figure 4.

The serial output routine (figure 5) starts by SAYing the accumulator, which contains the character to be printed, on the stacks. That protects the character from the following loop, which tests the status port of the UART to see if a character may be printed. When the program branches-out of the loop, the printable character is transferred back from the stack to the accumulator, and then output to the printer via the output serial port.

The printed character undergoes a further test after it has been printed, to check whether it was a line feed. If not, the printing routine makes a return; if a line feed has been issued, the printer routine enters a simple count-down delay loop. A null is printed on the console device for every pass round the loop.

That loop allows a mechanical printer the time to perform a carriage return and line feed. The timing of the loop can be tailored to the particular printer used. For figure 5, the printer used is the Axiom EX-800; the delay gives a comfortable printout rate of 1,200 baud. The long delay is needed because the printer does not output any characters until it receives a carriage return/line feed pair. For faster printers the delay can be reduced or even omitted.

It works

The new jump table contains the entry points for the new line printer driver, as would be expected. Since the old table had a line printer status called, the new one has to retain that call. The status was asked for by the old CDOS routine to check the position of the parallel printer during its printing operation; as that is taken care of by the new line printer driver, the entry in the jump table is a reference to a RETURN instruction.

Does the altered CDOS work? The answer is yes, once the modified version of CDOS has been transferred by a WRSTSYS operation to the boot blocks of the disc. This article is confirmation that it works; it was written using Crom-emco software and printed-out using a serial printer.

Figure 5. Serial line printer driver routine.
Lessons in teaching computers to learn

ARTIFICIAL INTELLIGENCE is a wide-ranging subject, involving problem solving, game playing, pattern recognition, theorem proving, automatic program writing, semantic information processing, robotics and learning. All are attempts, some successful, some not so successful, to mechanise human thought processes. Of these, the last, learning, is still clouded in too much mystery.

It has been long known that animals and people understand and do things better with experience and that the improvement is related directly to the amount and type of the experience they gain. It seems strange, therefore, that so little attempt is being made to apply the same ideas to computerising, that man-made source of excessive information processing power.

In fact, research goes on all the time and many techniques for computer learning are known, even though the programmer is faced with another level of abstraction above the problem the computer is set.

Great potential

A few examples of learning algorithms are presented, more to show how and what because the "why" is easy, it shows great potential for improved data processing and it stimulates the grey matter. Given the state of the art, a discussion of the social implications of computer learning would be premature but for those interested in very low-grade prediction, science fiction has volumes to say on the subject.

Rote learning is a technique in which some information is stored in a memory, computer or brain, and then recalled verbatim later. Most schools teach multiplication tables in this way. A poem must be learned by heart and repeated word for word. The storing of a byte in random access memory of a computer can be described as rote learning. Data files fall into the same category; one section of code will store some information in a prescribed place and another will recall it.

A practical example of the technique is the 'teach' mode in an industrial robot. A manipulator is required to carry-out repeatedly a sequence of actions with extreme regularity and monotonous accuracy. Before it can do so, it must be told what actions to perform.

One could instruct it by writing a program in machine code, Fortran or one of the languages developed specially for numerically-controlled machines but this is a remarkably time-consuming chore.

More often a skilled worker 'leads' the machine once through the task, using a joystick or hand control to 'teach' it the key positions to which it must go and the actions it must perform.

With this set of co-ordinates in the memory of the controlling computers, the robot will cycle through the sequence in a mindless way, sometimes not stopping if the work fails to be fed to it properly.

Adaption or parameter learning represents the next step up in the ladder. In this case, the overall structure of the problem has been solved already and only the final details remain to be worked-out. One major success of adaptive learning machines has been in pattern recognisers and classifiers. The program will be expected to name a pattern when shown, such as a handwritten letter of the alphabet (figure 1), out of a whole class of possible patterns, such as all the letters of the alphabet.

One trains it by showing the machine several samples of each letter. If it mis-recognises the letter, a part of the algorithm is called which adjusts internal parameters so that it will do better next time. After a number of attempts, the parameters are well tuned and it almost always recognises the pattern.

Rosenblatt's Perceptron is one of the better-known mechanisms of this type. It dates from the early '60s and was intended to model the idea of a neural-net brain mechanism, with neurones and synapses, inhibitory and excitatory connections and synapse facilitation.

Figure 2 shows a pictorial representation of the structure of a perceptron to classify visual stimuli. In theory, it could be used to predict the weather or any other situation where there are examples giving a well-defined state.

Mark Witowski, a researcher in Artificial Intelligence, looks at Perceptrons and the problems of making machines learn.

Connected to the retina — typically 20 by 20 points — would be a number of association-units (A-Units). Each A-Unit would be linked to a small number of retinal points by some excitatory links which would add something to the A-Units if that point was stimulated and some inhibitory links.

Weighting factor

For any given pattern, each A-Unit would either output a 1 if more excitatory points were activated than inhibitory, otherwise zero. Each of these outputs is then multiplied by a weighting factor and all the results are fed into a summation unit which, as its name suggests, adds all the values.

If the result is negative the pattern did not belong to the target class; if positive, it did. There will be one set of weights and summation unit for each pattern class. If the operator disagreed with the machine's classification, the values of the weights which contributed to the incorrect classification would have to be modified. This 'training' algorithm is very simple.

The perceptron is surprisingly effective with position invariant data and is very tolerant of noise in the image. It will discriminate a hand-written capital letter from the set A, B, C, D, E, F, G and H with about 95 percent accuracy, after being trained with 10 examples of each.

Interesting as the perceptron is, both as a trainable adaptive learning machine and as a brain model, its popularity waned considerably after a series of essays in the late '60s on computation by Minsky and Papert, of the Massachusetts Institute of Technology, in which it received some heavy, if somewhat unjustified criticism.
The theory and practice of the technique, however, are still valid; non-parametric training machines and their descendants live on. They are found not so much in visual pattern recognition but in speech recognisers. Because each speaker's voice is sufficiently different from every other's that it is almost impossible to analyse the waveforms, each speaker is asked to say each of the words in the vocabulary to be used several times before using the machine. This turns out to be a quick, convenient and satisfactory idea, giving good recognition rates in almost all cases, with minimal extra programmer effort.

Interest next passed to more formalised programs in which descriptions are matched and the differences used to generate more accurate descriptions. Patrick Winston of MIT made his name with a 'concept' learning program. He input to his program descriptions of simple structures made from blocks.

After being shown a number of examples, some of which are the structure and some of which are 'near-misses', the program would augment its internal description of the scene with notes to tell it whether something must or must not be present, to allow any input description to be a member of the class. Figure 3 shows a very simple example.

The program is being taught what a 'tower' is—a cylinder with a cone on top. The teacher shows it one example and then a near miss. Each generates an internal description, which shows each object and its relationship to all the others—above, below, supported-by.

Every time a new example, or a near miss, is presented to the program a set of differences between the old description and the new is produced. If it is a new example, one of nine possible actions stored in a table is applicable, two of which represent contradictions with previous examples.

A near-miss case means that the description must be updated with one of 10 possible actions, depending on the nature of the observed difference, usually by adding a 'MUST-BE' or 'MUST-NOT-BE' node to the model. Figure 4 shows the description after a few more attempts.

While this program demonstrates a point about learning concepts, it has its weaknesses—and other strengths to which this all-too-brief description fails to do justice; it still requires a trainer or teacher. If it is to work well the algorithm should be shown an example first and near misses should have only a single difference from the hit. Paradoxically, it's strongest failing is in the excessive power of its descriptive ability.

Winston could argue that this has to be the case for effective learning. But this holds true only if the pupil and teacher are interested only in towers and houses and arches and other constructions of toy blocks.

Descriptions

As soon as discussion moves to all primitive descriptions, such as 'MUST-BE-SUPPORTED-BY', 'MUST-NOT-TOUCH', the previous descriptions would be inappropriate and of very little use. We can then argue that a learning program must either have a large number of powerful descriptive tools at its disposal, or we search for some weaker but more generally-applicable descriptions about the world. They will then be combined to form the wide range of descriptions needed.

In all learning systems discussed so far a human provided the motivation and the correct examples the program required and generally guided things along. Young children learn, partly by being taught, but also by observing the world as it passes (continued on next page)
them by, and more so by playing with it, pulling an object apart, dropping it, and by general experimentation and investigation.

Learning by discovery; such power; a program with curiosity; what a curiosity. No longer can a learning algorithm stay in isolation. Now the computer must be able to perceive its environment.

It must be able to move around and discover the effects of doing. It must behave as well as sense and learn; it can no longer be a passive heap of electronics upon which information is deposited and from which ASCII flows.

Laboratory robots provide the right kind of peripheral for this task. Laboratory robots differ from their industrial counterparts in several ways. They are usually smaller and physically less powerful, but with more sophisticated computers to control them. They must also carry a great many sensors; they will provide the information, the learning, or any other control algorithm will use to make deductions and correct its actions in the world.

Learning programs show enormous potential in the field of robot control. The less you can rely on mechanical accuracy the more the emphasis shifts to using sensory information. A robot's view of the world is egocentric about its own sensory data, which for a typical robot, if there is such a thing, is different from our own.

Theorem prover

A number of robot projects involve all the essential human ingredients. One is SHAKEY, the product of a Stanford Research Institute team. Its 'intellect' was provided by a predicate calculus theorem prover called STRIPS, in which information about the world in which the robot must operate is stored as 'well-formed formulas' (wffs).

For instance, CONNECTSROOMS (D1, R1, R2) tells the system that door 1 connects room 1 with room 2. Robot action routines, such as GOTHRU(D1, R1, R2) would cause the robot to go from room 1 to room 2. The power of these constructs is not from the ability to execute them directly as commands but by being able to plan routes and complex actions using them.

Each action, like GOTHRU, has associated with it a list of things which would change if it were to be executed, and a list of things which must be true before it can be attempted — the preconditions wff.

The add and delete functions update the model of the environment as though the action had been carried-out. Thus INROOM (ROBOT, R1) is the precondition and will be deleted by GOTHRU(D1, R1, R2); INROOM (ROBOT, R2) would then be added.

Tasks for robot

Every significant object in the robot world and every action it can make are described in this way. Tasks SHAKEY must perform are also described as wffs, for instance:

Goal: \((x)\ EBOX(x) \text{ INROOM}(x,R1)\]

asks SHAKEY to produce a plan for moving box x from where it is into room 1. To do it the robot may have to go through some doors to where the box is, push it through some more doors until it is in room 1. STRIPS builds a plan from the basic operator actions, which is then passed to PLANEX (plan executor system) on a PDP15 system, which will then control the robot directly through the planned sequence of actions in real time.

The main force behind STRIPS and SHAKEY was not in learning but rather in the predicate calculus problem-solving. Sensory information from tactile 'whiskers', a range finder and television camera was used mainly to check that the information in the database was correct, rather than to add new data to it.

Learning, however, is achieved in two ways. First, a triangular table can be constructed of all the steps in a plan. The table is triangular because the add-list becomes longer as more actions are taken. This table shows all the pre-conditions, add-lists and operators at each step. The stored plan can be used at a later stage as a fully-computed sub-plan, saving the resol-
ution algorithm a vast amount of computing. The second form of learning is one of generalisation. It would replace specific instances of room, box and door by variable names; therefore one plan would fit many or all situations.

All these forms of learning are inadequate, since in them learning must progress by the program and robot doing something, making some action and then observing the effects. It ought still be able to learn passively, by observation, and by imitating a teacher performing the same actions; any final algorithm we devise should take into account all of these forms.

We should be able to command it to do things, only having to specify what should be achieved in the goal state, rather than having to give an explicit instruction sequence. The algorithm would then use a combination of a plan-forming mechanism to work out how to do it, perhaps like STRIPS; and a mechanism which always adds anything new or unexpected into its database memory.

Penalty

It is not necessary that the robot be engaged actively in any specific goal or task for the learning process to continue. At other times it might make movements and actions to test what happens, rather like a toddler. It might use a previous goal as a model, perhaps one which needed a long time to complete, or one of its sub-goals, which proved to be inadequate, which was generated during the planning process.

It might have a list of 'things to try' input by the user. It might take a particular sensor and see how its output changes in relation to actions made and the outputs of all the other sensors. Making even random actions is far better doing nothing. These processes are equivalent to play and curiosity, well known when applied to people and animals.

All this adds-up to a robot control program which performs better the next time. As a penalty for these potential gains one must dedicate a substantial amount of computing and engineering facility, since learning programs can be expected to learn, as do people, painfully and slowly. It is very difficult, however, to program robots to do anything interesting and this penalty will probably be worth paying.

Although human intervention is not ruled out in learning algorithms, with the other algorithms — adaptive and concept learning — the user was an essential part of the process. Even with the most general algorithms available somebody, somewhere is still required to specify useful goals.

If this type of algorithm becomes widespread, computers will be 'taught' and 'guided' rather than programmed. With our state of knowledge it would seem as if it will be a long time before we can expect the acquisition of natural language through learning, which would open the doors to a wide range of interesting possibilities.

ALP is a learning program developed at London University by David Mott which incorporates a significant number of the ideas discussed, albeit at a fairly primitive level. ALP uses a laboratory robot connected to a mainframe in which the learning program resides.

Instead of SHAKEY's world with rooms, doors and boxes, it lives in a simpler world dominated by a light and battery charger. Its task is to 'survive' by not letting its batteries run down.

The formal logic of STRIPS is not suitable in such a situation. Instead, information is stored in SCHEMAS, which have a form better-suited to the uncertainty a naive robot has about its environment. Schema are built as information flows from the sensors into Short Term Memory — STM — a term borrowed from psychology — and are stored in Long Term Memory (LTM).

Each time the contents of the continually-updated STM change it uses, its model of the environment stored in LTM predicts what will happen. Schemas are built up from KERNELS — the elemental sensory and motor information which can be received into STM. A schema is set up

Figure 4. The final description of 'tower' after more 'examples' and 'near misses'.

so that the kernels on its left-hand side predict some kernel on the right-hand side. There are only two kernels known to initially to the system, LOW and HIGH, which the user may include in schema to mean situations which must be avoided and those which should be achieved.

If the contents cause a LOW to be predicted, ALP will use its knowledge in LTM to plan a course of action to avoid this fate; a HIGH would encourage achievement. The progress of the plan is monitored continually because the program has only uncertain information about the effects its actions will produce. If it fails completely to avoid LOW, it must call for help. The environment can then be 'shaped' by placing the robot in a position where it cannot help but discover the answer.

Starting with little or no information about the environment the program attempts to build schema in LTM so that it can always predict what will happen. At a certain level of proficiency the environment might be changed to see how quickly it coped with the alterations.

The prediction mechanism drives the learning part of the program. If STM has predicted correctly, all is well and good. If no prediction is made, a new schema may be formed from the current and previous contents of STM. This happens more often when LTM is still relatively empty.

If an incorrect prediction was made, the schema which caused it may be modified, either by removing a kernel which was obviously redundant and happened to be in STM when the schema was formed, or by adding a new kernel if it was missing at first.

More diverse

The algorithm is non-trivial and schema modification is based on numeric information stored with the schema. ALP has learned to find a battery charger using the light when the robot's batteries began to fail, so that it could re-charge itself. The relevant contents of LTM can be converted automatically into code for a low-level minicomputer which will execute the learned code in real time.

There is always a trade-off between the labour of putting specific information into the database by hand and waiting while the computer laboriously finds out things for itself. Which means, in real terms, that the learning computer is not the all-embracing advantage some have promised. Progress is being made in this field, however, and the ability to learn will make computers useful in even more diverse applications.

Some further information about these projects, which, when you realise they all needed several years' work, often by a team of people, can be found in: Winston's book Artificial Intelligence (Addison Wesley) and The Thinking Computer by Raphael Freeman. Experimentally-minded readers may be interested to know that LISP, the high-level AI language, which is used for the examples in Winston's book is available for the M6800.
Rewards to be obtained from lucid approach

Reading the newspapers aimed at professional programmers, one cannot help noticing the phrases 'top down design', 'modular programming' and 'structured programming'. These modern programming methods are being used in commercial installations because their implementation leads to substantial savings in the time needed to develop easily maintainable software.

Initially, computing machinery was so excessively expensive that a saving of one second of execution time or 1/4K of core memory could have been worth a considerable amount of a programmer's time. In consequence, programs were judged as much on their ability to use the hardware efficiently as to produce correct results.

Today's computer managers, with cheaper, faster hardware and mounting salary bills, have inherited a collection of incomprehensible and inflexible programs which are awkward to use and very difficult to maintain. It is not surprising that which are awkward to use and very difficult to maintain.

In this article I discuss the concepts underlying modern programming techniques. In my next article I will show how the methods can be used to write a games program in both Basic and Pascal. The method is not dependent on a particular language, although implementation is easier and more natural in a language designed by one of its adherents.

Given a problem to solve with a computer program, the first step is to define the problem clearly. That may sound obvious but it is not uncommon to think 'I'll do something about X' and then expand the problem as one proceeds, at best, finishing only when it becomes uninteresting — the result being, at best, a rather ungrainy program.

Once the problem is defined clearly, the next stage is to design the program and data carefully. The design process should be completed before any coding — writing the program — is started. Designing, whether before or during coding, has a trial-and-error element in it. After completing one part, it may become clear that some previous section should be discarded.

The greater the amount of time already spent on that section, the greater the temptation to patch the program instead. If one designs before one codes there is not the same investment in time — when compared to typed-in code — and so mistakes are psychologically easier to notice.

Rewards to be obtained from lucid approach

Susan Eisenbach, of the Polytechnic of the South Bank, explains the use and disciplines of structured programming.

Figure 1. A hierarch diagram.
the second level, that is subdivided into several subproblems (modules), which in turn are subdivided, and so on.

How does one subdivide a problem in this way? Each module should accomplish a single function. In a card game there could be a module which deals the cards. It could be broken-down into two modules — one which shuffles the cards and a second which distributes them. The fact that it might be difficult to program the function should not cause any worry at that stage. Instead, attention should be paid to defining the module completely. That consists of a specification of input and output parameters and a description of the function to produce the output parameters from the input parameters.

Eventually one will reach a point where the modules can no longer be broken-down into simpler amounts. It is then time to start programming. The top module is the main program, while all other modules are coded in subroutines or procedures. The first line of each module should contain a clear description of its function — e.g. in Basic 100 REM SUBROUTINE TO SHUFFLE CARDS, in Pascal PROCEDURE CARD SHUFFLER. The last line of each module is its only exit. Having exactly one entry and one exit point for each module, reduces program complexity and makes it easier to trace program flow.

Use of stubs

Top down coding — of the program in figure 1 — begins by writing the code for the main module as if the second level modules already exist. The code includes subroutine calls to those modules. Next dummy modules, called 'stubs', are written for modules I, II, III and IV. They consist of a first line with the function description, the return to the calling program and a few lines of code which will allow the main module to be tested. That might accept, from a terminal, the values of the output the data module will compute later.

The use of stubs enables the checking of program logic and interface. When the first module is working properly, the next stage is to replace a stub with code. The code written for this level-two module will contain, if needed, subroutine calls to level-three modules, and stubs for those modules must also be written.

Each time another module is written, it should be tested completely. Data should be input which requires every branch to be traversed. Since the new module will be integrated within the rest of the program, it can be seen that it functions correctly as part of the whole program. The process of replacing, and testing, stubs with code continues until the whole program is coded.

There are many advantages of this 'top down programming and testing'. Firstly, only a small section of code is being tested at any time, so it is easy to pinpoint any difficulties. Secondly, major errors in program logic are detected before minor ones, because modules are tested in order of importance.

Thirdly, testing is spread throughout the program development, so one is not left with the daunting task of testing a large program, which tends to be tested until it appears to work, rather than until all paths have been traversed. Lastly, the continuous integration of new modules as they are written eliminates interfacing problems between sections of code.

The same type of care and attention used to design the structure of a program is also focused on the coding. Regardless of the language when writing a program, the same component building blocks are used. They are sequential statements — e.g., Basic LET X = Y * Z, Pascal X := Y * Z; unconditional branches — e.g., BASIC GOTO 10, Pascal GOTO LABEL; and conditional branches — e.g., Basic IF X = Y THEN 100; Pascal IF X >0 THEN Y := Z/X ELSE Y := 0.

Because programs are particularly helpful for solving repetitive tasks, almost all languages provide a loop construct as well — Basic FOR I = 1 TO N . . . , Pascal FOR I := 1 TO N DO . . . , WHILE . . . DO . . . , REPEAT . . . UNTIL . . . — even though this is not

(continued on next page)
Variations

Figure 2 shows, in flowchart form, the three control structures, with their variations. A process sequence is one or more program statements, or any other proper computational sequence with one entry and one exit, such as a subroutine or procedure, which move forward the program control.

A binary conditional — IF ... THEN ... ELSE ... — causes execution of one of two choices depending on whether a statement tested is true or false. After the THEN or ELSE branch has been completed, program control moves to the same instruction. The generalised conditional is a logical extension of the binary conditional, in which control switches to one of several alternatives, depending on the value of a test variable. Again, after execution of the appropriate process, control moves to the same instruction.

Loop test

Although all loops can be implemented by a loop controlled by a test at its beginning, there is no need to be so restrictive. Having three loop control structures makes programs easier to read and write. Indefinite loops, those executed until some condition is satisfied — or not satisfied — can have their test either at the beginning or the end of the process. Definite loops, those controlled by a counter, are also allowed.

Structured programming is sometimes called 'GOTOless programming' as it avoids the use of branches except in certain well-defined cases. The liberal use of GOTOs tends to result in the logic of many programs being difficult of follow. Altering a program which contains indiscriminate branching can lead to unexpected and unwanted results. Some programming languages, such as Pascal, designed within a structured programming framework, have the constructs necessary for its straightforward implementation. In those languages there is no need to use GOTO statements.

In other languages such as Basic, lacking some of the structured constructs, the implementation of the control structures requires a limited use of GOTO statements. REMarks should be used to highlight the control structures. Unfortunately, using structured constructs in a language which does not have them implicitly leads to an awkward programming style. Figure 3 shows possible implementations of the structured constructs in Basic and Pascal.

Rewards

If a program is to have a long life, to be alterable when conditions make changes necessary, it is most helpful for it to be well-documented. Standardisation is one of the essentials of good documentation, because it makes the program easier to follow.

Good structured programs — well-commented if the language does not contain the structured constructs — are nearly self-documenting. Flowcharts, useful for the unstructured program where it is difficult to follow the program logic, do not add any additional information to the structured program. What is useful is a description of each module — subroutine, procedure — and the relationship between modules.

The description of each module should include a list of input parameters and a description of the process performed. A hierarchy diagram such as in Figure 1 shows clearly the calling relationships between modules.

It is a tenet of modern programming that documentation should be produced during the design stage. A claim that documentation before coding is a waste of time, as it will need changing, is an admission that designing was not completed before coding started.

People who have programmed without these methods often find them awkward and restricting at first. Perseverance, however, brings, with an increasing ease, the rewards of lucid programs and the satisfaction that the job has been well and professionally done. My next article, which will take a game similar to Mastermind from design stage to final coding, should make the ideas detailed here appear more concrete.
Upgrade your PET...

... with the ACT PETSOFT PROFESSIONAL DISK SYSTEM

A complete stand-alone system for the Commodore PET allowing up to 800,000 bytes of mass storage online. Designed by Compu/Think for business use, this powerful double density system offers complete random or sequential file access and support.

The Disk Operating System is in ROM which plugs directly into 16K and 32K (new ROM) PETs, or via an Expandamem memory expansion board for 8K PETs. The Disk Operating System adds 16 extra easy-to-use commands to PETs \texttt{BASIC}. The Disk unit comes with a complete set of utility programs and a comprehensive manual.

Supported by PETACT Business Software:
- Sales Accounting
- Invoicing
- Purchase Accounting
- and soon Stock Control and Payroll

More memory power for your money

Reliable and easy to use

Languages supported include \texttt{BASIC}, \texttt{6502 Assembler}, \texttt{FORTH}, \texttt{FIFTH}, \texttt{PLM}, \texttt{PILOT}, \texttt{CESIL} and soon \texttt{FORTRAN} and \texttt{PASCAL}

Wide range of PETSOFT programs including
- Payroll £50
- Stock Control £25

Supports the Pagemate Database £299

Prices include VAT.

Try the ACT PETSOFT Professional Disk System and software at your PET dealer or write to us for full details and the name of your nearest stockist.

Radclyffe House, 66-68 Hagley Road, Edgbaston, Birmingham B16 8PF. Telephone: 021 455 8686 Telex: 339396

My name is ____________________________
I live at ____________________________ Postcode ____________
I have a new/old ROM PET

* Circle No. 187
Financial modelling

Playing with money

A model is a representation of the real thing. Models are used to discover the reactions of the real thing to changing conditions when it would be exorbitantly expensive, foolish, or just impossible to build the real thing and expose it to the stresses and strains it will encounter. A computer model is a representation of the operations of a company. The operations of manufacturing, selling, buying, investment, can be represented by sets of related mathematical expressions. For example, total sales equals number of units sold times price.

Price then, can be expressed as, say, cost of production, profit component, overheads, and so on. When all expressions are arranged logically and completely, a model of the company from first purchase of raw material to final nett worth is the result.

The value of such a model is apparent at budgeting time and when new ventures or changes to a company's way of doing business are mooted. Then, "what-if" questions can be put to the model and the chain reaction on all the company operations can be examined and the best course of action in the real world can be decided.

It should be obvious that the examination of a corporate financial model is best performed by using a computer. With a computer you can analyse the effects the changes make on the overall operation of the company.

Try again

Just as quickly, you can change the parameters and provide another result to compare to the first. You continue the process until you obtain the required effect or series of effects which can be examined at leisure.

The use of computers in corporate financial modelling does not have a long history. It was only about 10 years ago that either a system or a language was made available to modellers to ease the tasks involved. Until then it was usual to program the model in a high-level language like Cobol. The handling of time-series of data, as in week-by-week or month-by-month information or calculations, was tedious and subject to error. It was when financial modelling systems and languages began offering simplified notation to handle series arithmetic that modelling was used.

Corporate models produce forecasts of financial reports, such as profit-and-loss or balance sheets but, although their over-whelming use is in financial planning, models are also used to aid marketing decisions, solve problems in distribution or production, and are used also to great effect in the evaluation of capital projects.

Financial modelling, when wholeheartedly supported by the top management of a company, brings benefits undreamed of before the advent of the computer. It is the primary aid for decision makers.

At Carreras Rothmans in Basildon, Essex, financial modelling on the Rair Black Box microcomputer has become a key part of corporate planning activities.

Carreras Rothmans is a leading tobacco manufacturer in the U.K. and has achieved major growth in worldwide markets over last few years, receiving the Queen's Award for Exports in 1977. It began running its computerised financial model in September last year.

Financial modelling is the responsibility of the corporate planning department and comprises a three-year plan of what to sell—choosing markets, prices, determining overheads in selling—in fact, all financial aspects which could influence the profit achievement over a three-year period. As soon as one year of the plan ends, another year can be added to maintain a continuous planning process.

The continual company growth led to a re-structuring last year in which a number of regional business development centres were set up throughout the world. That created a need for a computer system to support the complex repetitive calculations involved in financial planning and to provide the facilities for dealing properly with "what-if" questions, thereby assisting the profit planning activities.

The information services division was given the problem of developing a suitable computer model and choosing a system to support its operation at corporate head-quarters. The centralised computer installation, equipped with two ICL 1903Ts, was already utilised fully in handling the wide range of accounting, order processing and other company functions.

Natural choice

It was also considered that installation, which is remote from corporate head-quarters, would not provide the necessary degree of response and interaction through terminal activities. So microcomputers seemed the natural choice.

Ken Sayce, technical support manager of the division, was responsible for implementing the financial model on to a microcomputer. He described the reasons which led to the choice of the Rair Black Box.

"We looked at desk-top computers but decided the micro field was better for us. They were there and they were much cheaper. We looked at the data volumes we would be using and thought that a micro could cope, so we looked at likely systems. "The Black Box was the cheapest on the market which could do the job. Most of the others were half as expensive again and didn't have all the facilities. As far as the hardware and software were concerned, it was as good a machine as was available".

The configuration chosen has 64K of storage and is used with a 180 C/S DECwriter, a Hazeltine 1510 screen and two double-density, double-sided mini-floppy discs. Total cost was around £3,500.

The project began in June, 1978 and the financial model was up and running by September. Despite some initial problems with the internal power supply, the project went surprisingly smoothly.

As far as the information services division was concerned, the experiment gave the data processing staff some valuable experience in designing systems and basic programming, which none of them had done previously. Carreras Rothmans said that the most noticeable conclusions during the project were that the Black Box offered mainframe computing capabilities on a micro-scale, conditioned development staff to break-down complex problems into simple, small components and enabled programs to be amended interactively, adopting what is in effect the "what-if" approach using the Black Box equipment.

Installing more

Carreras Rothmans is planning to supplement its existing centralised mainframe system by installing microcomputers in its various locations in the U.K. and overseas. The policy will be to use the facilities of the microcomputer where they offer the most appropriate means of meeting changing needs for business information within the company.

By committing itself to using microcomputers, Carreras Rothmans has realised the importance of using the new technology to support its continued growth.

Director of administration Keith Patterson says: "Financial modelling is important to the company for two reasons. Firstly, in planning and controlling future financial success and, secondly, in providing the knowledge and confidence to take a major step forward in planning and developing a computer service in the 1980s".
Buy a System...Not just a "Pretty Box"

The SD System* — From about 97p per hour (40-hour week)

A Total System
SD Systems knows that small businesses do not keep full-time programmers on staff. We also know that individually designed business programs can be expensive on a one-time basis. That's why we offer the SDS-200 and compatible business software.

Leasing Available
The SDS-200 is available by leasing. This gives the small business the opportunity to select the method of acquisition that best fits their needs.

The SDS-200 TOTAL System features:

System Hardware
The SDS-200 gives you features that are not found in systems costing thousands more.
State-of-the-Art Engineering. Quality Production and Full Reliability testing make the SDS-200 a dependable, compact and easy to operate data processing system.
- Up to 256K Bytes RAM
- Full Keyboard with Special Accounting Key Pad
- Large 12in. Video Display Screen
- Full Cursor Control including Addressable Cursor
- Blinking, Underlining, Reverse and Protected Fields
- Uses 8in. Flexible Diskettes for Permanent Storage 2 Mbyte on-line
- Forward and Reverse Scrolling
- Capable of up to 160 Special Characters
- Expandable with Memory and Peripheral Equipment
- Will Operate as a Remote Batch Processor for Large Systems
- S 100 industry standard bus
- 4 spare $100 slots.

System Software
A range of Business Programs are available from CAP-CPP written in Microcobal. The system will support all normal high level languages including:
- Fortran
- Cobol
- Basic
- CP/M

Authorised dealers are:
Anglo American Computers Ltd
Bell Computing Ltd
Picodyte
Optimal
Milburn House, Suite D, Dean Street
62 Lowther Street
Linton House, Catherine Street
142 Britannia Street
Newcastle-upon-Tyne.
Carlisle 0228 43690
Aston, Birmingham
Tel: 021-328 4840
Telex: Malta 683.
Peter McNaughton Ass.
Codified Computer Systems Ltd.
Picodyte
Anfield, Glenalmond
69 Calabria Road,
Peter McNaughton Ass.
London N5 1HX
Anfield, Glenalmond
Tel: 01-226 1319.
Perthshire 073-888 267
Tel: 0632 29693

Barcellof Ltd
Kimberley House,
Vaughan Way, Leicester

UK Distributor:
AIRAMCO LTD
Unit A2, 9 Longford Avenue, Kilwinning Ind. Est.,
Kilwinning, Ayrshire KA13 6EX.
(0294) 57755
Telex 779808
Dealer enquiries invited

*The SD System includes:
SDS-200 Microcomputer T.I. 810 Printer (or equivalent)
i.e., NEC SPIN WRITER £1,899. SDS 200 £4,750, T18 10 £1,499
We care about what leaves our factory. After all it's got our name on it.

The next time you want reliable microcomputer products – single card computers, floppy disk systems and disk systems – take a look at what we put in our boxes.

A Comart Computer Catalogue will show you.

Write to

Comart Ltd., P.O. Box 2, St. Neots,
Huntingdon, Cambs.
Or telephone (0480) 215005.
Solving the interface transfer problem

One limitation of the Commodore Pet 2001 is that it cannot accept or transfer analogue data. The Pet interface unit described here overcomes this problem, allowing analogue information to be transferred into Pet memory and on to an XY plotter or YT pen recorder. Facilities are also available for inputting data from eight multiplexed channels and from a peak height chart reader unit.

By utilising the IEEE bus and user port lines, available at the rear of the Pet, control and data lines are formed to operate the interface unit. The user port is used for output control lines and the IEEE bus for data transfer and input control lines (figure 1).

The cost of the unit has been kept to a minimum by using slower and less accurate devices for data conversion. The ADC and DACs can, however, be uprated according to need.

Improved reliability

The ADC can be switched to accept analogue voltages from two different sources. Firstly, from a chart reader (CR) via an offset and gain amplifier, and secondly, from an eight-channel multiplexer. A de-bounce circuit is incorporated to improve the reliability of data entry and provision is made for control of the pen lift on the XY recorder.

The ADC was built around the Ferranti ZN425E DAC, using a LM318 high slew rate op. amp as a comparator (figure 2). Once a convert command pulse has been received, the DAC counts up to the value of the analogue voltage applied to the comparator.

The comparator flips and generates a convert complete pulse. A variable attenuator is connected to the comparator as a Full Scale Deflection (FSD) control. The clock pulses are generated by an astable CMOS chip (CD4047). A clock frequency of 250KHz allows a maximum conversion time of about 1ms.

An 8212 buffers the outputs of the ADC and controls the transfer of data on to the data highway.

The CD4051 is an 8-to-1 multiplexer with a three-bit binary counter (CD4520) connected as a decoder (figure 3). Each multiplexed input is provided with an attenuator control to prevent the multiplexer being overloaded. The various inputs are selected by pulsing the re-set and clock lines of the decoder.

Simple switch

The simple switch de-bounce circuit uses cross-coupled gates to produce a latch which is re-set by the convert complete pulse from the ADC. This ensures correct data entry.

An offset and gain circuit is incorporated for calibration purposes when the chart reader is in use.

To output X and Y information simultaneously, three 8212 line buffers are used (figure 4). X information is output on to the data highway and buffer 2 is clocked, storing the X data. This data is also stored in buffer 3. Y information is then transferred on to the data highway and is stored only in buffer 4, since buffer 2 is not clocked. The outputs of buffers 3 and 4 are then enabled and the data is converted via the DACs to the X and Y outputs. Internal pre-sets set the FSD of the DACs.

A read relay driven by a transistor buffer (BC182L) allows remote control of the pen lift on the XY recorder. Power supply rails are derived from a Vero 3 rail power supply providing +5V at 500 mA and −5V at 50 mA.

The software to control the Pet interface unit is written as subroutines which can be added to any Basic program. They are:

- **Output routine** — GOSUB 2000 (See GOSUB 2300). Allows the pen to move to any position, set by X and Y. 0 ≤ X ≤ 255, 0 ≤ Y ≤ 255. Variable N9 is set automatically, depending on whether the pen up or pen down routines are executed first.
- **Pen down** — GOSUB 2100. The pen is put down and N9 is set, allowing the pen to stay down while executing the output routine.
- **Pen up** — GOSUB 2200. Similarly the pen is put up and N9 set accordingly.
- **Zero start for output routine** — GOSUB 2300. To be executed before output routine. It sets all control lines for output mode and need only be used at the beginning of a program.
- **Delays** — GOSUB 2400, GOSUB 2410, GOSUB 2420. These are loops which act as delays. They enable the XY plotter to draw lines and dots at the correct time. To change the delay, alter the final value of J9. The delay lengths are short, medium and long respectively.

GOSUB 2410 is also used in other sub-routines.

- **Axis routine** — GOSUB 2500. This draws the axes of a graph with calibration markers. A choice of three positions for both X and Y are available — X axis — top, centre, bottom; Y axis — left, centre, right.

To obtain the calibration markers, enter the maximum value and number of increments for each axis. If not

(continued on next page)

---

**Figure 1. Block diagram of Pet interface unit.**

**Figure 2. I/P interface board Pet 2.**
required, enter 0 for the number of increments.

- **Delay** — GOSUB 2800. Similar to other delays but shorter in time. It is also used in other subroutines.

**Variable P** becomes equal to the binary value. \(0 \leq P \leq 255\). If the value exceeds 255, the ADC will not convert.

Variables used in subroutines 2000 - 3100 are \(X, Y, P, A9$, B9$, D9, E9, F9, G9, H9, I9, J9, K9, L9, M9, N9, R9, S9, T9, U9, V9, W9, Z9, IX9, IY9, MX9, MY9\).

The printed circuit boards layouts available from the author — are manufactured in the usual way. After the relevant components have been assembled on to the boards, the front panel should be wired. The various components are mounted on to the front panel and wired to the relevant PCB edge connectors. Figure 5 shows details of how to wire the inter-connecting leads from Pet to the interface unit.

The power supply unit used in the prototype is the Verospeed 3 rail power supply which is mounted on to the PCB card Pet 4 and wired.

Additional mains filtering may be required to remove unwanted glitches from the power supply lines. Standard inductor or inductor/capacitor filters are sufficient.

The prototype was designed originally and built into a half-rack case to aid easy expansion of the system if required. However, the case alone adds considerably to the cost of the unit and could be replaced by a less expensive one.

Very little setting-up is required since the interface unit is mostly digital. After the unit has been switched on and any major mistakes in wiring have been corrected, turn all pre-sets to their central position and all controls on the front panel fully anti-clockwise. Enter the subroutine program in figure 6 and save on tape of disc and then enter the program shown in figure 7.

Execute both programs to check that most, if not all the functions are working correctly. By applying a biased sinewave to channel 1 of the multi-plexer and increasing the gain control to obtain a reasonable swing, the XY plotter should plot the incoming waveform.

To calibrate the instrument, enter the first of the two programs shown in figure 8. Execute the program and adjust the offset pre-sets on board Pet 1 so that the X and Y outputs read 0.00V exactly.
Erase line 1 and re-run the program, adjusting the f.s.d. presets so that the X and Y outputs are 0-1V.

Adjust the offset pre-sets on board Pet 3 for each 741 in turn while monitoring their respective outputs. This should be done only when the offset and gain controls are turned down.

To alter the offset and FSD presets on board Pet 2, enter and run the second program shown in figure 7. The equivalent voltage applied to the input of the ADC should be converted to a number between 0 and 255 and displayed on the screen. Short the ADC input to ground (CH1) and adjust the offset pre-set until 0 is displayed.

Check, if possible, the output of the 318 and re-run the program, increasing by more than 50 times when Pet is turned fully clockwise, apply the minimum FSD voltage to CH1 and adjust the FSD pre-set to obtain 255 on the screen. If in doubt, alter the pre-set so that it is effectively short-circuited. Re-run the test program in figure 7 to check that the unit is functioning correctly.

This interface unit should prove to be a very useful addition to the Pet. It has various limitations, however, some of which are discussed.

Under Basic control, the maximum sampling rate of the ADC is limited to 8Hz. This is decreased further to 1Hz when all eight channels are being multiplexed. The sampling rate can be increased by more than 50 times when Pet is under machine code control.

The ADC operates only in a standard binary code and hence will only accept positive-going signals. Its maximum input voltage depends on the setting of the FSD control and also on the passive gain controls connected to the multiplexer inputs. Offset controls were omitted for simplicity and cost.

When using the chart reader, maximum voltage swing and resolution is obtained firstly by adjusting the offset control and then adjusting the gain and FSD controls located on the front panel. In the MUX mode, only the FSD control is functional.

The Pet interface unit is designed as an economical instrument to aid data transfer to and from the Pet. It costs about £250 to construct, including a half-rack Vero case. It has numerous applications and the software is expandable easily to suit many requirements.

**Components list**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 of</td>
<td>ZN425E DAC</td>
</tr>
<tr>
<td>2</td>
<td>7415C High-slew rate 741</td>
</tr>
<tr>
<td>4</td>
<td>8212 B-bi latch</td>
</tr>
<tr>
<td>1</td>
<td>LM318 High-slew rate op. amp.</td>
</tr>
<tr>
<td>2</td>
<td>7400 Quad 2 input NAND</td>
</tr>
<tr>
<td>2</td>
<td>7406</td>
</tr>
<tr>
<td>1</td>
<td>4551 8-channel MUX</td>
</tr>
<tr>
<td>1</td>
<td>4047 Astable</td>
</tr>
<tr>
<td>4</td>
<td>4520 Dual binary counter</td>
</tr>
<tr>
<td>10</td>
<td>1K Presets (10 turn)</td>
</tr>
<tr>
<td>200</td>
<td>20K Presets (10 turn)</td>
</tr>
<tr>
<td>50</td>
<td>50K Presets (10 turn)</td>
</tr>
<tr>
<td>8</td>
<td>100K Potentiometers (10 turn)</td>
</tr>
<tr>
<td>10</td>
<td>50K Potentiometers (10 turn)</td>
</tr>
<tr>
<td>1</td>
<td>BC182L NPN Transistor</td>
</tr>
<tr>
<td>1</td>
<td>AA21J Ge diode</td>
</tr>
<tr>
<td>3</td>
<td>N914/54 diode</td>
</tr>
<tr>
<td>1</td>
<td>CPU/R) Alma Reed Relay (5v)</td>
</tr>
<tr>
<td>1</td>
<td>1uf 35v tant</td>
</tr>
<tr>
<td>4</td>
<td>47uf 16V tant</td>
</tr>
<tr>
<td>2</td>
<td>2uf 25V tant</td>
</tr>
<tr>
<td>1</td>
<td>0.1uf 100V</td>
</tr>
<tr>
<td>2</td>
<td>68R</td>
</tr>
<tr>
<td>1</td>
<td>0.2uf</td>
</tr>
<tr>
<td>1</td>
<td>100PF</td>
</tr>
<tr>
<td>10</td>
<td>22K All resistors 1/4 W 5%</td>
</tr>
<tr>
<td>12</td>
<td>1K</td>
</tr>
<tr>
<td>1</td>
<td>10K</td>
</tr>
<tr>
<td>1</td>
<td>4K7</td>
</tr>
<tr>
<td>1</td>
<td>4.7K</td>
</tr>
<tr>
<td>1</td>
<td>1M</td>
</tr>
<tr>
<td>1</td>
<td>470K</td>
</tr>
<tr>
<td>1</td>
<td>1K</td>
</tr>
<tr>
<td>1</td>
<td>100K</td>
</tr>
<tr>
<td>1</td>
<td>220K</td>
</tr>
<tr>
<td>2</td>
<td>18K</td>
</tr>
<tr>
<td>2</td>
<td>6K8</td>
</tr>
<tr>
<td>8</td>
<td>8 PIN DIL sockets</td>
</tr>
<tr>
<td>14</td>
<td>14 PIN DIL sockets</td>
</tr>
<tr>
<td>16</td>
<td>16 PIN DIL sockets</td>
</tr>
<tr>
<td>24</td>
<td>24 PIN DIL sockets</td>
</tr>
<tr>
<td>3</td>
<td>3 rail power-supply (Vero electronics type 89-20886j)</td>
</tr>
<tr>
<td>1</td>
<td>1/8 rack vero case (3U)</td>
</tr>
<tr>
<td>1</td>
<td>1/8 rack sub frame (3U)</td>
</tr>
<tr>
<td>1</td>
<td>Mains switch</td>
</tr>
<tr>
<td>25</td>
<td>25 way plug, socket and cover (R.S.)</td>
</tr>
<tr>
<td>20mm fuse holder</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0, in. single-sided edge connectors 43 way (Vero or R.S.)</td>
</tr>
<tr>
<td>10</td>
<td>10 turn pot. knobs.</td>
</tr>
<tr>
<td>9-way plug, socket</td>
<td></td>
</tr>
<tr>
<td>4mm Banana sockets</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>S.P.D.T. min. toggle switch</td>
</tr>
<tr>
<td>1</td>
<td>General hardware</td>
</tr>
</tbody>
</table>

**General hardware**

- 200K Presets (10 turn)
- 22K
- 4K7
- 4.7K
- 100K
- 220K
- 18K
- 6K8
- 8 PIN DIL sockets
- 14 PIN DIL sockets
- 16 PIN DIL sockets
- 24 PIN DIL sockets
- 3 rail power-supply (Vero electronics type 89-20886j)
- 1/8 rack vero case (3U)
- 1/8 rack sub frame (3U)
- Mains switch
- 25 way plug, socket and cover (R.S.)
- 20mm fuse holder
- 4, in. single-sided edge connectors 43 way (Vero or R.S.)
- 10 turn pot. knobs.
- 9-way plug, socket
- 4mm Banana sockets
- S.P.D.T. min. toggle switch
- General hardware
Hard-sectoring approach under examination

MOST disc file-handling techniques used in industry and commerce are the esoteric pursuits of software development teams, resulting in sophisticated operating systems. The applications programmer needs to know only how to present information to the operating system to access many types of files.

To the hobbyist, however, the implementation of a disc-based system may become a nightmare, especially with limited disc space and without a clear understanding of basic file types. It is hoped this article will be of assistance in this area and of general interest to users of existing systems.

A file is a contiguous set of records, held usually on contiguous sectors of a disc. For simplicity, let us assume that all records are of equal length and that records do not span sector boundaries. Figure 1 shows a disc file of eight records each of 128 bytes in length using two sectors of disc space.

![Figure 1](image)

As its name implies a floppy disc is a flexible circular disc, coated with a magnetic oxide. As the disc rotates the read/write head — or heads for double-sided discs — can read or change the magnetic patterns stored by the oxide. The available storage surface of a disc is split into tracks and sectors. A track is a complete annulus of the recording surface. A sector is a part of a track.

As the disc revolves, the read/write head can move to any track on the available recording surface. A photo cell detects light shining through the start sector holes to show the location of any sector on any track. Each sector can store about 512 × 8 bits of information, by magnetising the oxide in two directions — zeros or ones.

In the first of two articles, B R White looks at techniques for handling files on discs.

This organisation of sectors by their physical position on the disc is known as hard sectoring and has been until now the most common storage technique. On request by the CPU, a given sector is either read into memory or written to disc from memory.

The other approach is called soft sectoring. The position and length of each sector on a track is controlled by software, which writes a start sector marker followed by the sector data and an end sector marker. This can be useful in terms of compatibility for hardware supplied by different manufacturers since the hardware, under program control, will seek the information required independently of its physical location.

Very complex file-handling techniques are common to both hard- and soft-sectored systems and for the sake of simplicity the remainder of the article will assume a hard-sectoring approach.

Let us assume we start with a blank disc and know only how to read or write sectors to and from memory. How do we build to a multi-file disc system?

First, a disc directory is needed which is usually the first one or two sectors of the disc. For each file created on the disc there is a corresponding entry in the directory containing at least the basic information to access the file:

- Alphanumeric file name or perhaps only a file number.
- Start sector.
- Number of records.
- Number of bytes per record.
- Various pointers.

It is advisable to leave room for extra information in each directory entry, since it may be useful as your system expands. For example, a pass number to allow access to the file, the number of 'live' records in the file, and the like.

Most disc-based systems use more than one type of file, since information needs to be stored in different ways and retrieved in the most efficient manner.

To understand how information is held on a multi-file system, the concept of 'file pointers' must be grasped clearly. A pointer is an integer number held as an element of a record on disc, which refers either to another record on the same file or a record on another file. These pointers are used by programs to follow 'drains' of records via any number of files either to:

- Add a new record to a chain.
- Access an existing record in a chain.
- Update an existing record in a chain.
- Delete an unwanted record from a chain, maintaining the integrity of any remaining records in the chain.

There is an exception to the definition of a pointer which is called the 'null' pointer. This is where the pointer held on a record or used in memory by a program must not "point" anywhere.

Direct files are by far the fastest method of random access on disc systems. Suppose you require a customer file of, say, 200 records and it is convenient to code your customer account numbers in the range 1-200. Assume a sector length of 512 bytes and a record length of 128 bytes. Figure 2 shows how this file would be held on disc.

![Figure 2](image)

To calculate the sector containing any...
The record in the file requires the simple algorithm:

\[ \text{(Record number} - 1) \times \text{records per sector} \]

The remainder of the division will be in the range 0 to (records/sector - 1), hence the byte position within the sector is the remainder multiplied by the number of bytes per record.

When the record can be processed either within the single sector disc buffer, since its position is known, or can be copied to a record buffer within the program where the memory address of each element within the record will be the same as for any other record from the file. (See figure 3).

Before copying the record buffer to the disc buffer, the original sector must be read back into the disc buffer to retain the records adjacent to the record being written or re-written to disc. For example, suppose we read record 3 (R3) from our customer file in figure 2. The disc buffer will contain R1, R2, R3 and R4 and the record buffer will contain R3.

If R3 is to be updated with information from other files sharing the common disc buffer, then R1, R2 and R4 will be lost, so the same sector must be re-read from disc before copying R3 back to its original position and re-writing all four records.

Unless record lengths are of the form 2^n (i.e. 1, 2, 4, 8, 16, 32, 64, 128, 256, 512) there will be wasted space at the end of each sector. This can be saved by allowing records to span sector boundaries and by using different algorithms to calculate the record position. The disc buffer, however, must then be at least two sectors, even if the record length is only three bytes. (See figure 4).

A serial file is a contiguous set of records, held in contiguous record 'slots'. The determination of the sector and byte position is exactly the same as for a direct file. In fact, a serial file is similar to a direct file, except that it starts empty and records are written to it starting at one end.

Figure 5 shows a serial file containing five records each 16 bytes in length.

This file utilises the file pointers mentioned previously which are stored on the disc directory. Before accessing the file, the current state of these pointers must be determined and returned correctly to the directory after the file has been used. A serial file is useful to record events during processing which do not require immediate action.

For example, suppose from our customer file (figure 2) we need a monthly printout showing customers who have exceeded their credit limit during the month. The programs which update customer balances will be 'aware' of those occurrences and need only to write the relevant details to the serial file.

To write a new record, (say R6, figure 5) the new record is written to the slot determined by the FFRP; the LRP then becomes the FFRP used and the FFRP is incremented to point to the next slot.

Serial access

When reading the file, each record is accessed serially from the start of the file to the record preceding the FFRP. The FRP and LRP are superfluous in this case but I have used them to maintain continuity with other file types requiring pointers.

To clear the file, the pointers on the directory need only to be re-set so that they do not point to any record on the file — i.e. the null pointer. Some systems use slot numbers starting at 1, so 0 (zero) is convenient as the null pointer. Where slot numbers start from zero, a bit pattern is used as the null which is recognised by the software and obviously must not equate to a valid slot number.

The processing of direct and serial files is determined by the physical position of records on a file. Although they have distinct advantages for many applications they can become cumbersome in others. Many file-processing techniques require more volatile and flexible environments. Linked files remove the restriction of strict physical processing and incorporate the concept of a logical record sequence by using pointers on each record to indicate where the next logical record is. Within linked files there are two 'chains' of records — the record chain and the free chain. See figures 6(a) and 6(b).
With linked files which have a large number of insertions and deletions, although the logical sequence is maintained, the physical sequence can be lost completely, resulting in slower response times, since logically-adjacent records may be separated by many sectors. It is necessary to re-organise the file periodically, where possible, to keep the system speed to a maximum. The technique of re-organisation will be considered when discussing Indexed Sequential Files.

Linked files as described are rarely used in isolation unless the file size is small or the response times are of no importance. For example, to access a record in the middle of the record chain, one has to start reading from the FRP logically until the required record is found. It is much more practical and often necessary to use linked files in relation to other file types where their speed and flexibility are utilised most efficiently.

In part II I will discuss these file processes to describe the following commonly-used file types:

- Partially-linked files
- Indexed sequential files
- Pooled files
- Spooled output files

To the hobbyist who wishes to write file-handling software using these concepts, I would suggest a start at direct files only, since most files require the calculation of sector and byte position. The software requirements for files using record links and/or directory pointers generally share common sub-routines used independently of the file type to be processed, so it would be a good idea to understand (a) to (g) above before attempting an integrated file control program.
Solving chip problems

Process of testing for failures

David Peckett, a professional designer of automatic test equipment, describes how even the wonder-chip can give problems and what to do about it when it does.

There are many complex and lengthy tests to find this type of defect and the test for any particular chip depends on the physical layout of its memory cells. Straightforward, but effective, tests for any design of RAM, however, are 'walking a 1' and 'walking a 0'. This means that we clear the memory, and then try to set each bit, in turn, to '1', while holding all the others at zero. 'Walking a 0' is obviously the reverse of this process. By doing these tests, virtually any soft fault in RAM can be found.

Test program considerations: The details of the test program, and the faults it can find, particularly the possibility of indicating address bus faults, obviously depend on the system being tested. Certain principles are generally true.

If an address line may have 20 devices attached to it; an s-a-0 caused by any of those chips will hold the line at zero. The only 'simple' way to find the faulty device is to change each possible IC in turn; it would be a rare system in which self-test software could go 'beyond the node'. If no blatant stuck-at faults exist, the memory can be tested and, if required, the other LSI chips also checked.

Short as possible

The self-test program must be as short as possible; to run at all it assumes that the data bus and the microprocessor work correctly. The address bus test must use the minimum number of address lines to access the program.

All the tests must, wherever possible, use only the internal microprocessor registers, since the state of the system RAM is unknown. Equally, if the program is in RAM, it should be as short as possible to reduce the chance of it being corrupted by a faulty memory chip. If the self-test routine is re-locatable, it could be re-loaded into a different area of memory if it were corrupted in its original location.

A more reliable approach would be to use a PROM, either plugged-in as needed or permanently on-board, to hold the self-test software. Since the program operates mainly on single bits and must be very short, it must be written in machine code. If it were written in Basic, or any other high-level-language, it would probably be so long that most faults would corrupt the program, rather than being found by it.

Any stand-alone test program relies on the data bus and the microprocessor working correctly. The bus would be easy to check — write and read 0016 and FF16 to and from any memory location. Unfortunately, any possible program to do this would be corrupted by a stuck data bus line. It is not even possible to carry out the test via the monitor, because a faulty data bus would corrupt the monitor. The first stage, therefore, is to check the address lines and, if possible, try to indicate any fault. If the address bus is in order the RAM can be tested.

Testing the address bus. This test must

(continued on next page)
(continued from previous page)

check that each line can be set to '1' and '0' independently of all other lines. The simplest way to do this, assuming 16 address lines (A0 - A15) is to write, in turn, to memory locations 000016, 000116, 000216, 000416, 000816, . . . , 400016, 800016 — a total of 17 write cycles. For each cycle, a different code (e.g., 1-17) is loaded into memory. By then reading address 0000 only and checking the code, any faulty lines can be identified.

For instance, suppose line A3 is s-a-0. Then, when 000816 is addressed, the code (e.g., 4) is loaded into address 0000, overwriting the existing code (1) at that location. The following test would expect 000016 to contain 1 but would find 4. Alternatively, if A3 was s-a-1, reading 0000 would read the 4 in 000816. Either way, the faulty address line could be identified easily. If there is a fault, the program should attempt to display it and then stop.

**Specially adapted**

Obviously, this technique can be used only for addresses in RAM and must be adapted to suit specific systems. It could be extended to test addresses in ROM, e.g., reading address 010016 and checking for the correct code (e.g., A8). Figure 1 is a flow chart for the general test.

- **RAM test.** Once we are content with the address bus, we can test the RAM. Remember that this test will check that the memory can be cleared and set to all '1's, and will walk '1' and '0' round the RAM. It is obviously convenient to walk the '1' immediately after clearing the memory and to walk the '0' after setting each byte to FF16.

Any failing bit will be obvious and the address of the fault known. With this data and a knowledge of the physical layout of the memory board(s), it is easy to identify the failed chip, and to replace it. Since we know that the address bus is not corrupted, the program can be long enough to display a short fault message. As before, the details of the program will depend on the system being tested. General flowcharts for the program are given in figures 2, 3 and 4.

Having decided what tests are necessary, we can write code to perform them. The following examples are in 8080 assembly language. They would, of course, run on a Z-80 but would not make best use of its abilities.

- **Address test.** The flowchart of figure 1 is for a system with 64K of RAM. This is not very likely but the general program is shown in figure 5. The routine requires 1710 bytes of RAM, plus the display function, and thus cannot test address lines A0-A4, which must be satisfactory for it to run. It therefore tests lines A4-A15 and the index register (H,L) is initialised to 002016. A clear run causes a jump to the next test, otherwise the program tries to show the fault. The display procedure will be dependent entirely on the target system; you must assess the best way to write it.

You may well have to modify the program further. It can test only the RAM addresses in your system; calls to ROM

![Figure 2. Main program for RAM test.](image)

![Figure 3. RAM I subroutine.](image)
Solving chip problems

calls to subroutines 'FLTIND' and 'DISPLY respectively. I have not defined them, since they will depend on your own system and its output. They should be easy to write, however; on a failure (H,L) contains the failing address and A contains what should have been in it.

Two areas of the code may need a little explanation. In the 'walking bit' tests, register C is used to re-set each byte to 00 or FF at the end of the byte's test. Without this, the byte would stay at the last value to which it was set, either 80 or 7F. Either way, the program fault cover would be reduced, as the test relies on every bit in the RAM being set to '0' as a '1' is walked, and vice-versa.

The second detail is the way of controlling the outer loops of 'RAM1'

and 'RAM2' via (D,E). The 8080 does not set flags as the 16-bit register (D,E) is decremented through zero; we cannot, therefore, use this for the jump test.

Instead, D and E have to be decremented separately, with the high byte, D,

(continued on next page)
Figure 6. RAM test program.

- Systems with separate areas of RAM. The test program is designed for systems with a single, contiguous, area of RAM. This is not always the case; some systems have two or more separate blocks of RAM, while in others it is difficult to load programs directly into the lowest RAM addresses (figure 7). Nevertheless, we must still test all the memory ICs.

We can convert the program of figure 6 into a subroutine, with the size of each RAM block (‘BYTOTx’) and its start address (‘MEMBOTx’) passed as variables. Figure 8 shows one way of doing this. The two variables are passed in registers (D,E):

```
LXI SP,abcd
XRA A
CALL 'RAM1' TEST TO CLEAR MEMORY
MOV C,A CLEARS C FOR 'RAM2'
INR A A TO 01
CALL 'RAM2' WALK A '1'
MVI A,FF SET A TO FF
CALL 'RAM1' SET EVERY BIT TO '1'
MOV C,A C TO FF FOR NEXT TEST
DCR A SET '0' TO WALK ROUND
CALL 'RAM2' WALK A '0'
JMP 'DISPLAY' SHOW RESULT IS OK

'RAM1'
LXI D,'BYTOT' SET LOOP COUNTER. SEE TEXT
LXI H,'MEMBOT' H,L TO START ADDRESS
MOV M,A SET BYTE
CMP M SET OK?
CNZ 'FLTIND' DISPLAY FAULT
INX H POINT TO NEXT BYTE
DCR E COUNT DOWN
JNZ 'LOOP1'
DCR D "CARRY"
JNZ 'LOOP1' COUNT TO ZERO?
RET

'RAM2'
LXI D,'BYTOT' LOOP COUNTER
LXI H,'MEMBOT' H,L TO START ADDRESS
MVI B,08 INNER LOOP COUNTER
MOV M,A WALK ONE BIT
CMP M OK?
CNZ 'FLTIND' DISPLAY FAULT
RCL SHIFT A
DCR B ANOTHER BIT?
JNZ 'LOOP3'
MOV M,C RESET BYTE
INX H POINT TO NEXT BYTE
DCR E COUNT DOWN
JNZ 'LOOP2'
DCR D "CARRY"
JNZ 'LOOP2' COUNT TO ZERO?
RET

'FLTIND' SHOW FAULT

'DISPLAY' SHOW SYSTEM IS OK
```

(continued from previous page)

being decremented each time E passes through zero. The return from the subroutine is made when D reaches zero. D must therefore contain the number of times E is to reach zero, which is given by the number of times that E is decremented wholly or partly to 00 from FF.

To achieve this, D is set to one more than the high byte in ‘BYTOT’ unless E is initially zero. For example, if 079F₁₆ bytes are to be tested, set (D,E) to 089E₁₆, but if ‘BYTOT’ is 0400₁₆, then (D,E) should be 0400₁₆.

(continued from previous page)
Solving chip problems

and (H,L) of the 8080; the first act of the subroutine is to store them in suitable locations, such as the first four bytes of memory. The data is then available for the `RAM1' and `RAM2' subroutines.

With the memory map of figure 7, addresses 000016–000316 could be used as `STORE1' and `STORE2', with the program starting at 000416. The stack pointer should be set to 100016, and the two areas of RAM are that for the memory-mapped VDU, and the remains of the user RAM. The necessary test is then straightforward.

**Conclusions**

- Microcomputers are fine when they work; they are, however, bound to fail from time to time. Since a major source of failures will be the LIS chips in the system, we must design suitable tests for them.
- It is particularly easy to use software to test the RAM in the system and the single failed chip normally can be identified directly.
- In principle, it is also possible to test automatically the address lines but the system configuration may well prevent this.

**Listing**

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LXI SP,abcd</td>
<td>abcd IS TOP OF MEMORY</td>
</tr>
<tr>
<td>LXI H, 'MEMBOT1'</td>
<td>START OF FIRST BLOCK</td>
</tr>
<tr>
<td>LXI D, 'BYTOT1'</td>
<td>NO OF BYTES IN FIRST BLOCK</td>
</tr>
<tr>
<td>CALL 'MEMST'</td>
<td>TEST FIRST BLOCK</td>
</tr>
<tr>
<td>LXI H, 'MEMBOT2'</td>
<td>START OF SECOND BLOCK</td>
</tr>
<tr>
<td>LXI D, 'BYTOT2'</td>
<td>NO OF BYTES IN SECOND BLOCK</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>JMP 'DISPLAY'</td>
<td>SHOW RESULT IS OK</td>
</tr>
<tr>
<td>SHLD 'STORE1'</td>
<td>SAVE START OF BLOCK</td>
</tr>
<tr>
<td>XCHG</td>
<td></td>
</tr>
<tr>
<td>SHLD 'STORE2'</td>
<td>SAVE NO OF BYTES</td>
</tr>
<tr>
<td>XRA A</td>
<td>CLEAR A</td>
</tr>
<tr>
<td>CALL 'RAM1'</td>
<td>AS FIGURE 6</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>CALL 'RAM2'</td>
<td></td>
</tr>
<tr>
<td>RET</td>
<td></td>
</tr>
<tr>
<td>'RAM1'</td>
<td></td>
</tr>
<tr>
<td>LHLD 'STORE2'</td>
<td>D,E TO NO OF BYTES</td>
</tr>
<tr>
<td>XCHG</td>
<td></td>
</tr>
<tr>
<td>LHLD 'STORE1'</td>
<td>H,L TO START OF BLOCK</td>
</tr>
<tr>
<td>'LOOP1'</td>
<td>SET BYTE</td>
</tr>
<tr>
<td>MOV M,A</td>
<td>AS FIGURE 6</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>RET</td>
<td></td>
</tr>
<tr>
<td>'RAM2'</td>
<td></td>
</tr>
<tr>
<td>LHLD 'STORE2'</td>
<td>D,E TO NO OF BYTES</td>
</tr>
<tr>
<td>XCHG</td>
<td></td>
</tr>
<tr>
<td>LHLD 'STORE1'</td>
<td>H,L TO START OF BLOCK</td>
</tr>
<tr>
<td>'LOOP2'</td>
<td>INNER LOOP COUNTER</td>
</tr>
<tr>
<td>MVI B,08</td>
<td>AS FIGURE 6</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>RET</td>
<td></td>
</tr>
<tr>
<td>'FLTIND'</td>
<td>SHOW FAULT</td>
</tr>
<tr>
<td>RET</td>
<td></td>
</tr>
<tr>
<td>'DISPLAY'</td>
<td>RETURN FROM 'MEMST'</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PRACTICAL COMPUTING November 1979
Three Trumps from Acorn

Acorn Controller

Designed as an industrial controller module, it is based on the 6502 CPU with 2K Eprom, 1.25K ram and 32 I/O lines. In eurocard format it is provided with an onboard monitor (2 x 74S571) giving comprehensive development and debugging facilities. Also available in minimum configuration for low cost OEM applications.

Order Form

Send to: Acorn Computers Ltd. 4AMarket Hill, Cambridge, Cambs.

<table>
<thead>
<tr>
<th>Qty</th>
<th>Item Description</th>
<th>Price (ex VAT)</th>
<th>VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acorn Microcomputer(s) in kit form</td>
<td>£65.00</td>
<td>£5.20</td>
</tr>
<tr>
<td></td>
<td>Acorn Microcomputer(s) assembled and tested</td>
<td>£75.00</td>
<td>£6.00</td>
</tr>
<tr>
<td></td>
<td>Acorn controller(s) (minimum configuration)</td>
<td>£35.00</td>
<td>£2.80</td>
</tr>
<tr>
<td></td>
<td>Acorn Memory(s) assembled and tested</td>
<td>£95.00</td>
<td>£7.60</td>
</tr>
</tbody>
</table>

N.B. Price shown is for full 8K of ram, prices for smaller memory options and Eprom additions available on request.

All Acorn modules are guaranteed and full after sales and technical advice services are available.

Software available soon includes 4K-Editor-Assembler-Disassembler, 4K Proprietary Fast Basic, Disc operating system with full file handling.

Although designed for expandability, the Acorn Microcomputer is a complete development system for the Acorn controller and together with the Acorn Users Manual provides the perfect introduction to hex programming; the carefully optimised monitor has the following functions:

- System Program
- Set of sub-routines for use in programming
- Powerful de-bugging facility displays all internal registers
- Tape load and store

Acorn Memory

The first in our series of expansion cards is the Acorn 8K + 8K "state of the art" memory module. On a matching eurocard it provides 8K of ram (21141 and 8K of Eprom (27321 or 4K of Eprom (2716). It requires a single 5V rail, is designed for direct connection via a 32 way edge connector to the Acorn bus and is fully buffered for independent positioning of Eprom and ram.
High speed 8085 microprocessor
Priority interrupts and DMA
64K bytes of RAM memory
Transparent ROM bootstrap loader
Integral dual minifloppy disks
Programmable serial I/O interfaces
Advanced floppy disk operating system
Serial and random file processing
Macro assembler with symbolic debugging
Extended BASIC interpreter
Relocating FORTRAN IV compiler
ANS 74 COBOL compiler
Comprehensive range of peripherals
UK wide on-site maintenance
Quantity and OEM discounts
Leasing and rental facilities

New features
Double sided/density disks (260K bytes/drive)
High speed hardware arithmetic unit
Multi-user operating system support
Dual-drive add-on (over 1M byte on-line)

BLACK BOX MICROCOMPUTER
30-32 NEAL STREET COVENT GARDEN LONDON WC2H 9PS TELEPHONE 01-836 4663

PRACTICAL COMPUTING November 1979
● Circle No. 191
Keen Computers have an Apple base nearer to you!

Apple II 16K
Additional 16K RAM
Applesoft ROM
RS232 Card
Super Colour
Disk Drive and Controller
Disk Drive w/o Controller
Corvus 11MB Disk
Speechlab
Apple Clock
Supertalker
Printers from

Apple Bases
Nottingham
Keen Computers Ltd.
Tel: 0602 583254
Derby
P.T.S. (Electronics) Ltd.
Tel: Derby 43592
London
Adda Computers Ltd.
Tel: 01-579 5645
Sumlock Bondan Ltd.
Tel: 01-250 0505
Leicester
Arden Data Processing Ltd.
Tel: 0533 22255
Scunthorpe
Computer Facilities Ltd.
Tel: 0724 63657
Edinburgh
Microcentre Ltd.
Tel: 031 229 2022
Kettering
H.B. Computers Ltd.
Tel: 0536 85922
Barrow-in-Furness
Furnerco Computer Services Ltd.
Tel: 0229 24621
Stoke-on-Trent
Tekdata Ltd.
Tel: 0782 633631
Tamworth
Abel Computer Systems
Tel: 0827 895309
Birmingham
C.P.S. Data Systems Ltd.
Tel: 021 707 3866
Northampton
Ford & Wright Ltd.
Tel: 0604 39660
Sheffield
Datron Inter-form Ltd.
Tel: 031 225 2022
Kettering
H.B. Computers Ltd.
Tel: 0536 85922
Newbury
Newbear Computing Stores
Tel: 0635 30505

Software packages are available for most business applications.
A few are:
Word Processor, Addressing+Mailing,
General Ledger, Sales Ledger, Purchase
Ledger, Incomplete Records Accounting,
Stock Control, Payroll, Estate Agents.
All prices are subject to change
without notice.
Data — the sword of peace is yours

THIS VERSION of the Kingly Orb was adapted for the 380-Z using XDB by Bennet and Adam Laurie. There may be a problem on other machines caused by function definitions, as at lines 90,100. Those functions may have to be inserted explicitly or done as GOSUBs.

Line 340 is a Print Using alert; if your Basic does not have it, print the integers of X1, X2. Watch for double =, as in line 150. You may have to write: P1 = 2: P2 = 9 ‘S’ in line 120 sets your power.

Good luck, and may megabyte powers be with you.

10 CLEAR 1000
20 ?"DO YOU WANT INSTRUCTION
S?<YES,NO OR SPELLS")
30 INPUT A,
40 IF A="YES" THEN GOSUB 19
60
50 IF A="SPELLS" THEN GOSUB 2340
60 GOSUB 2460
70 DINA(100,3),D(S)
80 L="1"
90 DEFNR(X)=INT(X*RND(25)+1)
100 DEFND(X,Y,X1,Y1)=SQR((X-X1)^2+(Y-Y1)^2)
110 P=3
120 S=500
130 C=0
140 D=999
150 P1=P2=9
160 FOR I=1 TO 100
170 A(I,1)=FNR(10)
180 A(I,2)=FNR(3)
190 NEXT I
3020 RESTORE
3030 IF C0X THEN 330
3030 C=FND(X1,X2,D1,D2)
3040 IF C0K2 THEN 330
3050 P1=SGN(D1-X1)
3060 P2=SGN(D2-X2)
3070 PRINT USING 340;X1,X2
3080 !YOU ARE AT ### ###
3090 IF C0<1 THEN 700
3100 570 T=A(I,2)
3110 580 IF S<=30*L OR P<>10 THEN 600
3120 590 T=2
3130 600 "YOU HAVE FOUND A";A$;" WITH POWER ";S
3140 610 ON T GOTO 640,720,620
3150 620 IF FNR(10)(5 AND <S=30*8000204)
3160 630 GOTO 640
3170 640 CO=C04.1
3180 IF C0<3 THEN 670
3190 ON C0 GOTO 710,730,750
3200 670 IF S<L*30 THEN 750
3210 680 "YOU HAVE BEEN TAUGHT SPELL NUMBER";P+1
3220 690 P=P+1
3230 700 GOTO 270
3240 710 "YOU HAVE BEEN GIVEN A DISTANCE METER";
3250 720 GOTO 270
3260 730 "YOU HAVE BEEN GIVEN A COMPASS"
740 GOTO 270
750 ?"YOUR STRENGTH HAS BEEN INCREASED"
760 S=S+50*L
770 GOTO 270
780 D3=S-S0
790 IF D3<0 THEN 930
800 ?"WHAT SPELL NUMBER?";
810 INPUT V
820 IF V=0 OR (v>lo AND v<lo +L AND L>1) THEN 1260
830 IF 0>P OR 0<0 THEN 290
840 FOR 12=1 TO 5
850 IF D(I2)=V THEN 000
360 NEXT 12
270 IF FMR(5) <>3 THEN 1060
880 GOTO 910
900 TWO!! CANNOT USE THAT SPELL"
910 GOTO ROO
920 c0=50-0*10
930 P3=S0/10/L
940 V=FNR(INT(P3))
950 ?"THE ;$; USES A SPELL NUMBER ;V; ON YOU"
960 S=S-V*10
970 ?"YOU HAVE A STRENGTH OF ;S;"
980 IF SO<=0 THEN 1030
990 IF S>0 THEN 800
1000 ?"YOU HAVE FAILED IN YOUR QUEST. YOU WERE FOULY MURDERED BY A ;8$;.
1010 STOP
1020 BAD LUCK."
1030 ?"THE ;J&D; IS NO MORE"
1040 \"ONCE MORE THE POWERS OF GOD WIN THROUGH."
1040 \"NOW CONTINUE WITH YOUR QUEST."
1050 GOTO 270
1060 ?"YOUR SPELL HAD NO EFFECT"
1070 GOTO 930
1080 ?"YOU ARE STOOD ON THE MAGIC SPOT"
1090 READ A$,A$,A$
1100 FOR 1=1 TO 10
1110 READ AsJA,AJA,nabn
1120 NEXT I
1130 FOR I=1 TO L
1140 READ A$
1150 NEXT I
1160 RESTORE
1170 ?#*
1180 IF L=1 THEN 200
1190 IF L=6 THEN 1250
1200 IF F=10 THEN 1230
1210 \"EXTRA WISDOM MEANS THAT YOU KNOW SPELL ;IP;1"
1220 \"IP=1"
1230 \"YOU HAVE BEEN TRANSPORTED TO ANOTHER LEVEL"
1240 GOTO 200
1250 STOP
1260 IF U=12 AND B=""ROCK MONSTER"" THEN 1670
1270 IF U=12 AND B=""MUMMY"" THEN 1670
1280 IF U=14 AND B=""Giant"" THEN 1670
1290 \"YOU HAVE ALREADY USED THAT OBJECT OF STATE ;0;"
1300 GOTO 200
1310 \"THE ;0; IS UNDAMAGED""
1320 IF FNR(1000)<100 THEN 1650
1330 \"THE OBJECT OF STATE ON"
1340 GOTO 1040
1350 DATA " GOOD","N EVIL","NEUTRAL"
1360 DATA DRAGON,57
1370 DATA 4,6,7,9,10
1380 DATA WITCH,25
1390 DATA PRACTICAL COMPUTING November 1979
Game

1740 DATA 2,3,5,8,10
1750 DATA WIZARD:02
1760 DATA 2,3,5,8,10
1770 DATA VAMPIRE:12
1780 DATA 4,6,7,9,10
1790 DATA ROCK MONSTER:47
1800 DATA 4,6,7,9,10
1810 DATA MUMMY:47
1820 DATA 4,6,8,10
1830 DATA GOLD HORSE:70
1840 DATA 3,4,6,10,8
1850 DATA SAND MAN:14
1860 DATA 1,4,10,7,8
1870 DATA GIANT:75
1880 DATA 10,3,6,8,7
1890 DATA WATER WORM:30
1900 DATA 10,6,3,2,1
1910 DATA YOU HAVE FOUND THE GREAT RING
1920 DATA YOU HAVE FOUND THE KINSLY ORB
1930 DATA THE ROBES OF STATE ARE YOURS
1940 DATA THE SWORD OF PEACE IS YOURS
1950 DATA YOU ARE NOW THE TRUE MONARCH OF OZ
1960 "YOU ARE THE CROWN PRINCE OF OZ."

1970 "TO PROVE THAT YOU ARE WORTHY OF THE TITLE OF MONARCH YOU MUST PASS A TEST. YOU ARE CAST INTO A DUNGEON TO FIND FOUR OBJECTS OF STATE. THESE ARE HIDDEN ON ONE PAIRING SLAB ON EACH DUNGEON LEVEL."

1980 "THIS IS KNOWN AS THE MAGIC SPOT. EACH DUNGEON LEVEL IS 100 SLABS BY 100 SLABS IN SIZE. YOU MAY TRAVEL 10 SLABS IN ANY DIRECTION. DIRECTION IS GIVEN BY THE VECTOR (X,Y). INPUT THIS (WITHOUT THE BRACKETS) WHEN ASKED FOR DIRECTION. YOU MAY MEET "

1990 "VARIOUS MONSTERS ON OUR QUEST. NEUTRAL MONSTERS MAY ACT AS GOOD OR EVIL. GOOD MONSTERS WILL GIVE YOU THINGS WHICH WILL DO YOU GOOD. THE FIRST WILL GIVE YOU A DISTANCE METER WHICH WILL SHOW YOU HOW FAR AWAY FROM THE MAGIC SPOT YOU ARE. YOU CAN FIND THE MAGIC SPOT WITH ONLY THIS. THE SECOND MONSTER WILL GIVE YOU A COMPASS TO SHOW YOU THE DIRECTION TO GO (X, Y) THESE ARE -1, 0, 1. ALL SUBSEQUENT MONSTERS EITHER GIVE YOU ANOTHER SPELL OR MORE STRENGTH IF YOU NEED IT."

2010 "EVIL MONSTERS ON THE OTHER HAND TRY TO KILL YOU. THEY CAST SPELLS ON YOU WHICH LOWER YOUR STRENGTH. YOU DO THE SAME IF YOU CAST SPELLS ON THEM. EIGHT OF YOUR STRENGTHS DROP BELOW ONE YOU ARE DEAD."

2020 "BY CASTING SPELL 0 YOU MAY RUN AWAY FROM THE MONSTER HE MAY OR MAY NOT FOLLOW YOU IN WHICH CASE YOU HAVE LOST YOUR CHANCE TO CAST A SPELL."

2030 "AS YOU COLLECT THE OBJECTS OF STATE YOU MAY USE THEM TO DESTROY ONE MONSTER PER OBJECT. EACH OBJECT IS TUNED TO ONLY ONE SPECIES AND HAS A 10% CHANCE OF FAILURE.

2040 "TO USE THE OBJECTS OF STATE TYPE SPELL NUMBERS 11 TO 14 FOR:"

2050 "GREAT RING: KINSLY ORB: ROBES OF STATE: SWORD OF PEACE RESPECTIVELY."

2060 "MONSTERS ARE NOT SUSTAINABLE TO ALL OF THE SPELLS. AT FIRST YOU CAN ONLY USE 5 SPELLS 1, 2 AND 3."

2070 "WHEN YOU REACH THE FIFTH MAGIC SPOT YOU WIN."

2080 "THE SPELLS ARE:"

2090 "(1) LANDSLIDE, (2) MAKE SWAMP, (3) MAKE FOOL, (4) MAKE POOL, (5) CREATE HOLE, (6) MAKE SAND, (7) WATER WORM, (8) MAKE FIRE, (9) UNDERSTORM, (10) UNDERGROUND."

2400 "THE OBJECTS OF STATE DESTROY:"

2420 "(1) ROBES OF STATE "

2420 "(2) KINSLY ORB "

2420 "(3) SAND MAN "

2420 "(4) GIANT "

2420 "(5) ROCK MONSTER "

2420 "(6) MUMMY "

2420 "(7) WIZARD "

2420 "(8) VAMPIRE "

2420 "(9) GOLD HORSE "

2420 "(10) WATER WORM "

2430 "GOOD LUCK, YOUR IMPERIAL HIGHNESS!"

2440 "YOU'LL NEED IT!"

PRACTICAL COMPUTING November 1979
AT LAST
WE HAVE COMPLETED OUR MOVE, LOCK, STOCK
AND BRANDY, TO THE PREMISES ON THE HIGH
STREET

N.B.
IF YOU CAN'T FIND US,
LOOK FOR THE TANDY SIGN
WE ARE NEXT DOOR!

ROSTRONICS LTD.
The TRS-80 Specialists
115-117 Wandsworth High St.,
London SW18
Telephone: 01-870 4805
Telex: 6813089 INTPRMG.

The Rohan Computing Collection.....

Rohan computing, in addition to their normal software and systems consultancy services, now offer the following range of computer equipment for sale. As far as possible Rohan computing try to hold these items in stock ready for immediate delivery. Nationwide on site maintenance for all Rohan computing equipment.

**Qume**
The Qume is ideal as a general purpose printer or for adding word processing facilities to an existing microcomputer. Print only and keyboard versions available. The keyboard version can double as a spare typewriter. RS232 interface adaptable for the PET, APPLE, etc. XON/XOFF protocol available. Word processing package/driver available for CP/M based systems. Other versions in preparation.

**PET**
Commodore PET microcomputers. The PET is the ideal low cost computer for teaching yourself programming, educational use and time consuming calculations in science, industry and commerce. Graphic display excellent for histograms etc.
- 8k PET with integral cassette and minikeyboard
- 16 & 32k PET's with full sized professional keyboards.
- 2022 matrix printers
- 2040 floppy disc units.

**Cifer**
Cifer 2600 Series VDU's. Superbly engineered and made in Britain.
- 12 inch screen.
- 7 x 11 character matrix
- 8 x 12 matrix for graphic characters
- 62 or 100 key detachable keyboards
- Printer port
- VT52 emulation
- Line drawing set

**Rohan**
Phone Richard on SOUTHAM (092681) 3541 for prices and delivery.
Rohan Computing, B.A.S.S. (Engineers) Sales Limited, Kineton Road, Southam, Warwickshire CV33 0DQ

Circle No. 193

Circle No. 194
Arithmetic without need for number-cruncher

If you have attempted an analysis of variance or tried to calculate a co-efficient of regression, you will have become painfully aware that statistical analysis involves a good deal of squaring and summing of many numbers which have an excessive quantity of significant figures.

Beware of trying to simplify the task by reducing the number of significant figures, for, at the end of calculation, you may be required to subtract one large number from another slightly greater number and base your conclusions on the relatively minute difference between them.

If you have already discarded too many significant figures, you may find that you have a negative difference, which is meaningless. Even if the difference is positive it could still be seriously in error. In the days before electronic calculators, the task of working-out an analysis on paper was one of the most tedious operations imaginable. The coming of the calculator, especially the dedicated statistical calculator with built-in programs, has made a vast difference to the lives of those who have need from time to time to wrestle with statistics.

Now follows the microprocessor but alas, in spite of all its advantages, it is not designed to handle the large arrays of figures and perform the relatively-complex calculations traditional methods of analysis require. Coupling it to a number-cruncher is asking the microprocessor to do your job at the calculator keyboard and is not really taking advantage of the special features of the microprocessor.

Distribution

The mention of traditional methods of analysis is a reference to those tests such as the t-test, the analysis of variance and the chi-square test, which depend on the assumption that the data being analysed is distributed according to a known and clearly-defined pattern.

It is assumed that items of data are likely to be clumped around their mean value in some particular way. Many tests assume that the data is normally distributed. What is meant by the normal distribution needs some fairly complex mathematics to describe it, for the point is that if analysis relies on data being so distributed when the data is not so distributed, our analysis will be faulty. We may arrive at the wrong conclusion.

If we have a large amount of data, it may be possible to find its distribution pattern but if, as usually happens, the amount of data is small, there is no way of knowing how it is distributed.

Distribution-free tests — or non-parametric tests — do not rely on assumptions about distribution. They are easy to understand, they work just as well when the amount of data is small, and they do not require long calculations with innumerable significant figures.

Even a microprocessor can cope with the arithmetic required, without assistance from a number-cruncher. These tests may require somewhat tedious and lengthy manipulation of the data — sorting, ranking, re-arranging rows or columns of tables — but this is all to be done according to simple logical rules. The conclusion is that the microprocessor as in our example, the probability of a number of runs (= u). For our example, u = 6:

111000
111111
0001000
1123456

If people are tending to copy their neighbours, the number of runs will be fewer than would be expected by chance. What number can we expect by chance? We can calculate the probability of occurrence of different numbers of runs from the minimum (u = 2) to the maximum (u = 20), using the methods of calculating combinations and permutations you learned at school, and set out the results in a Table of Critical Values. Such a table tells us that with 20 events, positive it could still be seriously in error.

Most people would be happier to act on the second statement, while accepting the one in 20 risk that the first statement was correct.

The essence of the Runs Test is to arrange the data in sequence, count the runs, and compare the number to the critical value (U) looked-up in the table. The table has three sets of critical values for each of the probability levels 1 in 20 (p = 0.05), 1 in 100 (p = 0.01) and 1 in 1000 (p = 0.001) so we need to look at each set in turn.

Comparisons

The data is entered in memory as a series of 0s and 1s; the total number of events — e.g. houses — is entered after the last item of data. The program reads the first datum and the second. If the second is not 0 or 1, it must be the total number of events (2n), meaning that the data has all been examined and the program must move on to display the result.

During the operation of the program, each item of data is compared to the item following it, to see whether or not they are equal. If they are equal the run continues;
The program looks up \( U \) for the given value of \( n \) and for \( p = 0.001 \). If \( n \) is less than or equal to \( U \), \( p \) is greater than 0.001, and the program builds up this information in the display stores and displays \( 'p < 0.01' \). If \( n \) is greater than \( U \), the program looks at the next section of the table, to find \( U \) when \( p = 0.01 \).

If \( n \leq U \) at this stage the display reads \( 'p = 0.001' \), but if \( n > U \), the program looks finally at the third section of the table for which \( p < 0.05 \). Even at this stage \( u \) may be greater than \( U \), indicating that the number of runs is so large as to be unremarkable, and the display then shows \( 'p > 0.05' \), a result which is generally of no interest. These are not the kind of odds on which we would wish to base a major marketing scheme.

**Adaptable**

The program is given in machine code for the MK-14, to prove that even a small system can handle useful statistical tests. The program is explained in some detail, so that readers can adapt it for other systems. The main program runs in basic RAM, leaving room for some small additions to adapt the test for other applications.

The table of critical values and the table of data are entered in extra RAM. There is room for entering far more than the 40 items of data for which the program is designed. Those users who handle longer series of data frequently can calculate and enter an extended critical values to cater for their requirements.

**RUNS TEST**

Performs Runs Test on a maximum of 40 values, 0 or 1, entered from 0B00, and displays significance level. Main program relocatable; tables relocatable by changing pointers.

\begin{align*}
0000 &= \text{OF1D} \\
0F1D &= u, \text{counts number of runs} \\
0F1E &= d_1, \text{first datum of a pair} \\
0F1F &= d_2, \text{next datum after } d_1 \\
0F6F &= \text{OFDF stores for display characters} \\
0B00 &= \text{table of data} \\
0B80 &= \text{table of critical values of } U \\
2n &= \text{number of values entered and is stored at end of data table}
\end{align*}

\begin{verbatim}
  OF20  C40B  LDI  OB 
  OF22  35   XPAH P1 
  OF23  C400  LDI  00 
  OF25  31   XPAL P1 
  Points P1 to table of data (0B00) 
  OF26  C408  LDI  09 
  OF28  36   XPAH P2 
  OF29  C480  LDI  80 
  OF2B  32   XPAL P2 
  Points P2 to table of critical values (0B80) 
  OF2C  C401  LDI  01 
  OF2E  C8EE ST 
  Sets OF1D to 1, ready for counting 
  OF30  C501  A:LD @ P1 +1 
  Loads d_1, first datum 
  OF32  C8EB ST at OF1E 
  OF34  C501  A:LD @ P1 +1 
  Loads d_2, next datum 
  OF36  C8EB ST at 0F1F 
  OF38  1C   ADD d_1, d_2 
  Increment runs counter as run ends 
  OF40  8D   DAD u + 1 
  OF42  C8D6 ST at 0F1D 
  OF44  E8D8 DAD u + 1 
  OF46  C8D6 ST at 0F1D 
  OF48  CDD6 B:LD d_2 from 0F1F 
  OF4A  C8D3 ST d_2 to 0F1E 
  OF4C  90EC JMP to A, to collect 
  next datum and put in 0F1F 
  OF4E  CDD0 C:LD 2n, from 0F1F 
  OF50  1C   SR 2n/2 = n, 
  discarding any ½ 
  OF51  01   XAE n in extension 
  register 
  OF52  C280 LD P2, displacement = 
  n; value of U for p = 0.001 
  OF54  03   SCL 
  OF55  F8C7 CAD 
  OF57  914A JP if u < U, significant 
  for p = 0.001; to D 
  OF59  C411 LDI X'11' (= 1710) 
  OF5B  02   CCL 
  OF5C  70   ADE n + 17 
  OF5D  01   XAE n + 17 in extension 
  register 
  OF5E  C280 LD P2, displacement = 
  n + 17; locates value for U for p=0.01 
  OF60  03   SCL 
  OF62  918B CAD 
  OF63  9148 JP if u < U, significant 
  for p = 0.01; to E 
  OF65  C411 LDI X'11' (= 1710) 
  OF67  02   CCL 
  OF68  70   ADE n + 34 
  OF69  01   XAE n + 34 in extension 
  register 
  OF6A  C280 LD P2, displacement = 
  n + 34; locates value for U for p=0.05 
  OF6C  03   SCL 
  OF6D  8FAF CAD U-u 
  OF6F  9412 JP if u < U, significant 
  for p=0.05; to F 
  OF71  901E JMP not significant at 
  p=0.05; to I 
  OF73  C406 D:LDI 06 (character, 1) 
  OF75  C659 ST store 1 (0FCF) 
  OF77  C43F LDI 3F (character,0) 
  OF79  C866 ST store 2 (0FDD) 
  OF7F  0001, stores characters for two 
  right-hand digits 
  OF87  900E JMP to H 
  OF7D  C406 E:LDI 06 (character, 1) 
  OF7F  C850 ST store 2 p=0.01 
  OF81  9004 JMP to G 
  OF81  0001, stores right-hand digit 
  OF83  C46D F:Ld1 6D (character, 5) 
  OF85  C84A ST store 2 
  p=0.05, stores right-hand digit 
  OF87  C400 G:LDI 00 (blank) 
  OF89  C845 ST store 1 
  p=0.01 or 0.05, stores blank to right 
  OF8B  C469 H:LDI 69 (character, 9) 
  OF8D  C845 ST store 5 
  p=0.001, 0.01 or 0.05, stores ≥ 
  OF8F  9008 JMP to J 
  OF91  C46D I:LDI 6D (character 5) 
  OF93  C83C ST store 2 
  OF95  C44A LD 4A (character >) 
  OF97  C83B ST store 5 
  not significant, stores > & 5, with two 
  blanks between 
  OF99  C43F J:LDI 3F (character, 0) 
  OF9B  C835 ST store 3 
  OF9D  C4BF LDI BF (character,0) 
  OF9F  C832 ST store 4 
  OFA1  C473 LDI 73 (character, P) 
  OFA3  C830 ST store 6 
  For all results, stores P, space, 0.0 
  OFAF  C40D K:LDI OD 
  OFA7  35   XPAH P1 
  OFAB  C400 LDI 00 
  OFAA  31   XPAL P1 
  Points P1 to display (0D00) 
  OFAB  C40F LDI 0F 
  OFAD  36   XPAH P2 
  OFAE  C4CF LDI CF 
  OFBF  32   XPAL P2 
  Points P2 to stored characters 
  OFB1  C200 LD P1 + 0
\end{verbatim}

PRACTICAL COMPUTING November 1979
The typical sequence above represents data with 30 events:

```
000111110000001111011100001111
```

Number of runs = 8; n = 15
(14 0's, 16 l's); significant for p < 0.01
How to avoid those bombs

switched-in on receipt of a READ ON signal from the control interface, or on receipt of a RECORD ON signal.

In machine code, that is executed very simply by loading the A register with the hex value 11 (READ ON) and branching to a subroutine with sends the appropriate signal (OUTTEE). In Basic, however, the only commands which send the appropriate signal are SAVE, LOAD and APPEND, none of which is of much use if you are doing something else with that outgoing signal.

Enter PEEK N’ POKE. The job breaks-down into several easy stages. First, we

by Derrick R Daines
Deputy Head, Carsic School, Sutton in Ashfield

write a subroutine in machine code which does what we want. In the example given, we would write:

LDA A Load A with READER ON command
BPL EL If A > 255, then branch to OUTTEE
RTS Return from subroutine.

The example is for the 6800 micro. That RTS command is absolutely vital and we forget it at our peril.

The next problem concerns the questions of where to put our subroutine. Examination of Basic by means of the PATCH command will show that when Basic is first entered, all contiguous memory from the end of Basic to the top of memory is cleared (00) and that the topmost 256 bytes are reserved for string buffer.

Most Basics clear memory by first entering 00 and then checking to see if the memory addresses contains 00. It continues in that way until it encounters an address which does not respond — no memory there — and then back-.off 256 bytes. The address is then stored as the end-of-memory.

The clearance of memory by Basic renders it impossible for us to load machine code anywhere in memory contiguous with that occupied by Basic, either by hand, from tape or from disc, without being wiped-out the instant that we enter Basic.

There are three possibilities; we can re-address one memory board to cause a break in the continuity of memory. That will fool the interpreter into ‘thinking’ that it has reached the end of memory when it has not; we can fool the interpreter about the beginning of available memory; we can find some small amount of memory to spare elsewhere in the system.

The first solution is satisfactory if we expect to use a very large machine code program and is the solution which allows a disc operating system to be co-resident with Basic, but it could be scarcely sensible to allocate 4K of memory for one small subroutine. Those things have to be balanced.

The second solution brings in its wake a complication of finding and altering the memory Basic uses for the retention of the next available address. It is possible and for medium-sized subroutines may be the only solution.

For a tiny subroutine such as the example, the third solution is the best and it is surprising how many bits of unused memory can be found lying around if you search. Users of MIKBUG and STBUG will be familiar with the spare RAM at locations A014-A033 and A04A-A07F, for example, and no doubt other systems have unconsidered trifles waiting to be used. They are ideal for our purpose. They are not contiguous with core and so will not be wiped clear by Basic. They offer a small Insurance against bombing, for the same reason, and the alteration of Basic mentioned is not required.

Double check

So we have our machine code program and a location to hold it and the next problem is how to get it in there. Of course, we could enter it by hand if we were not scared and not bothered about the delay, but we will not learn anything, so let us forget it.

Loading from tape or disc might be the best solution if the machine code program is a large one or has been CHAINED, but for small routines it is doubtful if it is worth the extra effort involved. We will still need to POKE commands anyway and the method is simple.

The other possibility is for Basic to enter our machine-code program and obviously POKE is the command with which to do it. The general format is very simple:

FOR X = TO (number of bytes)
READ X
POKE (base address less 1) plus X,Y
NEXT X
DATA (machine code program)

The POKE statement takes the value of Y and places it in the location indicated by the expression before it. Note very carefully that the values and addresses are IN DECIMAL, so we must alter our machine code program and the first assigned into decimal:

108

PRACTICAL COMPUTING November 1979
Peek n' Poke

Substitute in the BASIC format given:

10 FOR X = 1 TO 6
20 READ Y
30 POKE (40979 + X * Y)
40 NEXT X
50 DATA 134, 17, 189, 225, 209, 57

Notice that in line 30 the base address is decremented by 1 because on the first pass through the loop X will have the value 1. Double-check everything, particularly that all of the four POKEs now have to decimal, and ten POKEs which runs the cassette for a few seconds.

For example, contained a Spelling Bee program which was entered by a return to Basic. That must be split into two bytes AO and AO2A.

We have not discussed the possibility of passing information between Basic and the machine code subroutine in either direction but it should be tolerably obvious that PEEK and POKE is one way of doing it. My version of Basic supports a USER statement to check that the desired machine code is written does not seem to be very common here, but our sample program is written:

```
A016 BD 12 LDA A Recorder on
A017 BD EI DI JSR (134 18)
A018 BD EI JSR (134 25)
A019 5F CLR B
A020 CE 00 00 LDX Loop 1
A021 CE FF FF CPX CPX (206 00 00)
A022 BC FF FF Loop 1
A023 2A FA BNE Loop 2 (38 250)
A024 5C INX Loop 2
A025 BC 07 CT CMP B (95 7)
A026 23 F2 Loop 2
A027 AE 16 A LDA A Recorder off (134 20)
A028 BD EI DI JSR (134 29 39)
A029 00 RTS (57)
```

In that time the user speaks the word, thus recording it. The program asks for the correct spelling of the word and then goes again into the time loop. The process continues until 40 words have been put in, or the user types STOP. The program then loops to a test portion in which another user, a pupil, hears the word being spoken and is scored on his correct response to the request for the spelling.

It is, of course, very similar to the dedicated Speak and Spell, but with the advantage of an infinite variety of words without a mid-Atlantic accent. Unfortunately, the variety of Basic in which the program is written does not seem to be very common here, but our sample program is extended easily:

```
40 POKE (335, 175)
50 PRINT "GOODBYE"
60 IF QS "YES" THEN 750
70 PRINT "ANOTHER GAME";
80 IF QS "NO" THEN 850
90 POKE (334, 30)
100 POKE (134, 30)
110 POKE (135, 175)
120 END
```

The subroutine switches-on the recorder for five seconds and then switches it off again, the timing adjustment being made by altering the O7 of 00 if so desired. In Basic the routine becomes:

```
10 FOR X = 1 TO 26
20 READ Y
30 POKE (40979 + X * Y)
40 NEXT X
50 DATA 134, 189, 225, 209, 57, 0, 0, 0, 1, 40, 255,
55, 23, 250, 92, 193, 7, 35, 242, 134, 20, 189,
191, 73, 242, 14, 20, 189, 0, 206, 135,
35, 193, 7, 35, 38, 250, 8, 206, 00 00,
206, 00 00
30 POKE (103, 160)
70 POKE (106, 20)
```

For copyright reasons I am reluctant to give more details, except to say that the USER statement should form the major part of a subroutine accessed both by recording half of the program, and then playback half. Screened instructions are also required for the pupil to wind back the cassette to the beginning in manual mode before switching to auto.

Obviously, synchronisation of sound and program string matching is achieved by time of record and playback. The tape must therefore start at the spot and the best place is at the beginning of the tape.

There is a time, of course, when one of two things will happen. Either the DATA statements become inordinately long, or we run out of handy little locations in which to POKE our routine. When that happens we have to start tinkering a little more with the Basic interpreter.

The best plan is to place the machine code routine in memory immediately following the Basic interpreter. Basic then uses an address to hold in memory the location of the next available address. It is updated constantly as new statements are added or others deleted.

When Basic is first loaded, this address points to a location immediately following the Basic interpreter. The documentation accompanying your Basic will have details.

In my case, this address is at 014E-014F, initially being set to 1EAF (SWTP Basic, Version 2.0).

Suppose, therefore, that I load a machine code program from 1EAF to 2048, I must alter locations 014E-014F before typing G for GO, thus entering the machine code part of the program which would wipe-out the machine code. It follows that this alteration should be an integral part of my machine code recording, together with the USER pointer mentioned earlier.

It may be worth remembering, however, that when we have finished with the Basic program which called the USER subroutine, we have no more use for that subroutine, yet Basic will not overwrite it unless and until we change the pointer to next available memory.

That might be embarrassing if memory space is tight in a later program. To overcome that it would be wise to make a note of the original address pointer and to add two POKE statements at the end of the parent Basic program which would restore this pointer:

```
9000 0000
9010 0000
9020 0000
9030 0000
9040 0000
9050 POKE (134, 30)
9060 POKE (135, 175)
9700 END
```

We have not discussed the possibility of passing information between Basic and the machine code subroutine in either direction but it should be tolerably obvious that PEEK and POKE is one way of doing it. My version of Basic supports a USER statement of the form.

```
LET X USER (Y)
```

in which either or both of X and Y may be utilised to transfer information. I also have a 3K Basic without this facility which forces the use of PEEK.

Complicated

Perhaps the simplest illustration would be where a subroutine raises a flag when something is done — or a test completed successfully perhaps and clears it when not. In that case we must reserve memory bytes as integral parts of our machine code routine, adjust or clear them during the subroutine, and then on return to Basic to execute a conditional test using the PEEK command.

If we do not have the facility to compute a desired transcendental as a user-defined command — DEF and FN(X) — and let us suppose we require the Arc tangent of a number. Obviously things become a little complicated but the same series is followed. We write a machine code program which computes the desired transcendental and stores it to the desired degree of accuracy in a series of reserved memory bytes.

We can point out that PEEK tests would need to take into account the position of the decimal point and the possibility of calculation overflow.
Gentlemen, the Petdisk has landed . . . £499 (single disk)

The sophisticated Disk Operating System is disk-resident, which allows for future DOS-enhancements without hardware alterations. PDOS supports multiple file handling, allocating disk space dynamically to each as and when necessary. Any file may occupy from 1 to 600 sectors as required, at up to 16 non-contiguous locations on the disk, PDOS may be used alone, or within a BASIC program and offers user-specified password security for any file. Multiple access-modes simplify BASIC program construction, and the user may generate tailored DOS modules.

Novapac dual-disk system complete with PDOS and BASIC demonstration programs on disc £899 + VAT.

Available from the manufacturer or selected dealers. Terms: 50% with order, balance on delivery. Full cash with order is subject to 5% discount. VAT-FREE Export arranged (Must be shipped by us).

The U.K.-designed and manufactured Novapac disk system for Commodore's PET*, first seen at Compec '78, is (after extensive industrial evaluation), now available to the domestic user. Its unique saddle configuration continues the integrated design concept of your PET, with no trailing wires or bulky desk-top modules.

- Novapac may be used with any available RAM plane.
- May be used with latest versions of PET.
- Data transfer takes place at 15,000 char/sec — effectively 1,000 times faster than cassette!
- Storage capacity is 125 K/bytes (unformatted) on 40 tracks per diskette side.
- Dual index sensors permit dual-side recording for 250 K/bytes per diskette.
- Easy operation full-width doors prevent media damage.
- System expandable to 1 Mbyte on-line storage (4 drives).
- Dual head and 2D versions provide 2 Mbyte on-line.
- Industry Standard IBM 3740 recording format for industry-wide media compatibility offered only by NOVAPAC.
- Dedicated Intel 8048 microprocessor and 1771 FDC minimise PET software overhead.
- Local hardware and software support available, including applications packages for small business use.

The UK-designed and manufactured Novapac disk system for Commodore's PET*, first seen at Compec '78, is (after extensive industrial evaluation), now available to the domestic user. Its unique saddle configuration continues the integrated design concept of your PET, with no trailing wires or bulky desk-top modules.

- Novapac may be used with any available RAM plane.
- May be used with latest versions of PET.
- Data transfer takes place at 15,000 char/sec — effectively 1,000 times faster than cassette!
- Storage capacity is 125 K/bytes (unformatted) on 40 tracks per diskette side.
- Dual index sensors permit dual-side recording for 250 K/bytes per diskette.
- Easy operation full-width doors prevent media damage.
- System expandable to 1 Mbyte on-line storage (4 drives).
- Dual head and 2D versions provide 2 Mbyte on-line.
- Industry Standard IBM 3740 recording format for industry-wide media compatibility offered only by NOVAPAC.
- Dedicated Intel 8048 microprocessor and 1771 FDC minimise PET software overhead.
- Local hardware and software support available, including applications packages for small business use.

COMPUTER FIELD MAINTENANCE
Keeps SWTP running smoothly
Keeps Cromemco running smoothly
Keeps Sol running smoothly
Keeps Horizon running smoothly
Keeps Abacus running smoothly
Keeping things running smoothly

Computers Field Maintenance
A CWT company, a Member of the IAL Group,
Excell House, Trust Industrial Estate, Wilbury Way
Hitchin, Herts SG4 0UZ
Tel: (0462) 51511 Telex: 826649

** Circle No. 195

** Circle No. 196
The C Programming Language


Read this book to learn how to format attractive telephone directories. It describes a high-level programming language developed by Bell Telephone Laboratories, mainly for PDP-11s, for applications such as string processing.

The C language developed partly from ideas in a language called B, which also gave rise to the academically-favoured BCPL. Ritchie's C contains many neat features in a clear and readable way. For universities it is inexpensive, probably in many cases too specific to the U.S. for direct use here but the general principles seem sound and, at this elementary level, the programming techniques look good.

In fact, he has written the kind of introduction to small computers which computer aficionados will probably find too light. It is for novices in particular — people who might be thinking about a personal computer.

The C Programming Language is a well-produced book describing a powerful and interesting language; it is probably of more esoteric interest than other literature describing recently-developed programming languages such as Basic.

Its background as a one-off language produced and marketed by Bell Laboratories for the Digital PDP-11 probably limits continued development of the Language.

How to profit from your personal computer

By T.G. Lewis; published by Hayden, 1978, distributed in the U.K. by Butterworth, paperback, 192 pages; price, £4.80.

The beauty of the new computing is that it means many things to many people. If computers are cheap and if computing is easy, the anti-establishment adherents can return to smaller values which threaten, and ultimately will replace the centralised, controlled facilities for information and calculation which characterise the present way of doing things.

The technological democrat sees cheap computing as a way of automating all the trivial and repetitive aspects of life, taking the drudgery out of existence and allowing us to exploit our potential more fully.

Then there are the pragmatists, the entrepreneurs, who see in small computers the opportunity for many of us to set-up small businesses to do smallish jobs for other small businesses.

If you want some illumination on the social possibilities, a good place to start is a group of recent articles in the radical technology magazine Undercurrents issues 27, 30 and 32 — highly recommended.

As other new "structured" languages such as Pascal, Coral-66, and the forthcoming ADA have become available for PDP-11s and the newer Digital Equipment VAX-11, it is no longer clear that C provides such exceptional advantages.

The language has some potential disadvantages too. There are dialect differences between newer and older compilers. The "rich set of operators" with asterisks and double plus signs, combined with the inherent dangers of over-kill in the use of recursive code, can produce very slick but incomprehensible programs; this is likely to appeal to programming enthusiasts but not to programming managers.

If you are a capitalist at heart, you may well reach for Theodore Gyles Lewis. Like most writers in the field, Ted Lewis is American and a college lecturer (Oregon State). His 'preface' opens with a curious disclaimer. "My goal in writing this material was to convey the important features of personal computers useful to computer aficionados".

In fact, he has written the kind of introduction to small computers which computer aficionados will probably find too light. It is for novices in particular — people who might be thinking about a personal computer.

Conclusions

• Lewis has the word Profit exhibited boldly in his title. His case histories, particularly the inventory control system and doctor billing system, demonstrate the way personal computers can be employed profitably today.

• His premise — "only lack of knowledge and lack of awareness of the usefulness of computers are barriers to anyone wanting a personal computer" — is too broad, but for a narrower argument like "don't be afraid of computers, here's why" this book moves neatly to the rescue.

Be a Computer Literate

By Marjol J. Ball and Sylvia Charp; published in 1977 by Creative Computing Press, paperback, 61 pages; price, £3.00.

The Ladybird book on computers for children has a well-deserved reputation as a good low-level introduction and there are apocryphal stories of large organisations scouring children's book-shops to buy it in bulk for senior executives.

Be a Computer Literate is better. It's more up-to-date, more fun, and its pedigree gives it more class — Creative Computing is one of the best U.S. magazines.

This book has been beautifully written and very well-presented. It is very easy to read, with large print — Lewis, at least they will all be linked with personal computers on a scale comparable to the current blanket typing of transistorised radios and calculators. Well it might happen.
Do you want to buy a MicroComputer?

Digitus stocks a wide selection of micros and provides expert advice, sizing and design. Test some robust, proven computers:
- Apple 11
- Cromemco
- DG MicroNova
- North Star Horizon

Choose from a range of peripherals:
- Shugart, North Star, Sanyo, Sony, Lear
- Siegler, Cifer, Centronics, Teletype.

Discuss and select a system to fit your present and future needs.

Do you need help to design and process your MicroSystems?

Through its MicroSkill Register of over 200 professionals, Digitus provides experienced programmers, designers and engineers to develop systems on most micros including:
- Z80/8080
- 6502
- 6800

Some of the Register people have their own machines. Others work on customer or Digitus equipment.

Whether you require a small program written or a large system designed and engineered, Digitus MicroSkill can provide support.

Do you want a MicroSolution for your business?

Some people want to buy equipment and software and bolt it together for themselves.

Others want to buy a solution, a complete system to meet their needs economically and reliably.

Digitus provides MicroSolutions for business, administration and professional practices.

We analyse your requirements, specify systems, choose suitable equipment and software, tailor it to fit your people and organisation, hold hands during transition, train operators and managers, arrange regular maintenance and support.

In short, provide a total MicroSolution.

Does your MicroComputer need software?

Digitus supplies application programs, systems, and tailormade software systems.

We specialise in business and administration programs for Z80/8080 and MicroNova computers including:
- Wordprocessing
- Mailing
- Sales Ledger
- Purchase Ledger
- Nominal Ledger
- Stock Control

Also supplied: systems software for Z80/8080 including CP/M, Extended Basic, Fortran and Interactive Cobol.

Applications to join the Register are welcomed. Please send C.V. and two professional references.

Digitus Ltd
Dumbarton House
68 Oxford Street
London W1
Tel: 01-636 0105

Circle No. 198
strong on the operation of the hardware, the processor, memory chips and serial and parallel interfaces.

In general, the emphasis is on computer hardware. Software has only one short chapter (10 pages) and introduces machine code, assemblers and high-level languages and explains, neatly enough, what an application program is.

There is no discussion of the techniques to be used in writing and testing programs; even at this level the basics of flowcharting and debugging seem to us to be important elements of home computing at least as important as the authors' lucid discussion of busses.

On the whole, we liked the organisation of the book. It starts with a chapter on the history of computers from the abacus via Babbage and Hollerith to the single-card computer. That is interesting, particularly the witty asides about the early electronic machines, ENIAC, EDSAC and MANIAC. Did you know ENIAC was composed of 18,000 valves and was expected to fail every 7.5 minutes?

The chapter on where to discover more is usually relegated to one of the appendices in this genre of book but this time it appears early. Of course, anyone reading this magazine will already know where to find what equipment is available but the authors describe helpfully some of the American magazines available — most of which can be obtained here from specialist shops — and follow with some hints on joining clubs, where to obtain technical information, and how to question your local computer shop. There is some good advice in this section and it will be just as useful in this country as in the States.

There is also an early chapter on number systems and binary arithmetic. An appreciation of binary is essential if you want to understand the fine points of how a digital computer works, and it is particularly important with microcomputers, where a good deal of programming is still done in assembler language or machine code.

Right pitch

Solomon and Veit go into some detail on the various devices which make up the central processor unit of the clock, 1/O ports, microprocessor ship. Operation and use are all explained in great detail and an explanation of bus structures to users, concentrating particularly on the widely-used format.

Moving to audio cassette interfaces, the discussion embraces as full a list of the various standards as we have seen; naturally the top three — Kansas City, CUTS, and Tarbell — are there, Video interfaces, 1/O boards, prototyping, extenders and the other components for the chassis or motherboard of the microcomputer are covered in enough detail, and that is one of the strengths of the book.

It is easy for technical people to lay heavy burdens of unnecessary information on a reader; but Solomon and Veit have the right pitch for their kind of reader.

The catch is that you might not be that kind of reader. The blurb describes you as having "an interest in what makes personal computers work and what can be done with them" and presupposes no knowledge of programming or electronics. Well, we think you might occasionally need recourse to the Practical Computing glossary to understand a few of the technical buzzwords, but not too often.

Memory devices have a chapter to themselves. ROM, RAM and PROM are explained and so are the workings of static, dynamic and three-state logic RAM — perhaps not too relevant but at least the level of explanation is suitable for our reviewer's better understanding of what they mean.

The middle of the book deals with some systems on the market in 1977. There are many obvious changes and additions but all the top-sellers are there.

In a neat summary of applications possibilities, there are no specific projects but a few words on several potential uses — business, word processing, games among the more obvious; home control, robotics, and personal computer networks are ideas encountered less often.

Conclusions

• We liked the tone of this book as an entry-level introduction. It needs more on software and programming techniques and binary arithmetic. An appreciation of binary is essential if you want to understand the fine points of how a digital computer works, and it is particularly important with microcomputers, where a good deal of programming is still done in assembler language or machine code.

Programming for Microprocessors

By Andrew Colin, published 1979 by Newnes-Butterworths; hard cover, 206 pages; price, £7.95.

The title is somewhat misleading. It is not all about programming. In fact, seven of the 12 chapters could more accurately be described as covering systems design. The publishers say it is directed to electronic engineers without computer knowledge and that seems as good a market as one could define for a book which might have been called Systems Design or something similar.

Disregarding this, it could be a useful book for the microcomputer user interested in how a system works. It might also be of relevance for anyone tempted to try to design a system for a particular function, though anyone who wants to design a computer probably knows most of what is in the book already.

For the daring ones who lack knowledge but would still like to design a system, this would be a useful theoretical introduction. It opens with some general information about microprocessors. Early it points out that correct programs are difficult and expensive to design. If that induces a little caution in the reader, so much the better.

The section on aspects of microprocessor design lists desirable features, most of which would be found in most micros. Of course, this is of no interest to anyone who owns or is thinking of buying a ready-made system where the selection of the micro has been done for you by the manufacturer.

Clear treatment

On the other hand, machine code programming which might well be of interest to the Pet or TRS-80 user, receives clear and thorough treatment. Because it is impossible to discuss beyond a very general introduction to programming specific, there is a chapter devoted to the Motorola 6800 with a very full exposition of its instruction set and the operations related to it.

The section on programming techniques stresses the necessity for structured design. There is an admonition to the effect that any one trying to write a program with more than about 100 statements will finish with a disaster unless adopting 'hierarchical', or modular approach. There is good sense there and it should encourage the kind of approach one must have to make full use of the potential of any computer.

Conclusions

• A tasty appetizer for anyone interested in basic systems design; for others, some good hints on machine code programming. If that is your need this is a good-quality publication, well-illustrated, well-written, easy-to-read, and British. — R.G.
Next Spring sees the birth of the first major Microcomputer Show in the North West of England.

Supported by the Department of Industry, the North West Development Association and the top names in micro applications, the Mersey Microcomputer Exhibition with daily seminars presents a unique showcase in the very heart of the North West business complex.

Book now and fly your flag at advantageous rates. And remember, exhibitors at the 1980 Microcomputer Show, London, and the Mersey Micro Show will be eligible to 10% discount on both events.

Just return this coupon or call Jane McBarnet at:
Online Conferences Ltd,
Cleveland Road,
Uxbridge, Middlesex, UB8 2DD.
Telephone: 0895 39262.
### November

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shugart minifloppy disks. Venue: Reading. Arranged by Thames Valley Amateur Club, 'The Southcote', Southcote Lane, off Bath Road, Reading.</td>
</tr>
<tr>
<td>5-6</td>
<td>Microprocessor project leadership. Venue: London. Two-day course designed for engineers with sound experience of microprocessors. It will offer the skills necessary to lead a team of engineers developing a microprocessor-based system. Fee: £160. Organised by Bleasdale Computer Systems Ltd, 7 Church Path, Merton Park, London SW19. Telephone: 01-828 6661.</td>
</tr>
<tr>
<td>5-7</td>
<td>Microprocessor course. Venue: Portsmouth Polytechnic. A follow-on three-day course, with a significant amount of time spent in the laboratory. Organised by the Department of Electrical and Electronic Engineering, Portsmouth Polytechnic, Anglesea Road, Portsmouth, PO1 3DJ. Telephone: (0705) 27681.</td>
</tr>
<tr>
<td>6-7</td>
<td>Fundamentals of computer operations. Venue: Compower Training School. Designed for trainee and junior dp staff. It gives a basic understanding of the technical aspects, hardware and software concepts, control procedures and provides job orientation. Fee: £125. Organised by Compower Training School, Cannock, Staffs WS11 3HZ.</td>
</tr>
<tr>
<td>8</td>
<td>Implications for the curriculum. Venue: Petersfield School. An evening meeting organised by West Sussex Institute of Higher Education, The Dome, Upper Bognor Road, Bognor Regis, Sussex, PO21 1HR. Telephone: (02433) 5581.</td>
</tr>
<tr>
<td>12-15</td>
<td>JCL for programmers. Venue: Compower Training School. For programmers using IBM equipment to enable them to code their own JCL. Fee: £215. Organised by Compower Training School, Cannock, Staffs, WS11 3HZ.</td>
</tr>
<tr>
<td>14-15</td>
<td>Microprocessor development systems and their use. Venue: Manchester. Two-day seminar to demonstrate how to select a microprocessor development system and operate it cost-effectively. Fee: £60 per day + VAT. Organised by Prodx (Seminars) Ltd, 79, High Street, Tunbridge Wells, Kent TN1 1XZ. Tel: (0892) 39664.</td>
</tr>
<tr>
<td>19-23</td>
<td>Microprocessor design and development. Venue: Sevenoaks, Kent. Five-day residential course designed for project managers and engineers concerned with incorporating microprocessors into measurement and control equipment. Fee: £480 + VAT. Organised by The Sira Institute Ltd, South Hill, Chislehurst, Kent, BR7 5EH. Telephone: 01-467 2636.</td>
</tr>
<tr>
<td>20-23</td>
<td>Principles of 2900 operating. Venue: Compower Training School. For staff with at least three months' operating experience; enables them to play their full part in a 2900 environment. Fee: £215. Organised by The Compower Training School, Cannock, Staffs, WS11 3HZ.</td>
</tr>
<tr>
<td>21</td>
<td>Teaching software design techniques for microprocessors. Venue: London. A forum for discussing methods of teaching software design techniques and to highlight the experience of those responsible for teaching the subject in academic and industrial environments. Organised by Conference Department, IEE, Savoy Place, London, WC2 OBL. Telephone: 01-240 1871.</td>
</tr>
<tr>
<td>27-30</td>
<td>Introduction to supervision. Introduces supervisory principles to all operations staff below management grades. Practical exercises are related to work situations. Fee: £215. Organised by Compower Training School, Cannock, Staffs, WS11 3HZ.</td>
</tr>
<tr>
<td>27-30</td>
<td>Structured programming. Venue: London. Four-day course in scientific and engineering applications designed for engineers, scientists, programmers, analyst managers and users responsible for the planning, design and implementation of complex program structures. Fee: £470 + VAT. Organised by Integrated Computer Systems UK, Pebblecoome, Tadworth, Surrey, KT20 7PA. Telephone: (03723) 79211.</td>
</tr>
</tbody>
</table>
CAUSE FOR CELEBRATION

At the Wembley Conference Centre.
22nd to 24th July 1980

This exhibition, international conference and six seminars adds up to the most significant microcomputer event ever held in the U.K.
Join the top names in the business and book your space now at advantageous rates.
And remember, some exhibitors will have an additional cause for celebration:
Exhibitors at the Mersey Micro Show and the 1980 Microcomputer Show are eligible to 10% discount on both events!

The 1979 Microcomputer Show

What the Exhibitors said
"Still suffering from shell shock. We are now getting over 100 enquiries a week" Tony Winter, Joint Managing Director, Grama [Winter] Ltd.
"Best micro show so far. Visitors were enthusiastically spending money and placing orders" Kerr Borland, Managing Director, Nascom
"An outstandingly successful show" Mike Sterland, Managing Director, Personal Computers Ltd.

What the Papers said
"Micro mania hits London - staggering success - the sort of frenzy usually seen at January sales" Datalink.
"Show's switch to small business systems was a great success" Computer Weekly.
"Online scores a treble - record crowds" Electronics Weekly.

Just return this coupon or call Jane McBarnet at Online Conferences Ltd, Cleveland Road, Uxbridge, Middlesex UB8 2DD.
Telephone: 0895 39262.
Business applications

DEREK ROWE's company has two TRS-80s running business applications. This progress report states:"Recently we added two mini-disc drives which work through an expansion interface with a further 16K — the Disc Basic limits the effective increase to 10K.

"So far there have been no breakdowns and virtually no problems with Level II Basic. Even the infamous keyboard bounce is within acceptable limits and it can be eliminated altogether by a software fix provided in the disc system.

"There is a more serious problem which may affect some systems; occasionally everything freezes-up during a program run and RESET provides only the only re-start. Tandy is apparently aware of the problem which is due to suspect memory chips; replacement by a high-quality alternative provides the solution.

"A similar but unrelated hiccup takes the form of noticeable pauses. They occur solely with one program which uses a large amount of string space — CLEAR 4000. The delay seems to be caused by machine operation on the string variables; re-programming to reduce string usage, combined with an increase in reserved string space, reduces the number of pauses significantly. Tandy has not produced an answer to this.

Increased potential

"We are now very satisfied with our disc system and it has increased the potential of application areas significantly. Our first week with it was a complete disaster. Fortunately we had considerable assistance from the TRS-80 specialist with whom we do business but the main problems were:

• Inability to SAVE/LOAD programs from disc without continual I/O errors.
• Complete loss of data on a number of discs.
• Total failure of attempted back-up operations.

"Our difficulties were caused by hardware faults compounded by ignorance of the correct way to handle the equipment. Some of the solutions we employed must have a general relevance:

• Install mains filters on the power supply to the system as a whole and also on each disc drive. Even so there is still a risk of corrupting the system if the nearby printer is switched on or off during operation.
• Buy an electronic 'bulk eraser'. Once a disc has been formatted, it is impossible to re-format without first erasing it first; an ordinary magnet is not a reliable alternative.
• Obtain a modified buffered expansion interface. This has an improved approach to the data links.
• Change faulty disc drives. Faults are shown by messages such as 'Motor speed too slow' or 'Disc trap not closed'.
• Implement a software fix to allow retry with I/O errors and avoid a possible system contention.
• Keep floppy discs in a metal cabinet with back-up copies in another separate place.

"The early problems have now been almost totally eliminated; certainly I/O errors with LOAD/SAVE under Basic are now virtually unknown. We are still experiencing failures with BACKUP, COPY and DISC I/O errors with the disc-based version of the Electric Pencil word processing system. We think this may be an internal error due to inadequate verification by the package.

New release

"Problems with BACKUP and COPY may also be due to less-than-perfect cleaning of the source disc or perhaps a problem with DOS. A new release of the operating system is imminent; a number of problems, like keyboard bounce, will be cured in this and I/O integrity may also be enhanced.

"Provided saved files are always tested before clearing the system, there is a minimal danger of losing programs. Even with BACKUP failures, individual programs can usually be accessed by COPY or the LOAD/SAVE sequence."

Debousse fix

AFTER a struggle, writes Ed Phipps of Nantwich, Cheshire, implemented A. J. Harding's software fix for the TRS-80 keyboard bounce on my 4K level II, using simple Basic commands. Surely there must be many other users without access to assemblers — and hence somewhat 'machine code blind', like me — but who still need a debousey?

"The program seems to work well. The only messy bit is line 6 — I can't seem to get around the error message without losing the 'fix'. Is there a better way of calling the code?"

Instructions: on switching on, answer MEMORY SIZE? with 20425. Load the program, run, and follow instructions given. After erasure, 3,230 bytes remain for Basic programs.

```
10 FOR A=STOE :READ B :POKE A, B
20 NEXT
30 IF A>STOE THEN 10
40 PRINT "FREE MEMORY: " :CLS
50 END
```

Software

W.E. RICHARDSON, 187 Victoria Rd, Edgware, Middlesex, has sent a letter announcing a new disk copy program, "Free Life", which can copy to disc, cassette tape, or floppy disc. It costs £1 for 19 pages 15cm x 21cm. The issue contains a disc Basic exten-

Control jack

TRS-80 owners might be interested to know that it is not necessary to pull out the remote control jack, to install a switch to recover control of the tape recorder after a CSAVE or CLOAD, to permit re-setting, writes I. R. Sinclair. The following will do the same job:

```
5 OUT 225,4 : GOSUB 5 (ENTER)
```

When you want to resume, press BREAK.

Incidentally, this looks like being the first step to a problem I'm trying to solve. Cassettedata files are very tedious and cause wear on the cassette motor relay inside the TRS-80 because each data line is preceded by the start routine, followed by the end routine, and with a motor switch-off. I am trying to find a way to permit one start routine, followed by several lines of data, then a single switch-off, as happens during a CSAVE or CLOAD. A routine like this might make the use of INPUT -1 and PRINT -1 much more useful; at the moment, a few lines of data take up more space than the program which generates the data.

Free Life

IF ANY TRS-80 Level II user would like to send a stamped addressed envelope to C Paradise, 59 Merdon Avenue, Chandlers Ford, Hampshire, he will provide a fast, machine-language cassette for Life. In return, he would like to hear about any interesting patterns users discover - in particular, shapes which move about, reproduce or destroy each other.

```
PRINT TAB (IS) "DEBOUNCE" :PRINT ? 448,","I P0KE16526,201:P0KE16527,79
20 FOR A=STOE :READ B :POKE A, B
21 NEXT
30 IF A>STOE THEN 10
40 PRINT "FREE MEMORY: " :CLS
50 END
```

Group

WE NEGLECTED to mention the national TRS-80 Group in our August issue. Brian Pain is the secretary, on 0908 566660 (during office hours) — 40a High St, Stony Stratford, Milford Keynes.
NEW from NEWTRONICS
‘EXPLORER 85’ microcomputer kit
Low Cost with On-Board
S100 expansion at £295 + VAT

NEWTRONICS KEYBOARD TERMINAL

The Newtronics Keyboard Terminal is a low cost stand alone Video Terminal that operates quietly and maintenance free. It will allow you to display on a monitor 16 lines of 64 characters or 16 lines of 32 characters on a modified TV (RF Modulator required).

The characters can be any of the 96 ASCII alphanumerics and any of the 32 special characters in addition to upper -lower case capability it has scroll up features: -

- a full 128 character set upper /lower case, full cursor control, Greek symbols for Maths, 75 ohm video output convertible to bauiot output, selectable baud rate, RS 232 or 20ma loop, I/O. 64 or 32 characters by 16 line (monitor or TV).
- And lots of other great features.
- Send SAE for Full Specification.

ADD-ONS

- POWER SUPPLY (6.3v AC) for ELF 11
- ELF 11 DE LUXE STEEL CABINET (IBM Blue)
- GIANT BOARD KIT System/Monitor, Interface to/ cassette — RS232, TTY etc
- 4K STATIC RAM board kits (requires expansion power supply)
- Expansion power supply (required when adding 4K Ram/s)
- ASCII1 Keyboard Kits 96 printable characters etc
- ASCII1 of lux steel cab. (IBM Blue)
- KLUGE prototype board (build your own circuits)
- 86 pin Gold plated connectors, Each
- ELF Light pen/writes/draws on TV screens
- Video graphics board 32/64 characters by 16 lines on TV/monitor screens
- ELF 11 Tiny basic on cassette
- ELF 11 Bug/monitor powerful systems monitor /editor
- T. PITMANS short course in programming manual (Nil VAT)
- T. PITMAN short course on tiny basic manual (Nil VAT)
- RCA 16K users manual (Nil VAT)
- On cassette Text Editor: Assembler, Disassembler, Each
- SAVE 10% AND BUY ALL THREE TOGETHER
All units can be supplied wired and tested.

The ‘EXPLORER 85’ is inexpensive with all the advantages of a powerful board plus potential for “infinite” expansion.
- Uses New Fast INTEL 8085 cpu, 100% compatible with 8080A software but 50% faster than 8080A cpu.
- Powerful 2 K monitor.
- 4K user RAM expandable to 64K.
- Provision for 8K PROM or EPROM.
- Sufficiently decoded S100 expansion on board (up to 6 S100 boards).
- Cassette Interface with (motor control & cassette file structure) RS232: 20ma loop: 4 8bit & 1 6bit I/O ports.
- Programmable 14 bit binary counter /timer.
- Separate ASC11/Video Terminal features:
  - a full 128 character set upper / lower case, full cursor control, Greek symbols for Maths, 75 ohm video output convertible to bauiot output, selectable baud rate, RS 232 or 20ma loop, I/O. 64 or 32 characters by 16 line (monitor or TV).

ELF 11 BOARD WITH VIDEO OUTPUT
STOP reading about computers and get your “hands on” an ELF 11 and Tom Pitman’s short course. ELF 11 demonstrates all the 91 commands which an RCA 1802 can execute, and the short course speedily instructs you how to use them.

ELF 11’s VIDEO OUTPUT makes it unique among computers selling at such a modest price. The expanded ELF 11 is perfect for engineers, business, industry, scientific and educational purposes.

SPECSIFICATION
- RCA 1802 8 bit microprocessor with
- 56 byte RAM expandable to 64k bytes
- RCA 1861 video IC to display program on TV screen via the RF Modulator
- Single board with professional hex keyboard fully decoded to eliminate the waste of memory for keyboard decoding circuits
- Load, run and memory project switches
- 18 registers
- Interrupt, DMA and ALU
- Stable crystal clock
- Built in power regulator
- 8 slot plug in expansion bus (less connector)

NEW! NOW ‘NEWSOFT’ GAMES for ELF11
4 GAMES for £5.00

ELF11 for less than £79.95 + VAT

BUY A ELF II microcomputer

NOW AVAILABLE
8K FULL BASIC
FOR ELF11

PRACTICAL COMPUTING November 1979

118
Software news

The IPUG swap library has made a good start and a new program has been added to those which IPUG offers cheap to members. This is a version of SPACEWAR with very intelligent Klingons; it works in real-time with nasty sound effects when things go wrong. There are nine levels of play but I have never managed to survive above level 5. The sound interface is the one mentioned in the February Practical Computing.

The program, like the Renumberer, PR40 interface and the Music/Organ/Morse programs, costs £2.50 to members — £5 to non-members. Don’t forget, membership is £2.50 for 1979. Contact, Mike Lake, IPUG, 9, Littleover Lane, Derby.

Sound

On the subject of sound programs and interfaces, Mike Lake has had a chance to try the Sound Box offered by Petsoft. It is a small black box, containing a 0.1 watt speaker and the minimum of electronics to form an amplifier which plugs into the second cassette interface. Power is drawn from Pet so no battery is needed. The unit is offered with a demonstration program written by HB Computers of Kettering.

The unit does not seem particularly good value at £13.99 plus 75p p&p. The quality of sound is not good. Programming for music would be difficult and the only good thing to say about it is that it allows you to hear data being streamed out to cassette when you SAVE or PRINT to cassette unit number 1.

By far the best way to produce sound is from the user port, since this uses the 6522 VIA to produce very clear notes. To produce good sound, connect the user port to any amplifier. If someone would care to produce a cheap amplifier for the user port, complete with connector, on/off switch, volume control and at least 0.5 watt output, many Pet users would certainly be interested. As mentioned previously, an Eagle Intercom certainly would be interested, though.

Inspired

I was inspired by your July issue to connect my Pet to a mainframe computer via a Small Systems Engineering interface. Although Michael Whitehead and Pet Users’ Club both assert that it is not possible to do this in Basic, I have had no trouble:

It is certainly adequate as a back-up machine for my Teletype. Admittedly there is no time for any sophistication, even though I have shortened line 2 to the minimum possible length and given top priority to incoming characters.

I have timed it carefully and the transmission speed is certainly 10 characters per second, writes Laurence Chatfield.

I intend to use machine language on 30 characters per second and save output from the mainframe in core, so that I can list it out after putting down the telephone. This should save me between £200 and £400 per year, so I think my subscription to your magazine is well worth it.

There is one snag. I cannot simulate the Teletype break signal on the Pet — it is not a character — and this is the only signal the mainframe recognises as an interrupt. Can anyone suggest something? At the moment I have to pull-out the plug if I have a lot of unwanted output.

Query

I have not opened the Pet and have connected no equipment to it, can I or not do any damage to the keyboard? That is a admonition in the manual, writes W. Green, such as “This could kill you if you touch the keys,” “Be prepared to re-set your machine” and “The beginner should not undertake such and such.”

Do these remarks mean that I would not get the desired results? Can I POKE or PEEK anything I like, just to see what happens?

In principle, there is nothing you can do at the keyboard which will damage the machine, other than your program which can all too easily be ruined. If finger slips smash machines, we would like to hear about it.

Flopies

The Computhink disc drives using the DISKMON operating system have been around for a few months and apparently have many happy users. The unit offers 200K user storage and is quick in handling large random access files.

After a short time with it Mike Lake was also impressed with its speed; it was loading a 20K program in about six seconds and finding random records within a large file in less than three. To try the disc he set up a file containing 780 128-byte records and then accessed at random.

At first, the speed seemed unbelievably fast, less than 0.5 second per record; on checking the program — which used the RND function to generate a random number from 1 to 780 — Mike found that the same number was being obtained every time. Apparently the DISKMON operating system overwrites the random number seed in the first 1K of memory and so the same random number appears again and again.

One or two annoying things spoiled an otherwise excellent drive. A FRE(O) after loading a program had a habit of hanging up the system, requiring that the Pet be turned off and on to clear it. Using sequential files would seem to be difficult, since only one file could be open at one time. The solution to this is fairly simple — don’t use sequential files. Instead, set up large random access ones which can be handled very quickly indeed.

The DISKMON system requires the use of a PETBIT memory board which provides an extra 24KB memory on the standard 8K Pet. The disc controller program is contained in EPROM and use is made of some of the extra RAM to store data which is going to and from the disc. The speed of the system is mainly a result of its picking up a whole track at each read and then allowing access to it from RAM.

At the end of last year, Midland Micros was offering a dual-drive system for the top of the Pet, retaining the all-in-one image. We understand there have been financial problems in putting this product fully on to the market but now the system is being made and sold by Analog Electronics of Coventry, under the name of the Novapac.

Useful features

The Novapac is placed on top of the VDU of the Pet and the two Wang drives give the Pet the look of an elephant with two large ears. The PDOS operating system supports files kept on diskette in standard IBM format, giving about 80K of user space per diskette.

The operating system offers many useful features — including password protection on writing, so that your files cannot be over-written without someone knowing the password. Each diskette is divided into 40 tracks, each containing 16 sectors of 128 bytes. Read and write operations are at the sector level and the second cassette buffer is used to store sectors read in or ready to write out.

The system uses an Intel 8048 micro and a Western Digital 1771B disc controller; 512 bytes of PROM are provided to boot the system which then resides in 8K at the top of memory. Obviously this means that the unit can be used only on expanded Pets. The interface is connected to the memory expansion board and provides a piggy-back arrangement for anything else plugged in there.

Both the Computhink and the Novapac are set up to use the 8K Pets with expansion memory; both are in the range £800 to £900 before VAT.

Co-ordinator required

Mike Lake of IPUG is having to relinquish his role as the prime source of input to Pet Corner. So we are looking for someone to take over the mantle. Write if you are interested to Pet Corner at Practical Computing.
MICROAID—the winning entry

FEW MARRIAGES would appear to have dimmer prospects of success than the one between the rigorous and highly-mathematical applications of computers and the descriptive, empirical and often intuitive approach of the microscopist. Nevertheless, the computer has certain features which permit it to assist in identification problems: it can have an extremely large, permanent and reliable memory; it calculates quickly and the information in its memory can be available when required.

The computer is not influenced by recent experience and personal bias; it can be updated easily but it cannot do the physical examination. At present, for example, it is unable to carry out the examination of the microscopist's powder sample or convert narrative or pictorial information for its use. The program required to imitate completely an experts' thinking would be impractically large. Advances in pattern recognition, however, will undoubtedly contribute to that end in due course.

There is scarcely an area of study or specialisation which the computer has not touched in one way or another, although there are vast differences in the amount of involvement existing between various fields. It is, therefore, surprising to find a singular lack of application of the computer as an aid to identification of powdered vegetable drugs or foods until the introduction of our programs DRUGID and FOODID in 1976. They involved the use of a mainframe computer (KRONOS CDC 6600) and the main disadvantages were:

1. The difficulty obtaining access at any given instant;
2. The terminal was situated inconveniently three floors away.

The program MICROAID was developed to give all the advantages accruing from the use of a microcomputer system:
1. The computer can be situated in the laboratory;
2. The complete system can be moved easily to other laboratories as required;
3. The system is under full personal control;
4. It is accessible at all times for a given individual;
5. The capital cost is a fraction of that of a mainframe computer and running costs are negligible.
6. Telephone charges for connection to a computer from a terminal are high.

More efficient

Simple translation of the program DRUGID to suit the TRS-80 proved to be rather slow in use because of the large number of numeric calculations involved and this motivated the development of a new, more efficient programming process. An analyst may be called upon to identify a powdered crude drug and absolute identity requires detailed microscopic examinations as an essential part of the technique. Reference is then made to suitable keys tables, atlases or a punched-card system. That approach, of necessity, is laborious and considerable experience is required to enable the analyst to identify the powder by microscopy.

Problems

The use of reference atlases, while a valuable aid in confirming identity, does not produce a systematic approach to the problem of identification of powdered vegetable drugs. Tables of histological features are sometimes difficult for the inexperienced analyst to interpret as the description, particularly "inflorescences and floral members" and "seeds and fruits" may apply to the powdered drug or, sometimes, it is more appropriate to the sectional appearance of the drug.

Before an atlas or table can be used, the drug must be referred to its morphological group; error at this stage is time-consuming and results frequently in incorrect identification. The punched-card system requires the assessment of more than 100 characters, some of which...
are difficult for the inexperienced analyst to interpret and moreover, entails microscale measurements.

The microcomputer is an ideal tool to aid the inexperienced microscopist to identify rapidly and correctly a powdered drug from a comprehensive list as possible, not necessarily limited to those in commercial demand. The main problems were, therefore:

- to convert a large data matrix of information into a format suitable for rapid comparison with input data;
- to provide an option for hard-copy output, if desired;
- to provide a facility for ascertaining the validity of the databank by use of a check digit;
- to keep input data as simple as possible;
- to check that input data is valid;
- to keep the user informed of processing progress, since a blank or unchanging screen while data processing is somewhat frustrating;
- to produce output data in ascending order of errors — the most likely powders to be listed first;
- to provide an option for hard-copy output, if desired;
- to help the analyst by indicating the possible sources of error in his microscopic observations, especially when complete identity is not achieved from his input data;
- to warn the user that final identity is not achieved from his input data;

The program

The program contains a databank of 174 powdered vegetable drugs together with a list of nine morphological groups. Each powder in the databank consists of up to nearly 50 alphanumeric characters. The first 30 indicate, in coded form, the morphological group. Character 31 is a number from 1 to 9 corresponding to the possible sources of error in his microscopic observations. Considering the first 30 characters, a '0' represents a histological feature which is definitely absent, '2' a histological feature which is definitely present and '3' a histological feature which is present but often in such a small amount that it could be missed by the inexperienced microscopist."

The input information required from the user is a string of coded characters comprising six blocks of five digits which indicate the absence or presence — 1 or 2

(continued on page 123)
The best computer programs are based on a flowchart. Try our flowchart for the best value with first-class advice & service.

Start

Are you buying a PET or its peripheral?

No

Do you live within 50m of N.W. London?

Yes

Move nearer - or use our fast mail order service.

No

Do you want to pay the lowest price?

Yes

The national debt needs people like you.

No

Are you only free after normal hours?

Yes

We are open normal hours too.

No

Then your obvious destination is L&J Computers. Our hours, prices & services are unbeatable.

We have excellent stocks of floppies, printers, interfaces, software, TV interfaces, PAD cassette decks (also with built-in counters!), discs & cassettes. If we haven't got it we'll get it faster than anyone else.

Special Offers:

- Blank C12 & C22 cassettes (high performance)
- 10 for £2.20
- Tractor feed pimpernels
- 11x5 ins. box 2000 for £10.80
- PR40 printer with fitted interface
- £295.00
- PR04 interface fitted to your machine (1 hr. service) £73.00
- Prices do not include VAT or P&P.

System of the Month:

32K PET + Floppy disc drive + Interface + 779 Centronic Printer

M.R.P. £2585 + VAT. Our package price only £2299 + VAT.

Will adequately service most small commercial needs. We will tailor make software for you at reasonable prices.

Ring 01-204 7525 anytime.

We accept Visa, Access, Barclaycard, Visa, Access, Barclaycard.

Cash, foreign currency.

Don't delay - phone to-day.

L&J Computers

01-204 7525

3 Crundale Avenue, Kingsbury, London, NW9 9PJ

Circle No. 204

We have the latest equipment, Petsoft, Petact and business software - as well as printers, VDUs, disks, paper and many accessories.

Call or drop in -
we're open from 10 till 6 from Monday to Friday - just by St. James's Park underground.

Logic Box Ltd

Planer Bldg.

Windmill Rd.

Sunbury, Middx.

(09327) 86262

Telex 928 185

Logic Box Ltd

31 Palmer St.

(by Caxton Hall)

London, SW1

(01) 222 1122

Circle No. 205
respectively — of the histological features being examined. This input data is first checked for validity so that characters 1 or 2 are acceptable and that there is one space present between each block of characters.

The input data is then converted by the program into the same format as the data-bank by eliminating the spaces. When this validity check has been completed, each one of the first 30 characters in the data-bank for each powder is compared to the input information and a tally is kept of the number of errors. Note that a 3 in the databank is equivalent to no error, since this allows for the possibility of not observing a feature present in a very small amount.

Errors stored

If more than five errors are detected, further processing of that powder is stopped to save unnecessary processing time. Where five or fewer characters are in error, the number of errors is stored for later access. When all the powders have been thus examined the powders corresponding to zero errors are output first, followed by those having only one error. Optionally, further output of 2, 3, 4 or 5 errors may be obtained on request.

The program requires 11-12 seconds to READ the DATA when verification of the databank is not required. When verification, using the check digit routine, is deemed necessary this time extends to 3.5 minutes. The time required from entry of the INPUT information to printing-out of the first powder ranges from 179 seconds, for powder No. 1, to 199 seconds, for powder No. 174, an average time of 3.1 minutes.

For teaching purposes, where a limited databank may be used, a program containing 32 drugs takes about 25 seconds to give an answer from inputting the experimental information.

Listing 2

0924 1B CIE
0925 1D LDA 16H 5(0005)
0926 07
0927 8D STA ABS 0251
0928 51
0929 02
0930 66 LDA 1WH 1(0006)
0931 07
0932 66 LDA 1WH 2(0006)
0933 51
0934 02
0935 66 LD STA ABS 0251
0936 51
0937 02
0938 66 LD STA ABS 0251
0939 51
0940 02
0941 66 LD STA ABS 0251
0942 51
0943 02
0944 66 LD STA ABS 0251
0945 51
0946 02
0947 66 LD STA ABS 0251
0948 51
0949 02
0950 66 LD STA ABS 0251
0951 + RESVR (OP)

The foregoing is a machine code routine to put 5 in loc 251, then add it to 10 in the accumulator, then put back the answer in 251. Finally jump to monitor, or if a subroutine used by USR function then put in 60(RTS) at loc 24E.
Operation of program

1. LOAD PROGRAM The program is loaded either from tape — loading command LOAD — or disk — loading command LOAD “MICROAD”.
2. TYPE RUN
3. TYPE IN CODED OBSERVATIONS, when requested
4. SWITCH ON LINE PRINTER, if hard copy is required
5. ANSWER any questions which appear on the screen regarding any further printing requirements
6. ANSWER questions regarding request for another run

User intervention during a run is limited to answering the questions asked.

Special preparation

THE POWDER is examined microscopically in the following reagents and the appropriate entry made on the analytical data sheet (see INPUT/OUTPUT).

Chloral hydrate solution: Chloral hydrate (50g) dissolved in distilled water (20ml). Used for calcium oxalate, cork, stomata, trichomes, fibres and cell walls. The powder should be "boiled in the presence of the mountant to remove unwanted cell content."

Picric acid solution: A saturated solution of picric acid in water made by dissolving 1g of picric acid in 15ml of distilled water. Used for protein in the form of amorphous protein. As many seeds and fruits are dissolved in distilled water. Used for starch granules, which yield a characteristic blue-black colour.

Plorogluconol solution: Plorogluconol (1g) plus ethanol (95%) to 100ml. This solution is used, in the presence of concentrated hydrochloric acid, for lignified parenchyma, vessels/tracheids and stone cells. If lignified, these structures will acquire a red coloration.

Iodine water: Mix one volume of a weak solution of iodine 2% with a nine volumes of distilled water. Used for starch granules, which yield a characteristic blue-black colour.

The usual format of +/− indicating present/absent is used to record the characters on the data sheet. This information is converted into numerals (= 1; + = 2) to convert into suitable input data for computer analysis.

Computer analysis of powdered, organised, vegetable, crude drugs

 discredit the program

1. LOAD "MICROAD".
2. CLOAD - or disc - loading command.
3. TYPE IN CODED OBSERVATIONS, when requested
4. SWITCH ON LINE PRINTER, if hard copy is required
5. ANSWER any questions which appear on the screen regarding any further printing requirements
6. ANSWER questions regarding request for another run

User intervention during a run is limited to answering the questions asked.

Special preparation

THE POWDER is examined microscopically in the following reagents and the appropriate entry made on the analytical data sheet (see INPUT/OUTPUT).

Chloral hydrate solution: Chloral hydrate (50g) dissolved in distilled water (20ml). Used for calcium oxalate, cork, stomata, trichomes, fibres and cell walls. The powder should be "boiled in the presence of the mountant to remove unwanted cell content."

Picric acid solution: A saturated solution of picric acid in water made by dissolving 1g of picric acid in 15ml of distilled water. Used for protein in the form of amorphous protein. As many seeds and fruits are dissolved in distilled water. Used for starch granules, which yield a characteristic blue-black colour.

Plorogluconol solution: Plorogluconol (1g) plus ethanol (95%) to 100ml. This solution is used, in the presence of concentrated hydrochloric acid, for lignified parenchyma, vessels/tracheids and stone cells. If lignified, these structures will acquire a red coloration.

Iodine water: Mix one volume of a weak solution of iodine 2% with a nine volumes of distilled water. Used for starch granules, which yield a characteristic blue-black colour.

The usual format of +/− indicating present/absent is used to record the characters on the data sheet. This information is converted into numerals (= 1; + = 2) to convert into suitable input data for computer analysis.

Computer analysis of powdered, organised, vegetable, crude drugs

 discredit the program

1. LOAD "MICROAD".
2. CLOAD - or disc - loading command.
3. TYPE IN CODED OBSERVATIONS, when requested
4. SWITCH ON LINE PRINTER, if hard copy is required
5. ANSWER any questions which appear on the screen regarding any further printing requirements
6. ANSWER questions regarding request for another run

User intervention during a run is limited to answering the questions asked.

Special preparation

THE POWDER is examined microscopically in the following reagents and the appropriate entry made on the analytical data sheet (see INPUT/OUTPUT).

Chloral hydrate solution: Chloral hydrate (50g) dissolved in distilled water (20ml). Used for calcium oxalate, cork, stomata, trichomes, fibres and cell walls. The powder should be "boiled in the presence of the mountant to remove unwanted cell content."

Picric acid solution: A saturated solution of picric acid in water made by dissolving 1g of picric acid in 15ml of distilled water. Used for protein in the form of amorphous protein. As many seeds and fruits are dissolved in distilled water. Used for starch granules, which yield a characteristic blue-black colour.

Plorogluconol solution: Plorogluconol (1g) plus ethanol (95%) to 100ml. This solution is used, in the presence of concentrated hydrochloric acid, for lignified parenchyma, vessels/tracheids and stone cells. If lignified, these structures will acquire a red coloration.

Iodine water: Mix one volume of a weak solution of iodine 2% with a nine volumes of distilled water. Used for starch granules, which yield a characteristic blue-black colour.

The usual format of +/− indicating present/absent is used to record the characters on the data sheet. This information is converted into numerals (= 1; + = 2) to convert into suitable input data for computer analysis.
Diagram 1. Read data.

Diagram 2. Input data validation.

(continued from previous page)

1480 DATA 21121212121111111111111111112112132 CORIANDER FRUIT
1490 DATA 11121111111111111111111111121211117 COTTON ROOT BARK
1500 DATA 11111111111111111111111111121211163 COUCH GRASS
1510 DATA 11121212121111111111111111121211137 CUMIN
1520 DATA 11121111111111111111111111121211251 DAMIANA
1530 DATA 11111111111111111111111111121111190 DANDELION ROOT
1540 DATA 21122212121111111111111111122222246 DATURA INOXIA HERB
1550 DATA 21222212121111111111111111122222244 DATURA METEL HERB
1560 DATA 21111121211111111111111111112222289 DERRIS
1570 DATA 11111111111111111111111111122222244 DIGITALIS
1580 DATA 11111111111111111111111111122222244 DIGITALIS LANATA
1590 DATA 11121212121111111111111111121211139 DILL
1600 DATA 12121211111111111111111111112222248 DISEASES
1610 DATA 11121211111111111111111111121111153 DOBOSIA LEAF
1620 DATA 21212212121111111111111111122222246 EGYPTIAN HENBANE HERB
1630 DATA 1111111121111111111111111112112186 ELECAMpane
1640 DATA 11121212121111111111111111122222245 ERIODICTYON
1650 DATA 11111111111111111111111111111148 ERGOT
1660 DATA 12121212121111111111111111121211175 FHCALYPYUS
1670 DATA 1111111111111111111111112111111163 FENUGREEK
1680 DATA 121212121211111111111111211221107 FRANGULA
1690 DATA 11111111111111111111111111111151 GALENAGAL
1700 DATA 11122212121111111111111121221112121 GINKGO
1710 DATA 11121212121111111111111111122222245 GINKGO LAURUS
1720 DATA 11121212121111111111111111121112187 GINGER
1730 DATA 111111111111111111111111111121221130 FENNEL
1740 DATA 11111111111111111111111111111158 EUCALEYPS
1750 DATA 11111111111111111111111111111158 EUCALEYPS
1760 DATA 11111111111111111111111111111158 EUCALEYPS
1770 DATA 11111111111111111111111111111158 EUCALEYPS
1780 DATA 11111111111111111111111111111158 EUCALEYPS
1790 DATA 11111111111111111111111111111158 EUCALEYPS
1800 DATA 11111111111111111111111111111158 EUCALEYPS
1810 DATA 11111111111111111111111111111158 EUCALEYPS
1820 DATA 11111111111111111111111111111158 EUCALEYPS
1830 DATA 11111111111111111111111111111158 EUCALEYPS
1840 DATA 11111111111111111111111111111158 EUCALEYPS
1850 DATA 11111111111111111111111111111158 EUCALEYPS
1860 DATA 11111111111111111111111111111158 EUCALEYPS
1870 DATA 11111111111111111111111111111158 EUCALEYPS
1880 DATA 11111111111111111111111111111158 EUCALEYPS
1890 DATA 11111111111111111111111111111158 EUCALEYPS
1900 DATA 11111111111111111111111111111158 EUCALEYPS
1910 DATA 11111111111111111111111111111158 EUCALEYPS
1920 DATA 11111111111111111111111111111158 EUCALEYPS
1930 DATA 11111111111111111111111111111158 EUCALEYPS
1940 DATA 11111111111111111111111111111158 EUCALEYPS

(continued on next page)
Diagram 3. Data processing.

Dr Geoffrey Jolliffe.

(continued from previous page)

1950 DATA 21111112111111111111111121221135 JUNIPER BERRIES
1960 DATA 2112111132111122122111112229 KOUSSO
1970 DATA 21111111311111222222222211112227 LAVENDER
1980 DATA 21111111111111111111111121221135 LILY OF THE VALLEY HERB
1990 DATA 211111111111111111111111131211167 LINSEED
2000 DATA 211111112211111111111111112221112180 LIQUORICE
2010 DATA 211111112211111111111111112221112184 LOBELIA
2020 DATA 211111112211111111111111112221112183 LOGWOOD
2030 DATA 21111111111111111111111121221189 LONGOCARPUS
2040 DATA 211111112211111111111111112221112184 LUCERNE
2050 DATA 21111111111111111111111121211166 MACA
2060 DATA 21111111111111111111111121221186 MALE FERN
2070 DATA 211111111111111111111111212211242 MARIGOLD
2080 DATA 211111111111111111111111212211242 MARMALADE
2090 DATA 21111111111111111111111121211155 MATE
2100 DATA 2111111111111111111111112122112226 MATRICARIA
2110 DATA 21111111111111111111111121211167 MUSTARD
2120 DATA 211111111111111111111111212211242 NUTMEG
2130 DATA 21111111111111111111111121211163 NUX VOMICA
2140 DATA 21111111111111111111111121221119 ORK
2150 DATA 21111111111111111111111121211152 ORANGE LEAF
2160 DATA 21111111111111111111111121211127 ORRIS
2170 DATA 2111111111111111111111112122112187 PAREIRA
2180 DATA 2111111111111111111111112122112189 PELLITORY
2190 DATA 2111111111111111111111112122112241 PAPAYA
2200 DATA 2111111111111111111111112122112154 PHYLLOSTACHYS LEAF
2210 DATA 2111111111111111111111112122112139 PIMENTO
2220 DATA 2111111111111111111111112122112198 PINE
2230 DATA 2111111111111111111111112122112185 POISON IVY
2240 DATA 2111111111111111111111112122112218 POISON IVY
2250 DATA 2111111111111111111111112122112218 POISON IVY
2260 DATA 2111111111111111111111112122112218 POPPY PETAL
2270 DATA 2111111111111111111111112122112122 PYRETHRUM
2280 DATA 2111111111111111111111112122112191 QUASSIA
2290 DATA 2111111111111111111111112122112183 QUILLIA
2300 DATA 2111111111111111111111112122112225 RASPBERRY LEAF
2310 DATA 2111111111111111111111112122112219 RATTLEFremium SERPENTINA
2320 DATA 2111111111111111111111112122112218 RATTLEFremium VOMITORIA
2330 DATA 211111111111111111111111212111227 RED-ROSE PETAL
2340 DATA 2111111111111111111111112121112193 RED SANDERS
2350 DATA 2111111111111111111111112122112218 RHATANY
2360 DATA 2111111111111111111111112122112188 RHUBARB
2370 DATA 211111111111111111111111212111156 RUE
2380 DATA 2111111111111111111111112121112225 SAPPFRON
2390 DATA 211111111111111111111111212111158 SAGE
2400 DATA 2111111111111111111111112121111218 SALICE
2410 DATA 2111111111111111111111112122112193 SANDAL WOOD

(continued on next page)
(continued from previous page)

2420 DATA 111111111121111111121211111121
2430 DATA 11111111111111111111111111111111111111111111111111111111111111111
2440 DATA 21111111111111111111111111111111111111111111111111111111111111111
2450 DATA 12111111111111111111111111111111111111111111111111111111111111111
2460 DATA 11111111111111111111111111111111111111111111111111111111111111111
2470 DATA 21111111111111111111111111111111111111111111111111111111111111111
2480 DATA 21111111111111111111111111111111111111111111111111111111111111111
2490 DATA 12111111111111111111111111111111111111111111111111111111111111111
2500 DATA 11111111111111111111111111111111111111111111111111111111111111111
2510 DATA 21111111111111111111111111111111111111111111111111111111111111111
2520 DATA 211111213111111111111111111221112
2530 DATA 211111121111111111111111111221112
2540 DATA 21111112111111111111111131213166
2550 DATA 12111111112111111111111121112172
2560 DATA 21111112132111111111111121231122
2570 DATA 11111112111111111111111121111162
2580 DATA 21222213121211112122211222244
2590 DATA 31121211111211112122211221111350
2600 DATA 31121112111111112211111131311162
2610 DATA 21111112132111111111111121222188
2620 DATA 111211111111111121221155
2630 DATA 1211111211111111212222222111151
2640 DATA 111111121111111121222111111112181
2650 DATA 11111112121211112122211111111211
2660 DATA 111211111111111121221155
2670 DATA 1211111211111111212222222111151
2680 DATA 11111112121211112122211111111211
2690 DATA 1211111211111111212222222111151
2700 DATA 111211111111111121221155
2710 DATA 1211111211111111212222222111151
2720 DATA 11111112121211112122211111111211
2730 DATA 111211111111111121221155
2740 DATA 11111112121211112122211111111211
2750 DATA 111211111111111121221155
2760 DATA 1211111211111111212222222111151
2770 DATA 111211111111111121221155
2780 DATA 1211111211111111212222222111151
2790 DATA 11111112121211112122211111111211
2800 DATA 111211111111111121221155
2810 DATA 1211111211111111212222222111151
2820 DATA 11111112121211112122211111111211
2830 DATA 111211111111111121221155
2840 DATA 1211111211111111212222222111151
2850 DATA 11111112121211112122211111111211
2860 DATA 111211111111111121221155
2870 DATA 1211111211111111212222222111151
2880 DATA 11111112121211112122211111111211
2890 DATA 111211111111111121221155
2900 DATA 1211111211111111212222222111151
2910 DATA 11111112121211112122211111111211
2920 DATA 111211111111111121221155
2930 DATA 1211111211111111212222222111151
2940 DATA 11111112121211112122211111111211
2950 DATA 111211111111111121221155
2960 DATA 1211111211111111212222222111151
2970 DATA 11111112121211112122211111111211
2980 DATA 111211111111111121221155
2990 DATA 1211111211111111212222222111151
3000 DATA*

3010 DATA BARK, FLOWER, FRUIT, HERB, LEAF, SEED, UNDERGROUND LEAF, UNDERGROUND ROOT/STEM, WOOD

9000 'ROUTINE TO CALCULATE CHECK DIGITS
9010 N=1:PRINT"ENTER 31 DIGITS":INPUT E(N)
9020 IF LEN(E(N))<31 PRINT LEN(E(N)): "DIGITS ENTERED" : GOTO 9010
9030 GOSUB 9060
9040 PRINT PRINT"CHECK DIGIT = ":RIGHT$(T,1)
9050 PRINT PRINT PRINT:GOTO 9010
9060 S=0 FOR I=1 TO 31: S=VAL(MID$(E(N), I, 1)) + I + S:NEXT I
9070 S=S+STR$(S):T=0
9080 FOR I=1 TO 31, T=VAL(MID$(E(N), I+1, 1)) + I + S:NEXT I
9090 T=S=STR$(T):RETURN

Dr Georgina Jolliffe.

Diagram 4. Output information.

Diagram of Page 2

Dr Georgina Jolliffe.

Diagram 4. Output information.

Diagram of Page 2

Dr Georgina Jolliffe.

Diagram 4. Output information.

Diagram of Page 2

Dr Georgina Jolliffe.
1 11111 11111 21111 12211 11112 12112 ACONITE LEAF (LEAF)
2 11111 11111 11111 11111 11116 12221 ACONITE ROOT (UNDERGROUND ROOT/STEM)
3 11121 12111 21111 12211 11112 11311 AILANTHUS (LEAF)
4 21121 11211 11111 11111 11115 12111 ALMOND (SEED)
5 21111 11121 11111 11111 12221 ALSTONIA (BARK)
6 12111 11111 11111 11112 12221 AMERICAN VERATRUM (UNDERGROUND ROOT/STEM)
7 22111 11211 11111 11111 12221 ANGOSTURA (BARK)
8 11112 11111 21111 12211 11112 12111 ANISE (FRUIT)
9 11111 11113 11111 11111 12111 ARECA (SEED)
10 11111 11113 21111 12222 11112 12111 BEARBERRY (LEAF)
11 11111 11111 11111 11111 11111 12111 ANGOSTURA (BARK)
12 11121 11111 21111 12211 11112 11111 12111 BELLADONNA HERB (HERB)
13 11121 12111 12111 22222 12222 11113 BELLADONNA LEAF (LEAF)
14 11121 11111 11111 11111 12221 BELLADONNA ROOT (UNDERGROUND ROOT/STEM)
15 11111 11111 11112 11112 12221 BETONY (LEAF)
16 21121 12111 12112 22222 12222 11113 BLACKBEAR (BARK)
17 11111 11113 11111 11111 12121 BLACKHELLEBORE (UNDERGROUND ROOT/STEM)
18 21111 12112 12111 11111 11112 12121 BLACK PEPPER (FRUIT)
19 11111 11111 12111 12121 11111 12111 BOLDO (LEAF)
20 11111 11111 12111 12221 11112 12111 BROOM TOPS (HERB)
21 11111 11113 21111 12211 11112 12221 BRYONY ROOT (UNDERGROUND ROOT/STEM)
22 21111 12112 21111 11111 11112 12221 CARDAMOM (SEED)
23 11111 11111 12111 21221 11111 12111 CARDAMOM (SEED)
24 11121 12112 12111 11111 12121 12121 CACAO (SEED)
25 21111 12111 11111 11111 12221 CASCARILLA (BARK)
26 11111 11111 11111 11111 12221 CANELLA (BARK)
27 11111 12111 12111 12122 21222 12211 CAPSICUM FRUIT (FRUIT)
28 12112 12111 21111 31111 11112 12221 CARRAWAY (FRUIT)
29 21111 12111 11111 11111 12221 CATHARENITE (HERB)
30 21111 12112 11111 11111 12221 CASCARA (BARK)
31 21112 11121 11111 12221 12121 CASSARILLA (BARK)
32 12112 11121 11111 11111 12221 CASSIA (BARK)
33 11111 11111 11111 12221 CINNAMON (BARK)
34 11121 12111 11111 12221 CELESTITE (FRUIT)
35 11111 11111 21111 12222 12112 12221 CHAMOMILE (FLOWER)
36 11111 11113 11111 11111 11111 12221 CHICHORY (UNDERGROUND ROOT/STEM)
37 21112 12112 11111 11111 11111 12221 COCA (LEAF)
38 12112 11111 11111 11111 12221 COLOMBO (BARK)
39 11121 11111 21111 11111 11112 12221 CLOVES (FLOWER)
40 21112 12111 11111 11111 11112 12111 COCCIA (LEAF)
41 11111 11121 11111 11111 11111 12221 COCILLANA (BARK)
42 11111 11111 11111 11111 11114 12121 COFFEE (SEED)
43 11111 11111 11111 11111 11112 12221 COLCHICUM CORM (UNDERGROUND ROOT/STEM)
44 11111 11111 11111 11113 11121 12221 COLCHICUM SEED (SEED)
45 11111 11112 21111 11111 11112 12111 COLOCYNTH FRUIT (FRUIT)
<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>COLTSFOOT LEAF (LEAF)</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>CONDRANGU (BARK)</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>CORIANDER FRUIT (FRUIT)</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>COTTON ROOT BARK (BARK)</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>COUCH GRASS (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>CUMIN (FRUIT)</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>DANIANA (LEAF)</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>DANDELION ROOT (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>DATURA INNOXIA (HERB)</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>DATURA METEL (HERB)</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>DERRIS (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>DIGITALIS (LEAF)</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>DIGITALIS LANTANA (LEAF)</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>DILL (FRUIT)</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>DIGSCEPA (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>DUBOISIA LEAF (LEAF)</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>EGYPTIAN HEBBAE (HERB)</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>ELECAMIPS (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>ERIODICTYON (LEAF)</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>ERGOT (HERB)</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>EURYAPYTUS (LEAF)</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>EUPATORIUM (HERB)</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>FENNEL (FRUIT)</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>FENUGREEK (SEED)</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>FRANGULA (BARK)</td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>GALLANGAL RHIZOME (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>GARLIC (UNDERGROUND LEAF)</td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>GELSEMIUM (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>GENTIAN (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>GINGER (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>GINGENG (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>GRASS (HERB)</td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>GRINDELIA (HERB)</td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>GUAIACUM (WOOD)</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>HEMLOCK FRUIT (FRUIT)</td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>HEMLOCK LEAF (LEAF)</td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>HEBBAE (HERB)</td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>HEBBAE LEAF (LEAF)</td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>HENNA (LEAF)</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>HORSESADISH (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>HORDWAS (UNDERGROUND STEM)</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>HYDRASTIS (UNDERGROUND LEAF)</td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>HOPS (HERB)</td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>INDIAN FOODPHYLLUM (UNDERGROUND ROOT/STEM)</td>
<td></td>
</tr>
<tr>
<td>Page</td>
<td>Plant Name</td>
<td>Common Name</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>90</td>
<td>IPECACUANHA</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>91</td>
<td>IPOMOEA</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>92</td>
<td>ISPHAGHULA</td>
<td>Seed</td>
</tr>
<tr>
<td>93</td>
<td>JABOANTI</td>
<td>Leaf</td>
</tr>
<tr>
<td>94</td>
<td>JALAP</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>95</td>
<td>JUNIPER BERRIES</td>
<td>Fruit</td>
</tr>
<tr>
<td>96</td>
<td>KOUSSO</td>
<td>Flower</td>
</tr>
<tr>
<td>97</td>
<td>LAVENDER</td>
<td>Flower</td>
</tr>
<tr>
<td>98</td>
<td>LILY OF THE VALLEY</td>
<td>Herb</td>
</tr>
<tr>
<td>99</td>
<td>LINSEED</td>
<td>Seed</td>
</tr>
<tr>
<td>100</td>
<td>LOQUIFICE</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>101</td>
<td>LOBELIA</td>
<td>Herb</td>
</tr>
<tr>
<td>102</td>
<td>LOGWOOD</td>
<td>Herb</td>
</tr>
<tr>
<td>103</td>
<td>LONCHOCARPUS</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>104</td>
<td>LUCERNE</td>
<td>Herb</td>
</tr>
<tr>
<td>105</td>
<td>MACE</td>
<td>Seed</td>
</tr>
<tr>
<td>106</td>
<td>MALE FERN</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>107</td>
<td>MARIGOLD</td>
<td>Flower</td>
</tr>
<tr>
<td>108</td>
<td>MARSHMALLOW</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>109</td>
<td>MATE</td>
<td>Leaf</td>
</tr>
<tr>
<td>110</td>
<td>MATRICARIA</td>
<td>Flower</td>
</tr>
<tr>
<td>111</td>
<td>MUSTARD</td>
<td>Seed</td>
</tr>
<tr>
<td>112</td>
<td>NUTMEG</td>
<td>Seed</td>
</tr>
<tr>
<td>113</td>
<td>NUX VOMICA</td>
<td>Seed</td>
</tr>
<tr>
<td>114</td>
<td>OAK</td>
<td>Bark</td>
</tr>
<tr>
<td>115</td>
<td>ORANGE LEAF</td>
<td>Leaf</td>
</tr>
<tr>
<td>116</td>
<td>ORRIS</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>117</td>
<td>PARJIRA</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>118</td>
<td>PELLITORY</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>119</td>
<td>PIQUINUS</td>
<td>Bark</td>
</tr>
<tr>
<td>120</td>
<td>PHLOXINUS</td>
<td>Bark</td>
</tr>
<tr>
<td>121</td>
<td>PIMENTO</td>
<td>Fruit</td>
</tr>
<tr>
<td>122</td>
<td>PINE</td>
<td>Wood</td>
</tr>
<tr>
<td>123</td>
<td>POKE FLOWER</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>124</td>
<td>POSEPHYLLUM</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>125</td>
<td>POMEGRANATE</td>
<td>Bark</td>
</tr>
<tr>
<td>126</td>
<td>POPPY PETAL</td>
<td>Flower</td>
</tr>
<tr>
<td>127</td>
<td>PYRETHRUM</td>
<td>Flower</td>
</tr>
<tr>
<td>128</td>
<td>QUASSIA</td>
<td>Wood</td>
</tr>
<tr>
<td>129</td>
<td>QUILLIA</td>
<td>Bark</td>
</tr>
<tr>
<td>130</td>
<td>RASPBERRY LEAF</td>
<td>Leaf</td>
</tr>
<tr>
<td>131</td>
<td>RHAUWOLFA SERPENTINA</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>132</td>
<td>RHAUWOLFA VOMITORIA</td>
<td>Underground Root/STEM</td>
</tr>
<tr>
<td>133</td>
<td>RED-ROSE PETAL</td>
<td>Flower</td>
</tr>
</tbody>
</table>
Program of the year

174. RED SANDERS (WOOD)
175. PHANTANY (UNDERGROUND ROOT/STEM)
136. RHUBARB (UNDERGROUND ROOT/STEM)
137. RUE (LEAF)
138. Saffron (FLOWER)
139. SAGE (LEAF)
140. SALEP (UNDERGROUND ROOT/STEM)
141. SANDALWOOD (WOOD)
142. SANTONIA (FLOWER)
143. SAFFRON (FLOWER)
144. SASSAFRAS WOOD (WOOD)
145. SAVIN TOFS (HERB)
146. SENEGA (UNDERGROUND ROOT/STEM)
147. SENNA FRUIT (FRUIT)
148. SENNA LEAF (LEAF)
149. SERPENTARY (UNDERGROUND ROOT/STEM)
150. SOY BEAN (SEED)
151. SHIRPERY ELM (BARK)
152. SIMARUBA (BARK)
153. SIRAPASANO (SEED)
154. SERRUSACRE (SEED)
155. SWEET FLAG (UNDERGROUND ROOT/STEM)
156. TER (LEAF)
157. TOBACCO (LEAF)
158. TURMERIC (UNDERGROUND ROOT/STEM)
159. TURPETH (UNDERGROUND ROOT/STEM)
160. VALERIAN (UNDERGROUND ROOT/STEM)
161. VANILLA (FRUIT)
162. WEDOARY (UNDERGROUND ROOT/STEM)
PRACTICAL COMPUTING November 1979
"My best Apple programs are on long-term deposit in the City...it pays rather well!"

We brought the first five Apples into the U.K. in November '77, with every penny we had. In November '79, we find several thousand throughout the country.

THANK YOU Apple owners.

Now we'd like to help you re-coup your investment by cataloguing and supporting the best Apple programs in the U.K. The Apple Software Bank is more like an old penny bank than a major clearing bank, but we know you'll help it grow. Telephone Stephen Derrick on 01-626-8121 to discuss your investment.

ATTENTION ALL Estate Agents, Employment Agencies, Yacht Brokers, Antique Dealers and Motor Traders.

Find out about FINDER SOFTWARE!

SOME BLUE CHIPS

TESKIM. This ROM will simulate the Tektronix 4010 family of graphics terminals. It's rather good!

UPPER LOWER CASE ADAPTOR A chip for the chap considering word processing.

NEW ISSUES

We are continually trying to bring the latest add-ons for your Apples. Please phone for the latest product information and data sheets.

NEW PRODUCTS

8" SHUGART DISKS giving 1.2 Megabytes A twin drive (with room for a third.) disk system with controller and software, give tremendous commercial possibilities. £2350 Excl. V.A.T.

WORD PROCESSOR. Ask about our Apple II Plus word processor package. Complete System with Diablo 1650 Daisy-Wheel Printer. £4250 Excl. V.A.T.

PERSONAL COMPUTER PRINTERS. Sensational 40 & 80 Character printer (graphics options) from £243 Excl. V.A.T. Interfaces for Apple, Pet & TRS 80. High quality silent printers. It's your choice!

A/D BOARD At last we have either an 8 bit or 12 bit A/D card for Apple. Excellent spec from £125 Excl. V.A.T.

APPLE PASCAL £296
EUROC is a new, simple to use, fast, powerful micro-computer system for business. It’s British, the program tried and tested.

EUROC is already being talked about by bankers, accountants and businessmen. See it on Stand 642 at the International Business Show at the National Exhibition Centre, Birmingham from 23rd October to 1st November, 1979.

EUROC hardware is manufactured exclusively for Euro-Calc Ltd., by Plessey Microsystems Ltd. EUROC will be on permanent display at Euro-Calc’s branches at 55, High Holborn, London WC1 and at 224, Tottenham Court Road, London W1.

EUROC looks after your day books (Cash-Sales-Purchase & Nominal).
EUROC looks after your ledgers (Sales-Purchases & Nominal).
EUROC prints out your Statements and Remittance advices.

In addition optional Stock Control and Payroll programs will be available.
There are no hidden extras. EUROC’s price of £7,995 ex. VAT includes—Hardware, Software, Initial Supply of Stationery and Binders—in fact everything you need to computerise your business including the 1st year’s Maintenance Contract—nationwide service is undertaken by Plessey Microsystems Ltd.

For further information and trade-distribution enquiries, talk to Peter Ingoldby, Managing Director, Euro-Calc Ltd., 55, High Holborn, London, WC1, telephone 01-405 3223 or Anthony Manton, Sales Director at Tottenham Court Road on 01-636 5560.
Practical Computing Back Issues

If you are interested in microcomputers you will want to read the Practical Computing reviews of the machines in which you are interested. Each month Practical Computing carries at least one hands-on test of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

Each issue is packed with essential reading on microcomputers, including all our regular monthly features: Book and cassette reviews; Glossary of computer terminology; Computabits; Pet Corner (February onwards); Apple Pie (May onwards); Tandy Forum (March onwards); serialised Illustrating Basic (October 1978 onwards).

All this makes Practical Computing the invaluable source for the whys, wherefores, hows, ifs and buts of microcomputing.

October 1978
- Review: Commodore PET I. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

November 1978
- Review: Tandy TRS-80 Projects for KIM. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

December 1978
- Review: Research Machines 802. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

January 1979
- Review: Nascom I. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

February 1979
- Review: Cromenco Z-2D. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

March 1979
- Review: Single-board computers for less than £50. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

April 1979
- Review: North Star Horizon. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

May 1979
- Review: Exidy Sorcerer. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

June 1979
- Review: Compucolor II. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

July 1979
- Review: AIM-65, SOL-20. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

August 1979
- Review: PET II KIM. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

September 1979
- Review: Powerhouse II. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

October 1979
- Review: Disc systems for Pet, Apple II and Tandy. Review of a popular microcomputer for use in business, the home, schools and colleges. Each review contains the kind of information you need - technical data and unbiased critical comment on the strengths and weaknesses of each system.

Only the above issues are still available. To keep your copies of Practical Computing in good condition and convenient for reference you will need a special binder. In blue, with Practical Computing in silver-style lettering on the spine, each holds twelve issues comfortably. Fill in the coupon opposite and return it with your remittance to Practical Computing, Room 125, Dorset House, Stamford Street, London SE1 9LU.

PRACTICAL COMPUTING November 1979
WE PROGRAM MICROs

- Occasionally for OhioS*
- Periodically for Pets*
- Also for AppleS*

S Software Services
14 Herbert Street, Dublin 2, Ireland.
Tel: 765197

Limited to first consignment only at special offer price of £187 (normally at least £230) this Stand-alone high-resolution visual display unit includes all these features:

- 12in CRT implosion protected, monochrome OR GREEN PHOSPHORS
- Better than 700 lines at centre, at least 80 characters across
- High-resolution graphics, 190 dots horizontally
- Constant stability, high brightness, perfect locking
- Excellent, world-wide market penetration, famous make
- Fully guaranteed, proper service backing.
- 10 in. model also available, same specification £142.56 + VAT.
Money back if not delighted (10 days)
Cash with Order to:
Intervision Division
Hamble Wilkes Ltd.
23 Acre Lane,
Cochallon, Surrey.
Tel: 01-669 4611.

* Circle No. 208

Special Offer!

The versatility of the microcomputer makes it particularly useful to the severely disabled. In the first of two articles we look at a Possum system for the Pet.

SOMETIME AGO Practical Computing ran a competition in which entrants were invited, with an Apple II as the prize, to devise a useful and interesting application for a microprocessor. The Seagrave family won with an entry for a microprocessor-based typewriter system for aiding the severely physically handicapped.

There is a very wide range of ills to which people can fall victim, both mental and physical. Considerable effort has gone into the search for gadgets and aids to help these individuals. Often the simplest ideas can be of most value; a knife fork or spoon can be re-designed, a chair modified, to the enormous everyday benefit of the handicapped. At the other end of the scale, houses can be re-designed to suit an individual, or cars can be altered, to give the disabled person greatly-increased independence and to reduce the degree to which they must rely on nurses, friends and relatives.

It is in that light that the following text and program is presented. The source of the program is in Basic, and it runs on the Commodore Pet.

While the program is long and fairly complicated, it has been developed and tested over an extended period and has proved to be robust. It should not be difficult to modify it to suit individual circumstances. It is a prototype laboratory set-up, never having been used by anyone who couldn't, if they became bored, walk away or, if it did not do as they wanted, to change or modify it.

It is the dual problem of reliability and usability which must be given special priority if computers are to help the disabled. Those considerations should be met by conservative design principles and thorough testing even though the cost, in both effort and money, will be increased.

The idea is not new. Equipment to do these things has been available for years and has helped countless people. By departing little from this well-tried and tested formula, only by adding new features and making small improvements can we hope that computer-based equipment, with its potential for greater flexibility and power, will gain rapid acceptance.

My interest in these machines was inspired by a visit to an exhibition aimed at demonstrating a wide range of aids for the disabled, writes Nick Hampshire. Among other exhibits was a Possum typewriter control system.

In essence, the user is provided with modified electric typewriter, a control board which displays the letters of the alphabet, the digits and other symbols a typewriter can print, arranged as a matrix, with a mouth switch, operated by sucking and blowing down a tube.

Variation

Carriage return and upper/lower-case shift are also displayed on the board. A character is selected first by blowing into the tube. An illuminated cursor will move across each of the columns in turn. Sucking selects the row containing the wanted option which can then be printed on the typewriter. When the user sucks and blows, each little box in a row or column is illuminated in turn to show which is being selected. The speed at which the cursor or pointer moves may be altered to suit the person using the machine.

The idea of selecting a column and then a row in turn is a variation of the menu selection technique, which may be employed whenever there is a limitation to
the speed with which the user can communicate to the machine, rather than the speed the machine can communicate to the person.

The computer will display a variety of options and the user types a digit or moves a cursor to the one required. Figure 1 shows the layout of the program display. It is similar in construction to commercially-available units. This arrangement is by no means the only one which could be used but it has the advantage of having been proven effective and usable.

It will also be entirely familiar to anybody who has already used the commercially-available equipment. It has more options present on the one screen than the basic commercial unit. We can also change at will the contents of the screen and hence the letters, words and the effect each selection will have.

The screen in figure 1 is divided into five distinct regions. At the top is the text buffer. Since characters are not printed as soon as they are selected, mistakes can be corrected before a whole line is finally printed. The line occasionally will display advice or warnings to the user, so as to print the text buffer when it is full.

Next there is a 7 x 10 matrix of characters and ready-made words. While commercial units use the character set of the electric typewriter, this version uses the ASCII set. The replacement of fractions by the special symbols is apparent as the box being selected. By default, it moves across the screen slightly faster than when going down.

When the character or word one wishes to print is selected, one releases the switch and it is appended to the text buffer. If the row, or column is overshot the cursor can be returned to 'HOME' by letting hit the "I". When the switch is pressed it will move down each row in turn. When the switch is released the cursor halts, pointing to the row selected.

The downward pointer or cursor is, in fact, five 'reverse' spaces, with a greater than sign in the fourth position. On pressing the switch for the second time, the cursor moves across the screen, along the row selected previously. The cursor is visible as it reverses the box being selected. By default, it moves across the screen very slowly.

When the character or word one wishes to print is selected, one releases the switch and it is appended to the text buffer. If the row, or column is overshot the cursor can be returned to ‘HOME’ by letting hit the right-hand side or bottom of the screen. It stays there until the switch is released and pressed again, when the whole cycle will repeat.

Frequency

It is important to note that if one misses the desired row or column, all will be well providing one leaves the switch pressed.

Some care has been taken on the layout of the 70 boxes. Since it takes a noticeable time for the cursor to travel down and then across, it follows that the most commonly-used characters should be closest to the "HOME" position. Every English word is separated by a space and as this is by far the most commonly-used character, it is only one down plus one across.

As for the other letters, printers have long known that they are used with different frequencies in the English language. Type is, or was, purchased according to a set number of 'a's, with all the other letters in proportion. Thus a font which contains 48 'a's may contain 64 'e's, the most common letter — two down, one across. The font will contain an equal number of a, i, n, o, r, s and t's all at 48, those being the next most common, and they are clustered about the "HOME" position.

All the other letters have a decreasing probability of use and that is reflected in THEM.

By selecting the function PROG, the user can write Basic, which is loaded into the text buffer line by line.

is more compatible with a high-quality matrix or daisywheel printer through the IEEE port.

Assumes worst case

Any of those 70 places can be selected by moving around the cursor. The program assumes the worst case, that of a person able only to operate a single on/off switch, possibly by blowing down a tube to a pressure-sensitive device or by a slight movement in one hand.

Commercial equipment is available with a wide range of possible input mechanisms, tailored by the manufacturers to the individual require-

ments. Our simple input allows typing speeds up to about 10 words per minute. Less handicapped people can use inputs which have more than one or two states, such as pressure switches with more than one level of pressure or a joystick-type switch giving eight possible directions, allowing speeds up to 40 words per minute.

When the switch is pressed the first time, with the cursor in the "HOME" position, the cursor will move downwards as far as the row with the 'SP' for space character — "A", "T"... "THE". About one-third of a second later it will move to the next row, "E", "I"... "AND" — if the switch remains pressed. While the switch remains pressed it will move down each row in turn. When the switch is released the cursor halts, pointing to the row selected.

The downward pointer or cursor is, in fact, five 'reverse' spaces, with a greater than sign in the fourth position. On pressing the switch for the second time, the cursor moves across the screen, along the row selected previously. The cursor is visible as it reverses the box being selected. By default, it moves across the screen slightly faster than when going down.

When the character or word one wishes to print is selected, one releases the switch and it is appended to the text buffer. If the row, or column is overshot the cursor can be returned to 'HOME' by letting hit the right-hand side or bottom of the screen. It stays there until the switch is released and pressed again, when the whole cycle will repeat.

Frequency

It is important to note that if one misses the desired row or column, all will be well providing one leaves the switch pressed.

Some care has been taken on the layout of the 70 boxes. Since it takes a noticeable time for the cursor to travel down and then across, it follows that the most commonly-used characters should be closest to the "HOME" position. Every English word is separated by a space and as this is by far the most commonly-used character, it is only one down plus one across.

As for the other letters, printers have long known that they are used with different frequencies in the English language. Type is, or was, purchased according to a set number of 'a's, with all the other letters in proportion. Thus a font which contains 48 'a's may contain 64 'e's, the most common letter — two down, one across. The font will contain an equal number of a, i, n, o, r, s and t's all at 48, those being the next most common, and they are clustered about the "HOME" position.

All the other letters have a decreasing probability of use and that is reflected in THEM.
their distance — though not particularly rigorously — from the Home position. The other special characters are dotted around the edge. A few English words which occur frequently, such as "THE", "AND" and "OR" have been included down the right-hand side and it is very convenient to have them. One early idea was to include frequently-used letter pairs, such as "TH", but that is less easy to do. The fourth region is labelled "VARIABLES". Those boxes will contain words, phrases or complete sentences the user decides he or she will need to use frequently. Photograph 1 shows some of the individual words used in the text at the top, set up as variables. Each of the 21 boxes contains the first four characters of the contents of the variable. Thus "QUIC" contains "QUICK", "BEAU" contains "BEAUTIFUL" and "PEA-" contains "PEA-GREEN" one of the examples is "The owl and the pussycat went to sea in a beautiful pea-green boat".

Edit boxes
It was a major design decision how the generation of a new variable word be arranged. Initially I assumed that a variable should be made from the most-recently-typed word in the text buffer. The final program makes the whole of the text buffer into the variable, although only the first four characters are displayed on the screen. One must therefore type each of the words or phrases to be stored and put them in their locations before starting in earnest. Figure 2 shows a more realistic situation. Each of the variable boxes contains some small part of a potential business letter. As most business letters seem to be of a kind the scheme is well matched. Such phrases as "Dear Sir or Madam", "Thank you for your", "unless your account is", "Yours faithfully" and so on, may all save a huge amount of effort. A small selection of candidates — most of them single words — is shown. If a set of words proves to be very useful they could be built into the program. The Possum company supplies a word storage add-on module with eight or 64 words which it claims can cover up to 20 percent and 50 percent of word usage.

So far, none of these functions has affected the printer but the next group do. "SEND" prints the contents of the text buffer on the printer, takes a new line and erases the contents of the text buffer. One of the design options was to have "SEND" format the text either partially indelible. "DEL" removes the whole text buffer with no other effects. It is put in the bottom right-hand corner to try to prevent accidental erasure.

Combination
"NL" takes a new line on the external printer, with no other effect. "PARA" is the special case of a new paragraph. Its effect is a combination of the previous three. It prints-out and erases the current buffer, takes three new lines, adds three spaces to the new text buffer to indent the case. The current mode is indicated by a "*" against the relevant function.

There are some exceptions to the rule concerning the words and variables. The words "THE", "AND" are stored in upper-case and will be printed in upper-case if "UC" is set and in lower-case if "LC" is set, including the stored capitals — figure 2 — but will be printed as they are stored, lower as lower, capital as capital if "UC" is set. That is probably the best compromise in the circumstances. "SENT" is another function which affects "UC" and "LC": it stands for 'end of sentence'. Its effect is to add a full stop and three spaces to the buffer and make the next letter a capital, so that "THE" would be added to the buffer as "The".

"DELC", deletes the most recent character in the buffer and "DELW", deletes the most recent word, back to, but not including, the next space. There are true editing commands which give the microprocessor system a great advantage over direct control versions. If you make a mistake — and it isn’t difficult to overshoot the desired box accidentally — it can be corrected before the printer makes it indelible. "DEL" removes the whole text buffer with no other effects. It is put in the bottom right-hand corner to try to prevent accidental erasure.
Good person calls and function names typical of the digits, special Basic characters, system alphabet and English words, it shows the system.

```
440 DATA), (, $, AO 
430 DATA8,9, 
420 DATA3,4,5, 11, C. 'PORE  
410 DATA0, 2,6, "  
270 DATA. , +,  
250 DATA0, 2,4,6,8,  
240 DATAF,  
230 DATAc, 0, H, M, X, Q, IS  
220 DATAN, 0, R, P, J, *, OF  
210 DATAe, I, S, U, Z, 0, AND  
140 DATAF, B, W, Y, K, '  
120 DATAN, 0, R, P, J, ', TO  
100 DATA" SP  
30 DATA" TEXT  
20 DATA" UC  
50 DATA=5, MC=6  
40 P0KE59468,14  
- may be set up and the system works as 'Al' or 'Qs', rather than words or phrases variables - this time Basic variables like "PROG" modes, so a list of up to 21 variables are not those of Pet Basic, but SWTP 8K Basic. This is for a good reason: it is not advisable to run an untested and undebugged user program on the Pet if it is your only means of communication.
```

When your program crashes, goes into an infinite loop or whatever, you are very stuck. Instead, the system sends the Basic text generated in the text buffer to a second microprocessor, using the "ESC" or 'escape' function.

That is similar to "SEND", except that it transmits the text to a different file number through the IEEE port and terminates the line with an escape character — at the moment CR/LF, but it could be an escape or an ASCII control character. "1C" is a second special programming function which sends the ASCII character 3 to the second micro, allowing a 'break-in' to occur if the program fails. One must contrive to have the second micro output to the printer as it runs.

This month the bulk of the program is presented. In part two the working and structure of the program will be explained and documented.

before. Words are created in "TEXT" mode and Basic things in "PROG" mode, so one can easily skip between the two to generate strings like "NOT ZERO" in figure 3.

There is no need to display on the screen exactly what will be added to the buffer; the "PROG" frame shows that to a greater degree than "TEXT". Some of the boxes contain abbreviations, such as "RTRN" for "RETURN" and "TRON" for "TRACEON". Moreover, each of the functions also includes its opening left bracket, so "ASC" is actually "ASCI" and "RIGHT" is "RIGHT!", which improves the shorthand facilities.

You will notice that the commands and functions are not those of Pet Basic, but SWTP 8K Basic. This is for a good reason: it is not advisable to run an untested and undebugged user program on the Pet if it is your only means of communication.

When your program crashes, goes into an infinite loop or whatever, you are very stuck. Instead, the system sends the Basic text generated in the text buffer to a second microprocessor, using the "ESC" or 'escape' function.

That is similar to "SEND", except that it transmits the text to a different file number through the IEEE port and terminates the line with an escape character — at the moment CR/LF, but it could be an escape or an ASCII control character. "1C" is a second special programming function which sends the ASCII character 3 to the second micro, allowing a 'break-in' to occur if the program fails. One must contrive to have the second micro output to the printer as it runs.

This month the bulk of the program is presented. In part two the working and structure of the program will be explained and documented.
PET Serial Interfaces

Phone John Handy, 042 050 374.

SPECIAL XMAS OFFERS: system desk for TRS-80 Micropolis disc drives
Word-processing system
Estate agents' system

PET Parallel Interfaces

CENTRONICS 779 Printers

Is user-programmed by 39 instructions
Links the Z80 registers to form two 40-bit
Operates the Z80 as a 40-bit floating point

Software/Hardware/Servicing

Is supplied as manual and descriptive
Is instructions interface directly with Z80

Emg 120, 30 Heathfield Rd., Croydon, Surrey. Tel: (01)-688 0088.

Cash & Carry

* PET 2001 8K & 32K
* PET serial interfaces
* PET parallel interfaces
* Plessey 24(32)K memory
* Gentronics 779 printers
Also some ex-demo/hire units available.
(with full warranty).
Phone John Handy, 042 050 374.

TRS-80/SORCERER

Software/Hardware/Servicing

Complete business systems
£3,399
electric agency system
£2,499
Word-processing system
£1,999
Microdias cdi drives
£350
Modifications available (lower case,
round mod etc.)
Special Christmas offers: system desk for TRS-80 or Sorcerer £170, games cassette £5, games
diskette £7, 5x copies of Source, the Sorcerer
magazine £5
EMG 120, 30 Heathfield Rd., Croydon, Surrey. Tel: (01)-688 0088.

PRACTICAL COMPUTING November 1979
We are looking for people for a new software company which we are setting up in Milton Keynes.

We still want people for our London based company.

Good money plus profit-sharing. Lots of mini and micro projects and the chance to play with the latest micro system which we review for Practical Computing.

Contact:
Martin Collins
AST Ltd
Staple Inn Buildings North,
High Holborn,
London WC1V 7PZ
01-242-4127 (daytime)
Hemel Hempstead 53549 (evening)

---

TRS80 SOFTWARE

For example:
Address Pad £7
Data Base Utility II £14
Microchess £14
Numeric Integration £5
Professional Diary £12
Star Trek £8.50

MICROGEMS

32 Buckingham Avenue,
Hucknall, Notts

Send SAE for latest catalogue
MINE OF INFORMATION LTD
1 FRANCIS AVENUE, ST ALBANS AL3 6BL ENGLAND
Phone: 0727 52801
Telex: 925 859

MICROCOMPUTER CONSULTANCY & BOOK SELLERS

London Microcomputer School One-Day Introductory Courses, Every Saturday from 17 November 1979. Designed for Businessmen and others interested in use of Micros. £30 +VAT (including Lunch & Refreshments). Phone 01-388 5721 to book a place or ask for brochure.

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

* We also specialise in the repair of all makes of office equipment.

PRACTICAL COMPUTING November 1979
The Buyers' Guide is a summary of low-cost computers available in this country. It appears each month; we add new computers and amend existing information, as required, to keep it up-to-date. Systems are listed by manufacturer.

ACORN COMPUTERS

**Acorn.** Single Eurocard-sized microcomputer with 6520 processor, 1KB RAM, 16-way I/O. Max size; a second Eurocard adds hex keypad and CUPS cassette interface. Monitor and machine-code programming now. Basic and disc operating system in the future. "Highly cost-effective basis for a computer or an industrial development system". Available from Acorn (0223) 312772 or Microdigital (051) 236 0707.

£74.75 kit, £86.25 assembled

APPLE COMPUTERS

**Apple II.** Min size: 16K memory; 8K ROM; keyboard; monitors; mini assembler; colour graphics; Pal card; RF modulator; games; paddles and speakers; 4 demo cassettes. Max size: Expandable to 48K memory; floppy discs and printers are now available. Two versions of Basic, PASCAL, Assembler; games; business packages. An American system regarded as suitable for any kind of applications. Maintenance contracts offered. Microsense Computers is the sole U.K. distributor and has a national dealer network. Tel: (0442) 41191/48151 (24-hour answering service).

Around £1,000

ATTACHE

**Attache.** Min size: system with 10 slots, S100 bus, 8080 processor and 16KB housed in desk-top case with built-in keyboard. Max size: 64KB, parallel printer interface, two single- or double-density 8in. floppy discs and printers are now available. Disc Basic; business applications produced by Moncoland, the sole U.K. agent. Distributors include Keen, GBH, Alba, and Lion.

From £1,737. Full business system about £9,000

BRUTECH ELECTRONICS.

**BEM-CPUI.** Single-board processor with 6502 and no RAM. Applications software. Available from Data Precision Equipment (04862 67420). (Reviewed March, 1979.)

£133 exc VAT

BYTRONIX MICROCOMPUTERS

**Megamicro.** 8080A/Z-80 processor. 64K. Double-sided discs, two-page addressable VDU, 140 cps printer. Software includes Basic, Fortran, Cobol and Pascal, all running under CP/M. Applications include automatic letter writer, sales ledger and stock control, payroll and bought ledger, Self-diagnosis utilities. Aimed at business and university user. Available from Bytronix (0252) 726814.

From £6,080.

Software and Books ideal for schools and colleges now available.
COMART

Floppy. Chassis with three to six PCB sockets for S100 boards, plus fan. Several S100 boards available. Aimed mainly at OEM industrial users and perhaps the serious hobbyist. It will take Cromemco, North Star and other processors. Available from Comart (0480 215005).

COMMODORE SYSTEMS DIVISION

PET. Single unit containing screen, tape cassette and keyboard. Floppy disc, printer and full-size keyboard are options, as are external cartridges. Non-games, business packages. The British subsidiary of Commodore Systems of the U.S. sells PET for home, educational and small business applications. About 80 distributors.

Kim-I, processor (6502 chip); small calculator-type keyboard; LED six-digit display; built-in interfaces for audio-cassette and Tele-type; 1K RAM; 2K ROM (can add up to 64K). No software available, but it has three good manuals. An American import which gives PET-type capabilities with a maximum configuration. For the hobbyist but used mainly as an evaluation board for the 6502 chip. Twelve to 15 dealers. (Reviewed October, 1978.)

COMPELEC ELECTRONICS

Series I. Z-80 processor 512MB floppy, 32KB, Centronics printer, VDU, Up to 4MB disk and 64KB. CP/M, Basic, Cobol, Fortran IV, Assembler, Business and word processing packages available. From Compelec (01-580 6296), which is also sole supplier of Altair systems.

COMPUCOLOR

Compucolor II. Packaged system including 13in. eight-colour display with alphanumericics and graphics, 16 key detachable keyboard, 5KB, and built-in mini-floppy. Max size: 32KB. Extended disc, Basic in ROM, graphics programs and games. The system now ranks fourth behind PET, TRS-80 and Apple in personal computer sales. Abacus (01-580 8841) is sole U.K. agent and is arranging distributors, including the Byte Shop and Transam. (Reviewed June, 1979.)

COMPUCORP

610: desk-top unit using Z-80 and incorporating screen, 150KB floppy, 48KB. Up to 60 KB memory, four floppy, printers. Basic, Assembler, DOS, text editor, file manager, business packages. Nine dealers.

COMPULINK

MINI KIT: Z-80 CPU, CTC, USART, serial and parallel I/O, 16 bytes memory, Western Digital disc controller, SA400 5in. drive plus CP/M, cables and connectors.

MAXI KIT: As above but with DRI 7100 8in. drive instead of 5in. drive. All (33) volumes of CP/M user group library available for cost of media. Library includes utilities, games, Basic compilers/interpreters and Algol compiler. Microsoft Basic, Cobol, Fortran also available. Computer Centre (02514 29607).

THE BEST FOR LESS!

Computers, Firmware, Software
Most Makes Bought, Sold, Exchanged, Constructed.
PET II/ETL & NOW NEW SHARP!
PETSOFT & GEMSOFT
Examples of low, low prices: --

OPTELCO
PHONE: RAYLEIGH (0268) 774895
UP TO 9 pm

COMPUTER WORKSHOP

System 1. Typical size: 40K memory, dual 8in. floppy disc; total storage capacity 1.2MB, Ricoh daisywheel printer.

System 2. Typical size: 24K memory, dual mini-floppy discs of 80K bytes each; Centronics 779 dot matrix printer; Editor, Assemblers, Basic, games, information retrieval package. The systems were designed and built in Peterborough and are suitable for educational and small business users and perhaps the more serious hobbyist. Twenty-five dealers.

COMPUTER WORKSHOP

System 1. £5,000, plus
System 2, around £3,000
System 3, from £1,300

Michael Collins Computer Supplies Limited, 52, Canbury Passage, Kingston, Surrey. Telephone: 01 549 9441

Some people would give anything to have your micro experience

If you have solid experience on Intel 8080 or similar and are interested in contract work Richard Kaluzynski will put you in touch with them.

Knight Computer Services Limited, 14 Old Park Lane, London W1Y 4NL.

Staff Services Division of BOC Datasolve Group and a member of Computing Services Association

THE BEST FOR LESS!

Computers, Firmware, Software
Most Makes Bought, Sold, Exchanged, Constructed.
PET II/ETL & NOW NEW SHARP!
PETSOFT & GEMSOFT
Examples of low, low prices: --

OPTELCO
PHONE: RAYLEIGH (0268) 774895
UP TO 9 pm

COMPUTER WORKSHOP

System 1. Typical size: 40K memory, dual 8in. floppy disc; total storage capacity 1.2MB, Ricoh daisywheel printer.

System 2. Typical size: 24K memory, dual mini-floppy discs of 80K bytes each; Centronics 779 dot matrix printer; Editor, Assemblers, Basic, games, information retrieval package. The systems were designed and built in Peterborough and are suitable for educational and small business users and perhaps the more serious hobbyist. Twenty-five dealers.

COMPUTER WORKSHOP

System 1. £5,000, plus
System 2, around £3,000
System 3, from £1,300

PRACTICAL COMPUTING November 1979
CROMEMCO

**Single-card computer.** 4MHz Z-80 CPU, S100 bus, 1KB RAM, sockets for 8K ROM, 20mA/RS232 serial interface and parallel bidirectional interface. Basic in ROM and Z-80 monitor. For OEM and industrial users; used with backplane for “full computer capability.” Datron Interform and Comart are agents, the latter with 12 distributors. (Reviewed February, 1979.)

£247—£281

**Z-2.** Min size: chassis, 31A power supply, motherboard, Z-80 processor, 16KB memory, 512K sockets, three mini-floppies or four 8in. floppies. Basic, Fortran, Cobol, assemblers. For serious hobbyists, OEMs, educational applications, and industrial/scientific users. £372 (in kit form) to more than £4,000

**System Two.** Min size: factory-assembled system with 32KB, dual 90K minifloppies, dual printer interface, serial interface. Max size: two additional floppies, 512KB, up to seven terminals, CP/M-compatible operating system (CDOS), Fortran, Cobol, Basic, assemblers, word processing, database manager. Multi-user system for software development, or scientific/industrial/business users. £1,995 upwards

**System Two/64.** New configuration featuring mini-diskette drives and 64K bytes memory. Software and applications as System Two. £1,995

**System Three.** Min size: 32KB, dual 256KB floppies, dual printer interface, 20mA/RS232 serial interface, Z-80 processor. Max size: two additional discs, 12KB, seven terminals, multi-channel AD and DA interface, PROM programmer. Software as for System Two. Describable as appropriate for small to medium business, scientific and industrial users — “rivals minicomputers at more than twice the price.” £2,995 to more than £8,000

**System Three/64.** New configuration featuring dual 8in. diskette drives; Z-80A processor; 64K of 4MHz memory; console and printer interfaces. Macro Assembler, Fortran IV, Extended Basic, Cobol, Multi-user Basic. Prices quoted by Micro Centre (031-225 2022).

DYLE HOUSE


£5,000—£40,000 plus

**Equinox 300.** Min size: 48K memory; dual floppy discs giving 600K bytes of storage; 16-bit Western Digital m.p.u. Max size: up to 256K memory; up to four 10MB hard discs. Basic, Lisp, PASCAL, Macro Assembler, Text Processor. All software bundled. The system is a multi-user, multi-tasking, time-sharing system for two to 12 users. Application software available for general commercial users. Sole distributors Equinox Computers Ltd (01-739 2387).

£2,995 to more than £8,000

**EXIDY**

**Sorcerer:** based on Z-80, 16K and 32K; cartridge and cassette interfaces; 79-key keyboard; 256-character set (128 graphics symbols); 12in. video monitor; expandable with Micropolis floppy discs. Basic, Assembler and Editor; games, word processor. Other pre-packaged programs plus EPROM Pack for your own programs on cartridges. Factor One is sole distributor for U.K. (Reviewed March, 1979.)

From £760 without VDU to £1,200 with floppy discs

HEATH SCHLUMBERGER

**H8.** 9080 CPU, 4664K PAM. Serial/cassette I/O; front parallel monitor; keypad; optional parallel I/O; serial multiport, breadboard I/O and disc system. Basic, Ext. Basic, Microsoft Basic, HDOS, CPM.

From £262 (in kit form)

**WH89.** All-in-one computer. Z-80 processor plus Z-80-controlled VDU. 16K expandable to 48K, user-accessible. Two RS232 I/O ports. Operating system includes Benton Harbour Basic, two-pass absolute assembler, text editor, utility programs, Microsoft Basic and Fortran word processor package. Heath Schlumberger (0452 29451).

About £1,600
HEWART MICROELECTRONICS

Mini 6800 Mix II. IK monitor, 1K user RAM, IK VDU RAM, CUTS. Upper- and lower-case VDU with graphics options. 128-byte scratchpad, decoder/buffer, power supply. Basic in ROM; monitor command summary; SWTPC programs, Newbear 6600; Scelba 6800 Cookbook. Markets are small business, education and home user. Cash with order to Hewart (0625) 22030.

6800S. 16K dynamic RAM; IK Mikbug-compatible monitor; room for 8K Basic in ROM; upper- and lower-case graphics; single floppy disc drive; printer and high-speed tape interfaces. "Mountains of software available." Test tape with CUTS test tones, test message and games with kit.

DIGITAL MICRO SYSTEMS

DSC-2. Min size, 32KB, but 64K standard; Z-80; over 1MB floppy disc on two single-sided 8in. drives; four programmable RS232 and one parallel interface. CPM and Basic included in price. Extended Basic, Fortran, Cobol, text processing, Macro Assembler, Link Loader, business packages and CAP-CPP business software. Add-on rigid disc system (14 and 28MB) available soon. Modata (0892 39591) is sole U.K. distributor, dealers being appointed.

IMSAI

VDP 40: 32K or 64K RAM memory, 9in. display screen, standard keyboard. Two 5IVm floppy disc drives; serial I/O. Full software support, and packages available for the VDP 42, which has larger disc capacity. Packages for VDP 80 could be converted for smaller systems. This would be from about £700 per package. Two main dealers in the country.

ITT

2020. Identical to Apple II. Min size: 4K memory; 8K ROM; keyboard, monitor; colour graphics, mini assembler; Powell card; RF Modulator, games, paddles and speaker. Max size: 48K with floppy discs and printers. Basic, Assembler, games, business packages. Generally suited to any type of application. Fifteen wholesalers, including Fairhurst Instruments.

LUXOR


MICRONICS

Micros. Typical size: IK monitor, 47-key solid state keyboard; interfaces for video, cassette, printer and UHF TV; serial I/O, dual parallel I/O parts; 2K RAM; power supply: 2K Basic; British-designed and manufactured system. Claimed to be the cheapest data terminal — a system with an acoustic coupler and VDU for £1,020. Prospective applications for small businesses, process controllers and hobbyists. Packages for VDP 80 could be converted for smaller systems. This would be from about £700 per package. Two main dealers in the country.

PRACTICAL COMPUTING November /1979

PET USERS!

We have numerous games, educational, scientific and general business programs available, as well as various interfaces, s.a.e. for details. We require original programs and interfaces, if you have one (or more) send for evaluation. Very good royalties paid. — Qwerty Computer Services, 20 Worcester Road, Newton Hall, Durham, DH1 5PZ. (Tel: Jim, Durham 67045)

PET USERS!

We have numerous games, educational, scientific and general business programs available, as well as various interfaces, s.a.e. for details. We require original programs and interfaces, if you have one (or more) send for evaluation. Very good royalties paid. — Qwerty Computer Services, 20 Worcester Road, Newton Hall, Durham, DH1 5PZ. (Tel: Jim, Durham 67045)

PRACTICAL COMPUTING November /1979

**HEWART MICROELECTRONICS**

**Mini 6800 Mix II.** IK monitor; IK user RAM, IK VDU RAM, CUTS. Upper- and lower-case VDU with graphics options. 128-byte scratchpad, decoder/buffer, power supply. Basic in ROM; monitor command summary; SWTPC programs, Newbear 6600; Scelba 6800 Cookbook. Markets are small business, education and home user. Cash with order to Hewart (0625) 22030.

**6800S.** 16K dynamic RAM; IK Mikbug-compatible monitor; room for 8K Basic in ROM; upper- and lower-case graphics; single floppy disc drive; printer and high-speed tape interfaces. "Mountains of software available." Test tape with CUTS test tones, test message and games with kit.

**DIGITAL MICRO SYSTEMS**

**DSC-2.** Min size, 32KB, but 64K standard; Z-80; over 1MB floppy disc on two single-sided 8in. drives; four programmable RS232 and one parallel interface. CPM and Basic included in price. Extended Basic, Fortran, Cobol, text processing, Macro Assembler, Link Loader, business packages and CAP-CPP business software. Add-on rigid disc system (14 and 28MB) available soon. Modata (0892 39591) is sole U.K. distributor, dealers being appointed.

**IMSAI**

**VDP 40.** 32K or 64K RAM memory, 9in. display screen, standard keyboard. Two 5IVm floppy disc drives; serial I/O. Full software support, and packages available for the VDP 42, which has larger disc capacity. Packages for VDP 80 could be converted for smaller systems. This would be from about £700 per package. Two main dealers in the country.

**ITT**

**2020.** Identical to Apple II. Min size: 4K memory; 8K ROM; keyboard, monitor; colour graphics, mini assembler; Powell card; RF Modulator, games, paddles and speaker. Max size: 48K with floppy discs and printers. Basic, Assembler, games, business packages. Generally suited to any type of application. Fifteen wholesalers, including Fairhurst Instruments.

**LUXOR**

**ABC 80.** Min size: 35K with keyboard, CPU 12in. screen and cassette. Max size: 40K RAM with discs. Z-80 processor, loudspeaker with 128 effects, real-time clock. Options: printers, plotter, discs, module cards, display screen, modem. 60 compatible I/O memory boards. Software: Basic, resident editor, assembler, games, business and educational packages. Personal computer aimed at home market, small business and education. CCS Microsales is U.K. agent and is looking for distributors.

**MICRONICS**

**Micros.** Typical size: IK monitor; 47-key solid state keyboard; interfaces for video, cassette, printer and UHF TV; serial I/O, dual parallel I/O parts; 2K RAM; power supply: 2K Basic; British-designed and manufactured system. Claimed to be the cheapest data terminal — a system with an acoustic coupler and VDU for £1,020. Prospective applications for small businesses, process controllers and hobbyists. Packages for VDP 80 could be converted for smaller systems. This would be from about £700 per package. Two main dealers in the country.

**PRACTICAL COMPUTING November /1979**

**PET USERS!**

We have numerous games, educational, scientific and general business programs available, as well as various interfaces, s.a.e. for details. We require original programs and interfaces, if you have one (or more) send for evaluation. Very good royalties paid. — Qwerty Computer Services, 20 Worcester Road, Newton Hall, Durham, DH1 5PZ. (Tel: Jim, Durham 67045)
MIDWEST SCIENTIFIC INSTRUMENTS

MSI 6800. Min size: 16K memory, Act I terminal; cassette interface. Basic system: £1,100 ($15 as kit); Minidac: £2,500; floppy disc £3,200; hard disc £12,000.

NASCOM MICROCOMPUTERS

Nascom I. Min size: CPU, 2K memory, parallel I/O, serial data interface; 8K monitor in EPROM. Max size: CPU, 64K memory; 16 parallel I/O ports. Mostly games, but also a dedicated text editor system written by ICL Datakit. Nascom is working on large versions of Basic, and 8K Microsoft Basic should be available soon. Eleven distributors in U.K. Nascom is negotiating to increase the number. (Reviewed January, 1979.)

NATIONAL MULTIPLEX

Pegasus. Min size: 48K, Z-B0; double-density floppy (320KB), £100 bus; 12-in. CRT; 8-key keyboard; two serial and one parallel interfaces; bi-directional printer. Options: 8-in. disk; 1-2MB additional drives; digital recorder; 9,600 baud; ribbon printer. Extended Basic. General business package available as well as text editing and mailing list. All run under CP/M. Suitable for education, business and home users. London Computer Store (01-388 5721) sole supplier.

NETRONICS

Elf II: single-board computer in kit form or assembled. RCA Cosmic 1802 processor, 1K memory; 256 bytes RAM; options include additional drives; digital recorder; 9,600 baud. Assembler, COBOL, Fortran. Extended Basic. General business package available as well as text editing and mailing list. All run under CP/M. Suitable for education, business and home users. London Computer Store (01-388 5721) sole supplier.

NEWBEAR

7768. CPU board, 4K memory, cassette and VDU interfaces. Range of basic and games. British-manufactured system for hobbyists. Expandable to 64K memory available only in kit form. From Newbear, also from Bearbag dealers, Microdigital, Microbits.

NORTH STAR

Horizon. Min size: 16K memory; Z-80A processor, single minifloppy disc (180KB); 2K monitor in ROM; 4K RAM, 8K Basic in ROM, 256 bytes RAM; options include additional drives; digital recorder; 9,600 baud. Assembler, COBOL, Fortran. Extended Basic. General business package available as well as text editing and mailing list. All run under CP/M. Suitable for education, business and home users. London Computer Store (01-388 5721) sole supplier.

OHIO SCIENTIFIC

Ohio Superboard II. Min size: 6502 processor, 8K Basic in ROM; 2K monitor in ROM; 4K RAM; Cassette VF, full keyboard, 32 x 32 video VF, 8K Basic in ROM; Assembler/Editor. American-designed system with in-board keyboard. Aimed at hobbyist/small business. Ohio makes games, personal maths tutors, and business programs. This and other Ohio products have six U.K. distributors. (Reviewed June, 1979.)
PERTEC

System 1300. Min size: 32K memory, dual mini floppy discs 71 bytes each, formatted serial interfaces. Max size: 64K memory; four serial ports. Basic (single and multi-user), Fortran, Cobol. The Hardware for Compelec Altair systems is from Pertec but the software is Anglo-Dutch. Sole distributor Compelec (01-950 6296).

£3,000-£5,000

POWERHOUSE MICROPROCESSOR

Powerhouse 2: desktop unit using Z-80 with SPPD built-in VDU and built-in mini cassette. 16K or 32K RAM, full keyboard, real-time clock, two spare slots. RS232 interface. Software: Disc and cassette operating system, programmable keyboard, 16K PROM, extended Basic. Options: 14K Basic, XY graphics, 2K monitor, larger screen, discs. Compatible with all computers. Aimed at OEMs and expert users such as scientists or researchers. Applications include real-time process control, engineering calculations. Availability: Powerhouse only (0442) 42002. Reviewed, September 1979.

£1,480-£1,760

PROCESSOR TECHNOLOGY

Sol. 808-based S100 microcomputer packaged with cassette video interfaces (including graphics), keyboard with numeric pad, and 16KB RAM. Basic, assembler, word processors. Floppy disc systems available. Several distributors including Comart (0480 21505), which offer nationwide maintenance contracts (Reviewed July, 1979.)

From £1,750 (excluding monitor and cassette).

RAIR

Black Box. Min size: 32K memory dual mini floppy discs, 80K bytes each, two programmable serial I/O interfaces. Max size: 64K memory, eight serial interfaces. MB disc storage (or 10MB hard disc); range of peripherals. Basic, Fortran IV, Cobol. Hardware distributors are being signed and agreements made with software houses to add software. A warranty and U.K.-wide on-site maintenance is given. From manufacturer (01-836 4663) and systems houses.

From £2,300

RESEARCH MACHINES LTD

380-Z. Min size: 4K memory, 380-Z processor, keyboard. Max size: 56K memory. Options: cassette, single or dual mini floppy discs, dual 8in. double-sided discs (IMB); serial interfaces; parallel interfaces; analogue interface; printer available. Basic, Z-80 Assembler, interactive text editor; terminal mode software; data logging routines; CP/M, DOS, text processor, CBasic, Fortran, Algol, Pilot, Cobol, CP/M users’ club library. Sold principally to higher and secondary education, and for scientific research, data processing and data logging. Available from Sintel and the manufacturer. (Reviewed December, 1978.)

From £830-£3,500

280-Z. Board version of 380-Z system. 4K or 32K (identical in performance to the 380-Z). Interfaces, software as for 380-Z.

4KB version at £398. 32KB for £722.

RCA

Cosmac. 1902 micro with hex keyboard and output to TV screen. Assembler and machine code programming; options include Tiny Basic. Available by mail order from HL Audio (01-739 1582).

Kit £79.95. Assembled £99.95 exc VAT

ROCKWELL

Alm-65. Kim-compatible with full keyboard and on-board printer. 1K or 4K RAM. The 4K version is described as a development system rather than a personal computer. Assembler, editor, Basic. Available from Pelco, Microdigital and Portable Microsystems (Reviewed July, 1979.)

1K — £249.30
4K — £315

SCIENCE OF CAMBRIDGE

Mix 14. SCMP processor, 256 bytes user memory; 512-byte PROM with monitor program; hex keyboard and eight-digit, seven-segment display; interface circuitry; 5V regulator on board. To this can be added: 16K RAM (£3.60); 8K RAM (£12.20); cassette interface kit

£39.95 basic
TANDY CORP.

Tandy 800. Single unit containing 32K memory (expandable to 46K); up to 8K PROM; 8K floppy disc unit, printer. Can be coupled to any external device and controls up to 8 floppy disc units. Four configurations available. Options: Light pen attachment; DC power supply; remote terminals. Software: Editor, Assembler, debug, file-handling capabilities. From manufacturer (0223 312919) and by selected dealers. (Reviewed May, 1979.)

SEMEL

Semel 1. Min size: 4K with CPU, keyboard and monitor. Max size: 64K with floppy disc unit, printer, VDU and keyboard. From manufacturer (0223 312919) and by selected dealers. Also available from Airamco (0294 65530).

SYNERTEK

Sym 1. 6502 chip and keypad with memory available in 4K blocks up to 64K. Optional expansion kit, TV interface card, RAM expansion kit, cassette and Teletype interfaces. Any Kim software, Basic interpreter, Assembler/Editor, American, meant to be the foundation system for small business and OEMs. Available from Semel exclusively (0622) 5439.

TANDY CORP.

TRS-80. Min size: Level I 4K memory; video monitor; cassette; power supply. Max size: Level II 48K up to 350K on-line via floppy discs; line printer; tractor feed printer and quick printer; floppy disc system. Modern, telephone interface soon available. Basic; some business packages. Level I aimed at the hobbyist and education market and Level II at small business applications. Hundreds of dealers. (Reviewed November, 1978.)

TRANSMON COMPONENTS

LA1. 1K monitor, 2K Basic in EPROM, full graphics capability; 128 character set; power supply; cabinet; 56-key keyboard. Expandable to 65K. Available from manufacturer (01-402 8137).

VECTOR GRAPHIC

48KB RAM, Z-80 micro: 63K bytes, mini-discs are standard. Options: graphics, Monitor, MDOS, Basic; business packages from dealers. Several distributors.

**Micro ADS**

8800 - 5 BUS.

32K Dynamic Ram Kit available in 16K form at £130 and only £200 for 32K

8800S The world's most powerful single-board 8800-9 computer kit. 16K version with keyboard £299.

Mini 8800 multi-board system from £127.50. All prices without VAT and post SAE for leaflets to: Hewart Microelectronics, 95 Blakelow Road, Macclesfield, Cheshire SK11 7ED.

For Sale: Edidy Sorcerer Computer. I can supply this little-used machine in its 8K, 16K or 32K versions. Only one available so phone now for details. Deal this little-used machine in its 8K, 16K or 32K versions. From manufacturer (0223 312919) and by selected dealers. Also available from Airamco (0294 65530).

**APPLE DISK USERS**

Are you looking for software that will handle the tedious chores of file creation, editing and retrieval, allowing you to get on with the real application work? Total package comprises 30K of programs. SAE for leaflets to: Hewart Microelectronics, 95 Blakelow Road, Macclesfield, Cheshire SK11 7ED.

8800 CPU System with PROM, RAM, I/O 199; Matching Hex Data/Address Display Unit 949; Matching Power Pack +5V, ±12V, ±24V 949; EPROM Eraser, little used £30; MS-80 405NL, 4Kbit Dynamic RAM Chips £1.99; 92222 suitable refresh control chip £1.99; S. Albans 6077 after 7pm.

**PRACTICAL COMPUTING**

November 1979
Prints 40 cps in 40 columns.
Plain paper, multiple copy.
Data storage — 168 characters.
Current Loop, RS.232
Parallel Bit inputs.
Double width printing selection.
OEM quantity price £295

**data systems**

**wh—19 intelligent terminal** £699 + VAT
- dedicated Z—80
- 25 x 80 format, upper/lower case
- function keys, numeric pad
- heavy-duty keyboard
- editing, scrolling, addressable cursor

**wh—89 integrated computer** £1380 + VAT
- all wh—19 features
- second programmable Z—80
- 16K RAM (expandable to 48K)
- 102K mini-floppy drive
dual drives optional)

Also available for wh—89: MICROSOFT BASIC and FORTRAN (requires 40K RAM)

MICRONEX provides custom hardware, software and turnkey system specification, design, development, installation and support. Also available: the complete Heath Data Systems range, including the DEC LSI—11 based system; ITHACA DPS—1 (£695); new Apple II plus improved colour (£899); SORCERER (£760); new PET with large keyboard (£630); RICOH RP—40 daisy wheel printer (£1900); and HEATH 132—column dot matrix printer (£510).

---

**Heath**

MICRONEX LTD
HARFORD SQUARE
CHEW MAGNA
BRISTOL BS18 8RA
027—589—3042

**Don't waste time just reading this — act now!!**

**Let us take care of your growing requirements for management information and operations control**

**Systems for accounting**
**Your payroll computerised**
**Stock control**
**Tailored software**
**Estimating and costing**
**Manufacturers' control systems**
**Specialists' systems**

**Decision making tools**
**Economic advice — free in fact!**
**Simple and efficient operations**
**Independently recommended hardware**
**Guaranteed results**
**Now — let us solve your problem!!**

**Contact us**

WE HAVE IT ALL — SO WHY NOT USE IT?
Logma Systems Design, Whewell Bldgs.,
2/10, Bradshawgate, BOLTON, Lancs.
Telephone Bolton 389854

**Micro & Mini Solutions**
**E.G. Packages available from £3,500**

---

**Don't waste time just reading this — act now!!**

**Let us take care of your growing requirements for management information and operations control**

**Systems for accounting**
**Your payroll computerised**
**Stock control**
**Tailored software**
**Estimating and costing**
**Manufacturers' control systems**
**Specialists' systems**

**Decision making tools**
**Economic advice — free in fact!**
**Simple and efficient operations**
**Independently recommended hardware**
**Guaranteed results**
**Now — let us solve your problem!!**

**Contact us**

WE HAVE IT ALL — SO WHY NOT USE IT?
Logma Systems Design, Whewell Bldgs.,
2/10, Bradshawgate, BOLTON, Lancs.
Telephone Bolton 389854

**Micro & Mini Solutions**
**E.G. Packages available from £3,500**
Operator
Bored, underpaid human with aching back - bad posture for data entry work - and two bad eyes. Also an operator is a symbol denoting a mathematical operation (like + for plus and - for divide) or a logical operation - they vary, but check Boolean algebra for some examples if you're really interested.

Opm
Operations per minute. A measure used only by appendectomy surgeons, American dp heavies, and glossary compilers.

Optical character recognition
Recognising characters by looking at them, or rather the machine equivalent. An OCR reader scans the surface of a sheet of paper, analyses the light patterns made by anything printed or written on it, compares that information to a known set of patterns, and transmits to the computer anything it recognises. Some clever OCR systems can recognise handwriting but most can read only typescript in a particular character formation.

Each letter of the alphabet obviously must be identifiable differently and this meant that the first standard OCR-readable script - it was called OCR-A - was characterised by ugly blobs and blocks on the letters. Film-makers and advertising agencies like to use this kind of script for the instant connotation of 'computer'. In fact, most OCR uses a much more ordinary, and more readable, script called OCR-B. It looks fairly normal; ordinary, and more readable, script most OCR uses have a kind of script for the connotation of 'computer'.

OS
Operating system. Several manufacturers have operating systems called - with singular lack of imagination - OS. The big IBM computers are a prime example; so are Interdata minicomputer operating systems.

Output
As a noun, it's what you get from a computer, sometimes given the blanket term "results". It is also a verb in which case it means transfer information from the computer to some kind of clever device - usually a CRT screen or a printer. Less common these days are paper tape or card punches. Esoterica will include graph plotters and electronic gnomes which convert computer data into some near-recognisable representation of the human voice.

OV
Abbreviation for overflow.

Overflow
The computer has to assume that internal work areas are a specific size. If it uses a 16-bit word, it probably uses accumulators - also called registers - which are eight or 16 or 32 bits long; that way it knows that anything inside that particular string of bits is relevant to the operation in question, and nothing else is. But what happens when the result of an arithmetic operation needs more bits than are in that accumulator? (try dividing 22 by 7).

Well, overflow is what happens. Your program might not be able to handle this. Perhaps your accumulator will contain the first eight (or 16 or 32 or whatever) bits of the answer and the rest will be lost. That generally happens in pocket calculators, doesn't it? Perhaps it will round-up the result. Or it might set aside a special 'overflow accumulator' to hold at least some of the overflowing number. Several computers will set a flag (or tell you the overflow has occurred, without letting you know where or why.

Overlay
Overlying is a popular technique used by the clever kind of operating system for bringing routines, generally called overlays, into main memory from disc or some other kind of mass storage during the execution of a program. With overlying, several overlay routines can occupy the same main memory storage locations at different times. The technique is used when main memory is not large enough to satisfy total storage requirements of a program.

The other widely-used method in operating systems is virtual memory. We shall reach this eventually but for the moment it is basically to have an automatic kind of overlaying - overlays are specified and controlled by the programmer. In virtual memory systems, the computer pretends to have a larger memory in a fashion not seen by the programmer.

Over-write
Another obvious one. It means to store information in such a way that it destroys whatever was previously stored there. Since disc, tape and internal computer memory are all reusable, it follows that re-using them - by storing new information - will overwrite their previous contents. One of the virtues of ROM will be equally obvious - you clearly can't over-write anything in read-only memory.

Pace
An early 16-bit micro from National Semiconductor.

Pack
Packaging is a way of compacting information to economise on storage space inside a computer. Usually it means lopping-off zeros and omitting spaces in data to be stored, replacing them with some kind of marker which takes-up less space. When the data is read subsequently, unpacking takes place and the zeros and spaces are re-inserted.

Package
In electronics, a package is what you have when you embed a chip in a block of plastic so that it can be used on a PCB, though that is usually called 'packaging'. You are more likely to meet this word when it is applied to software; a package is a program developed for a particular application which is designed to be usable by more than one person. This is normal outside computing, of course; you don't often find books designed to be read by only one person. Most applications software is custom-written to suit one user; that is because every computer user has different requirements, even in doing the same basic work.

An application package tries to be all things to all people. Or rather, it tries to be most things to some people. In theory, the user has a tried and tested program which is available more quickly and more cheaply than it would be if it had to be designed and written from scratch and if only he were bearing all its costs.

There have been problems in practice, of course. The package may not be flexible enough to cope with all the idiosyncrasies you require. It was probably written in the first place as a customised job for one user and tweaked subsequently to make its appeal more general. That might not be the best way of producing software; it has to be sufficiently general in its approach to appeal to many users. You may be paying for facilities you will never use and the software may be voluminous and inefficient when it is inside your computer.

The thinking on design of software packages usually means one of two compromises. Either you will amend your ways of doing things to suit the package - quick and cheap, or the package will be capable of amendment, perhaps by being initially a bare-bones framework on to which can be attached some custom...
A clever data transmission process
Software packages frequently are the
and they are not common either.
People who can design and develop
written routines to make it suit you
Circle No. 246
processed.
fixed-length
increase it to a fixed size. It is usually
set-ups, of course.
international
one end to the other. Here we are
before any information can pass from
telephone 'address', rather like ordinary mail.

The 80 s brain.
public telephone network
modem so that you can communicate
V-24 jack for connecting to a telephone
system, 16 K BASIC of ROM, graphic symbols.
Built-in graphic mode. Uses 64 different
Program memory. 16K bytes of RAM, 2K Monitor in ROM,
128 different sound
Cassette memory for storing programs
and data. Fast writing in both direc-
tions.

V-24 jack for connecting to a telephone
modem so that you can communicate
with other computer systems via the
public telephone network.

Page
Either a screen-full of characters —
or rather character positions on a
VDU; or chunk of storage, usually
defined fairly arbitrarily; 512 and
1,024 words are page 'lengths'
employed frequently.
Page printer
Compare fine printers, which print a
line at a time. Page printers generally
assemble a page of output in a small
internal memory and then put it out
very quickly.

Paging
A facility on some operating systems;
a procedure for transferring 'pages'
of information between disc storage
and main memory. Memory is
expensive and you may find you don't
have enough of it to hold the
programs and data you want. Disc
storage is much cheaper and your
operating system may allow you to
overcome the problem by swapping
chunks of information between disc
and memory — you are putting part
of the current contents of memory
temporarily on to disc and reading
into the space so freed a piece of
program or data you need. As
presented, this is overlaying; when it is
done automatically, it's paging.

With paging, pages of memory are
moved in and out at a time. Since this
is automatic, the programmer
doesn't have to know what is
happening and when. To the
programmer it looks as though the
total memory available is the capacity
of main memory plus whatever disc
storage there is. That is why paging is
also called virtual memory.

Paper tape
Long strips of paper. Usually people
mean punched paper tape when they
use the phrase, though punching
holes in it isn't the only way to store
information on paper tape — some
esoteric systems print dots on it,
impregnate it with chemicals to hold
data, and so on.

Punched tape is simple. A single
row of holes across the tape encodes
one character, rather as on punched
cards. Paper tape has one big
advantage over card, though — a
card normally has room for no more
than 80 or 96 characters. Paper tape
has no such restriction and you can
have blocks of characters up to any
length.

You will need the software to cope
with that. It is much easier to write
programs which expect information
in pre-defined record lengths of, say,
80 characters.

Page 152

Paper tape is cheap, less bulky than
cards, and can be read at speeds of up
to 1,000 characters per second. No-
one uses it much these days, though,
because it's messy — all those hole-
sized bits of paper fluff — and noisy
— paper tape punch is a fairly crude
mechanical device — and you have to
buy special hardware — the reader
and punch. Cassette or floppy disc
are much to be preferred if you can
afford them, principally because they
are so much faster and are more
difficult to tear accidentally.

Two exceptions spring to mind. There
are still hundreds of Teletypes around,
cheap and noisy terminals
which, frequently, have a built-in
reader/punch for paper tape, so you
might as well use it. Some older high-
speed printers also utilise pre-
punched paper tape, typically a loop
of it; this is being read while the
printing is proceeding and it
determines vertical format — when
to start a new page.

There is one largely-unexplored
and extremely flippant use for paper
tape, which incidentally is available
in several colours. Remember those
ticker-tape welcomes in New York
City which no longer seem to
happen? Well, ticker tape is paper
tape from teleprinters and that is
the same as a computer's paper tape.
INTEGRATED SMALL BUSINESS SOFTWARE
- ISBS -

FAST AND EASY TO USE ISBS MEANS INCREASED EFFICIENCY AND PROFITABILITY - PUT IT TO WORK FOR YOUR BUSINESS

- STOCK CONTROL
- ORDER ENTRY & INVOICING
- NAME & ADDRESS
- COMPANY PURCHASES SYSTEM
- COMPANY SALES SYSTEM
- GENERAL ACCOUNTING
- PAYROLL

ISBS

STOCK
CONTROL
ORDER ENTRY & INVOICING
NAME & ADDRESS
COMPANY PURCHASES SYSTEM
COMPANY SALES SYSTEM
GENERAL ACCOUNTING
PAYROLL

Packages supplied on floppy disk with easy to follow Reference Manuals — NO PREVIOUS COMPUTER KNOWLEDGE REQUIRED TO OPERATE. ISBS runs on 48K Northstar Horizon, Rair Black Box or other systems supporting CP/M* — plus VDU and 132 col printer. Complete suite or individual packages available now and are fully supported.

Other software packages available include Time Recording Systems, Finance Control and many others. Special application software undertaken for Northstar & Black Box and also complete TURNKEY SYSTEMS.

*CP/M registered trademark of Digital Research.
Costs shown exclusive of VAT.
Dealer enquiries welcome.

52 SHAFTESBURY AV. LONDON W1.
01-734-8862

CRAFFCOM

NewBear *Systems

WE SPECIALISE IN:—

APPLE II

FROM £810.00

* PURCHASE LEDGER £295.00
* SALES LEDGER £295.00
* GENERAL LEDGER £295.00
* WORD PROCESSING £50.00

LEDGER MANUALS AVAILABLE SEPARATELY @ £10.00 EACH

NORTH STAR HORIZON

HRZ-2.32 32K + DUAL DISK DRIVE £1480
HRZ-1.16 16K + SINGLE DISK DRIVE £1135
CP/M FOR HORIZON £115
PASCAL FOR HORIZON £70

THE ITHACA INTERSYSTEMS S100 MICROCOMPUTER

For education, industry, research and all professional uses, including hardware and software development, low cost OEM Systems, teaching applications etc.

+ Mainframe with front panel
+ 30 Amp 8v power supply
+ 20 slot motherboard with active termination and shielding between bus lines
+ Guaranteed operation at 4MHz

Price with 4MHz 280 CPU Board £695

Please send for details of the full range of Ithaca Inter/ systems S100 products.

FULL RANGE OF VDU’s AND PRINTERS

HEAD OFFICE & MAILORDER:
40 Bartholomew Street, Newbury, Berks.
Tel: 0635-30505 Telex: 848507 NCS

NORTHERN SHOWROOM:
220-222 Stockport Road, Cheadle Heath, Stockport.
Tel: 061-491 2290

TERMS

Official Orders Welcome.
Please add 15% VAT on all prices.
Barclaycard and Access Welcome.
Send or Phone (0635-30505) for Catalogue and Booklist.

PRACTICAL COMPUTING November 1979

• Circle No. 248

• Circle No. 249
SOFTWARE FOR TRS-80
Level II 16K

CASH/BANK ANALYSIS
A really practical program designed by accountants to take the drudgery out of incomplete records.
Cassette and superb operation manual £46.00

VAT REGISTER
Input and output Register
Cassette and Manual £17.25

SMALL TRADERS SPECIAL
Cassette and Manual £46.00

CASH/BANK ANALYSIS
Leven! 16K
FOR TRS-80

SOMETHING COMPLETELY DIFFERENT
with instruction sheet
special high frequency test tape. Complete
troubles start. Check the alignment with our
should be precisely perpendicular to the
the angle of the record/playback head, which

CLOADING PROBLEMS?
Perhaps it’s the azimuth adjustment. This is
the angle of the record/playback head, which
should be precisely perpendicular to the
motion of the tape. It very often isn’t, and then
troubles start. Check the alignment with our
special high frequency test tape. Complete
with instruction sheet £4.60

ONE FOR THE CHILDREN
Even in this exciting computer age, teachers
agree that TABLES STILL MATTER! Our
Teach yourself tables program, devised by a
teacher makes it fun. Just £5.75

SOMETHING COMPLETELY DIFFERENT
Not a program but an audio tape. ‘The Petrol
Saver’ dozens of hints and tips on saving fuel,
which means saving cash £3.45

(NOTE: Analysis, VAT, and Scheme D
require Line Printer)

All prices include VAT and post and packing.
Programs written to order.
High speed cassette duplication (Customers
must produce evidence of Copyright)
(Callers by appointment only please)

Alan Ford + Company
PHOENICE HOUSE, GREAT BOOKHAM, SURREY

SOFTWARE PACKAGES FOR:
DIABLO, ELBIT & TEXAS PERIPHERALS.
SOFTWARE PACKAGES FOR:
STOCK CONTROL
ACCOUNTING AND VAT
CLIENT INFORMATION & MAILING
BUDGET CONTROL
CAR STOCK BOOK
IMPORT CONTROL
PAYROLL
‘LOCATE-A-CAR’ SYSTEM, ETC.

50, Chislehurst Road, Orpington,
Kent.
Tel: Orpington 26803

* Circle No. 250

PRACTICAL COMPUTING November 1979
We’ve pioneered the west!

We’ve opened up the west of London and if you’re local to the Ealing area that can only be good news for you. We stock all the big names—Commodore, PET, Apple and Nascom. We have the knowledge and expertise to provide a software package or business system that’s right for you plus a comprehensive maintenance and engineering back-up service. Call in for more information or a demonstration. (We also sell a wide range of tapes and books.)

Adda Computers, 17-19 The Broadway, Ealing, London W.5. (between W.H. Smiths and Burtons)
Telephone 01-579 5845
Open 09.00-18.00 Monday to Friday; 10.00-16.00 Saturdays.

**Adda** we add up to a great deal.

---

**CENTRALEX**

**LONDON**

**TRANSLATOR**
An instant translator of words and phrases from the world’s major languages.
Use this amazing Hand Held Microcomputer translator as a
- Personal interpreter when you travel
- Quick reference to most often needed phrases
- Metric system converter
- Calculator
Basic Unit £170 (including six languages, re-charger, and carrying case). Each additional Language Module (for more extensive vocabulary) £34 – French, Spanish, Italian, Greek & German. Calculator Module £24.
The above prices include VAT and delivery nationwide.

**MICROCOMPUTERS**

APPLE
EXIDY SORCERER
ITT 2020
HORIZON
Full support for Hardware and Software.
Twelve months parts and labour guarantee.
Maintenance contracts.
Part exchange welcomed.

**PRINTERS & VIDEO MONITORS**

Printers:
- Centronics
- Integral
- Teletype

Video Monitors:
- Hitachi
- Sanyo

**SOFTWARE- PROGRAMMING-TRAINING**

Software
A comprehensive range of programmes and software packages are available (Sales Ledger, Purchase Ledger, Payroll, VAT, Data Base System, Word Processing, COBOL, Fortran, Stock Control, Medical Records, Educational Programmes, Estate Agents, Hotel Reservation System, School Administration, Building Maintenance, Project Management, Statistical, Mathematical, and Engineering Programmes, etc)

Programming
Systems Analysis, Design, and Programming support available.

Training
Courses on Microcomputer Appreciation, Programming, and Systems Design are frequently held.

Free Delivery Nationwide – Credit Cards Accepted – Terms Arranged
Centralex-London Ltd, PO Box 111, Sidcup, Kent DA15 7NY (Callers by appointment only)
Telephone: 01-309 7799 01-300 0380

---

* Circle No. 253

---

PRACTICAL COMPUTING November 1979
APPLE II EUROPLUS IS AVAILABLE NOW, AT A BIG SAVING, FROM

Microwave Computers

1133 Hessle High Road Hull HU4 6SB
Telephone (0482) 562107

APPLE II

16K RAM £830 £750 + VAT

(delivery charged at cost)
also pet and microstar main dealers

* Circle No. 255

SIRTON PRODUCTS

13 Warwick Road
Coulson
Surrey
Tel: 01-660 5617

MIDAS S100 SYSTEMS
Substantial Mainframe to house your S100 system, with optional
5in. or 8in. disc drives. Special systems built to your requirements
from Z-80 CPU and other S100 boards held in stock.
Mainframes from £228
MIDAS 1: Z-80 System from £625 (built)
MIDAS 2: Z-80 5in. Disc System from £1,100 (built).
MIDAS 3: Z-80 8in. Disc System from £1,300 (built).

ITHACA INTERSYSTEMS DPS 1
Professional versatile computer system with comprehensive front-
panel facilities and 20-slot motherboard. Units have substantial
power supply etc. and come with 2 or 4 MHz Z-80 CPU. BUS
conforms to the IEEE S100 standard.
DPS.1 from £695

COMPREHENSIVE RANGE OF S100 BOARDS AND SOFTWARE STOCKED
from
ITHACA INTERSYSTEMS · S D SYSTEMS · GODBOUT · CROMEMCO ·
ECT · SSM · Etc
Write or Phone for Catalogue

* Circle No. 256

PRACTICAL COMPUTING November 1979
WORD PROCESSOR
COMPLETE WITH PRINTER
FOR £1,195

Based on TRS-80 Level II, 12in. wide screen, 64 characters (A4) wide, upper/lower-case, superb Electric Pencil software, Anadex 8000 dot matrix printer or Qume daisy-wheel printer (option).

General business software also available to run on the above system.

Complete with Anadex printer 16K £1,195
As above with expansion box & 48K £1,445
Qume daisy printer in lieu Anadex £995
Dual floppy disc drives £575

All prices ex. VAT.

Phone/write for further details or demonstration.

LONDON COMPUTER STORE
43, GRAFTON WAY, LONDON W1.
Tel. 01-388 5721.

* Circle No. 257

EQUINOX 300

A powerful multi-user multi-tasking multi-language 16-bit microcomputer time-sharing system

supporting
• BASIC
• LISP
• PASCAL
• Floppy discs
• Hard discs

including a powerful Text Formatter, Assembly Language Development System and disc-based Sort utilities.

Priced from under £5,000

Write or phone for further information.

EQUINOX COMPUTER SYSTEMS LTD
“Kleeman House” 16 Anning Street, New Inn Yard, London EC2A 3HB.
Tel: 01-739 2387/9. 01-729 4460.

* Circle No. 258

If you are looking for amusement arcade type games, with lots of bangs, flashes and aliens — our software is definitely not for you!

Games for Super Intelligent People!

Our Games require thought, imagination, intelligence and creativity. If you want your mind stretched — look no further!

“Eleusis” is a card Game unlike any other. It involves your skills of inference, and makes such Games as Mastermind, simple. With over 100 variations, this game will “stretch” you over the winter (£15). “Sucker” is a Game you have never seen before ... with equal chances, the computer will beat you in prediction ... you will have to be good to discover how ... exceptionally good to work out why! (£10). “Anticipation” is a new card Game involving strategy for between 1 and 3 players. Very exciting and elegant (£10). We have a range of Business Games, suitable for PET, APPLE 11/ITT 2020 and TRS-80 (II) ... write now for more details.

Training modules

We have a wide range of training modules on cassette ... “Break-even” teaches the fundamentals of Break-even Analysis (£10) ... Management Activity Analysis (£10) enables you to compare your own work pattern and attitudes with those of other professionals ... Management Style Orientation (£10) gives you an in-depth look at the way you supervise others ... Interpersonal Orientation (£15) is a very detailed analysis of your strengths and weaknesses in relation to other people. (All prices include VAT + P&P).

Business Applications

If you advertise and sell “off-the-page” or use Direct Mail, our AMORE program is certainly going to interest you. Simply write for details.

PET □ APPLE II □ TRS.80 □

/ ENCLOSE:

CHEQUE/POSTAL ORDER NO.
BARCLAYCARD NO.
ACCESS CARD NO.
NAME
ADDRESS

Phone in your Access/Barclaycard Number on 026 57-71220 or complete this order form

Rathlin Island Software,
Ulster Management Centre,
Manor House, Rathlin Is, Co Antrim

* Circle No. 259
GILBERT COMPUTERS

Gilbert Computers believe in the NEW MZ THE
- IMPECCABLY-ENGINEERED
- MODESTLY-PRICED
- BIG-HEARTED, COMPLETE MICROCOMPUTER

It is what we, and you, have been waiting for to solve the problems of the smallest business. You will be able, without specialist knowledge, to quickly and effortlessly handle your stock control, accounting, VAT records, invoicing and other chores.

This, too, from the equally exciting

COMPUCOLOR II

with its dazzling colour graphics.

...And they can both be absorbing and educational.

Give your children the tools of the future.

Provided locally from centres in Market Harborough and Swindon by Gilbert Computers the ONLY suppliers offering these AND

* FREE initial demonstration and explanation at your office, shop or home with no pressure to buy
* Inexpensive tailor-made program service
* Equipment maintenance contracts available
* Credit facilities

Call or write for further details

GILBERT COMPUTERS

Old Hall Lane,
Lubenham, Leics. LE16 9TJ 0858-65894

Cassette Duplicating Supplies

Blaylynn Ltd.

OFFER YOU A COMPLETE RANGE OF

COMPUTER CASSETTES

Any Length Produced to Order
Any Quality Supplied
With or Without Labels or Cases
Top Quality Guaranteed

REALISTIC PRICES
10 C12 for 18.0p each
100 C12 for 16.5p each

Contact
FRANK WHIPP
Tel: 01 - 540 0707

Blaylynn Ltd.

OFFER YOU A COMPLETE RANGE OF

COMPUTER CASSETTES

Any Length Produced to Order
Any Quality Supplied
With or Without Labels or Cases
Top Quality Guaranteed

REALISTIC PRICES
10 C12 for 18.0p each
100 C12 for 16.5p each

Contact
FRANK WHIPP
Tel: 01 - 540 0707

GILBERT COMPUTERS

Old Hall Lane,
Lubenham, Leics. LE16 9TJ 0858-65894

Mind your own business...

...with a Bondain Book-keeper.

The Bondain Book-keeper brings big business benefits without breaking budgets.

Whatever your problem we've got a complete solution you can afford.

The Bondain Book-keeper includes complete systems for Stock-Control, Invoicing, Sales Ledgers, Statement Preparation, Debt Dating, Purchase and Nominal Ledgers.

Head Office:
Sumlock-Anita House
15 Clerkenwell Close
London EC1R 0AA.
Tel: 01-253 2447/8
Telex: 299844

See us at the International Business Show
OCT 23rd - NOV 1st
NEC BIRMINGHAM
HALL 2 STAND 739
Get it right...

The right machine PET

The right programs

Computastore

**PAYROLL**. This flexible PAYROLL system makes wage calculation fast, easy and accurate. It prints payslips, totals, coin analysis, and year end totals. Updates for tax and NI changes available.

**PETE** Go on-line with this unique software package which turns your PET into an intelligent RS-232 terminal with user definable transmission parameters.

**ASSEMBLER** Really fast Assembler written in machine code, assembles up to 500 lines per minute on the Commodore Disk. It allows 200 symbols on an 8K PET (1000 on larger PETs).

**DISASSEMBLER** Can even display the PET’s ROMs, and search them for strings of characters or patterns of hexadecimal bytes. Outputs to screen or printer.

**KEYBOARD** Big keyboard terminal or printer (e.g. TTY 43) can now be used as a dumb terminal for keying in BASIC programs or data for your PET. The PET can even be in a different location! Also, speeds up data entry for 8K PET owners with keyboard/printer.

Cassette and Commodore Disk versions available for old and new ROM PETs.

---

Ask your local PET dealer or Computastore for a demonstration
Computastore Ltd, 16 John Dalton Street, Manchester M2 6HG Tel: 061-832-4761.

PRACTICAL COMPUTING November 1979
HOW TO SOLVE SYSTEMS PROBLEMS
WITHOUT HAVING TO WATCH YOUR LANGUAGE
ZILOG'S MCZ FAMILY. FROM AROUND £4000

The MCZ computer family using Zilog's famous Z80 CPU can solve your problems (or your customers' problems) more efficiently and economically than ever before.

Just look at what Zilog offer.

To start, the Zilog system is multi-lingual. Every model has a full five language capability. You can move your programs in any language up and down the family at will.

- Pascal. Rapidly becoming a favourite.
- Cobol. For business use — and it's the highest level implementation of Cobol available on a computer in this price range.
- Fortran. Outstanding performance for scientific use at an attractive price.
- Basic. Zilog's version has been extended for both business and scientific applications.
- PLZ. Zilog's own family of systems implementation language.

The key to the MCZ family's success is it's RIO operating system with features normally found only on very high priced computers.

- Device Independent I/O
- Mid-file record insertion or deletion
- Interactive and batch command input
- Full set of utilities
- Macro assembler
- Text editor

The range includes the MCZ 1/05 — a low cost floppy disk model, the table-top MCZ 1/20 or MCZ 1/25 rack mounting floppy disk computers and the highest performer, MCZ 1/35 cartridge disk version with 10 MBytes of storage.

Zilog UK Ltd, Babbage House, King Street, Maidenhead, Berks. Tel: Maidenhead (0628) 36131. Telex: 848609.

Welcome to tomorrow's world

For full details of all you need to stay well ahead in tomorrow's world, call Zilog. Now.

Software packages available now include order entry, payroll, purchase, sales and nominal ledgers, stock control, formatting and many more.

To back this up, Zilog offer full maintenance on software and hardware.

For practical computing November 1979
Sumlock Electronic Services (M/cr) Ltd.
Petsoft and Commodore Software Stockists

Petact business programs demonstrated during business hours

Plus all these add-ons for your PET 2001

Printers
- Teleprinter 43 with keyboard £395.00 Current
- Teleprinter 43 without keyboard £370.00 Current
- PET 2023 £560.00 No further orders
- PET 2022 £645.00 Orders accepted

Floppy Disk Unit
- PET 2040 £795.00 Current
- PET 2023 £129.95 Current
- PET 2022 £875.00 Current
- ANADEX with PET interface £35.00 Current
- AXIDM MICRO PRINTER £7.72 Current
- AXIDM GRAPHICS PRINTER £74.99 Current
- TEXAS 810 £995.00 Current
- PET DUSTCOVERS (Plain) £6.00 Current
- PET DUSTCOVERS (Printed) £6.50 Current

(Commodore Approved)

PET/BASIC training manuals available from £3.00

Sumlock printer interface IEEE to RS232c from £100.00
- £995.00 Current
- £970.00 Current
- £550.00 No further orders
- £645.00 Orders accepted
- £700.00 Current

Circle No. 265

INTEX DATALOG LTD
AGENTS FOR:

COMMODORE

APPLE II

PETSOFT

PET/BASIC training manuals available from £3.00

PET DUSTCOVERS (Printed) £6.50 Current

Circle No. 266

INTEX DATALOG LTD
AGENTS FOR:

COMMODORE

COMPUTHINK

APPLE II

PETSOFT

PET/MICROCOMPUTER

PET 2001-4 £400.00
PET 2001-8 £500.00
PET 2001-16N £675.00
PET 2001-32N £795.00

KIM MICROCOMPUTER

KIM 1 £189.95
KIM 3 £129.95
KIM 4 £89.95

CASSETTE DECKS

PET C2N £56.00

FLOPPY DISKS

C64 (2X) £799.00
COMPUTHINK 400K (OLD ROMS) £795.00
COMPUTHINK 400K (NEW 16K) £840.00
COMPUTHINK 800K (NEW 16K) £950.00

MEMORY EXPANSION

EXPANDAPET 24K £320.00

PRINTERS

PET 2022 £550.00
CBM 3022 £648.00
ANADEX DP9000 £876.00

TELETYPE 43- WITH KEYBOARD £875.00
TRENDCOM 100 INTERFACE (EXTRA) £263.00
CENTRONICS 779 £885.00

AXIDM MICRO PRINTER £305.00 Current
AXIDM GRAPHICS PRINTER £749.00 Current
TEXAS 810 £995.00 Current
- FROM £1480.00

CABLES ETC.

IEEE TO PET CABLE £20.00
IEEE TO IECE CABLE £25.00
DUST COVER £7.50
NEW ROM SET FOR 8K £26.50
TELETYPE 43 RIBBON £7.72
ANADEX DP9000 RIBBON £4.52
PR-40 RIBBON £5.00

APPLE MICROCOMPUTER

16K APPLE £630.00
32K APPLE £920.00
48K APPLE £1070.00

ADDITIONAL MEMORY

16K BLOCK £90.00

ROM ADDITIONS

APPLESOFT £110.00
PROGRAMMERS AID £40.00

FLOPPY DISK

SHUGART 5 1/4in 168K CAPACITY £425.00

ACCESSORIES

CARRYING CASE £25.00

INTERFACES

TV/VIDEO INTERFACE (PET) £35.00
BAILEY OMN-DIRECTIONAL (P) £106.00
BAILEY BI-DIRECTIONAL (P) £180.00
BAILEY PARALLEL (P) £45.00
TNV 2003 BI-DIRECTIONAL (P) £170.00
TRENDCOM (P/F) £49.00
LIGHT PEN (A) £156.00
PRINTER OR SERIAL CARD (A) £110.00
CENTRONICS PRINTER CARD (A) £125.00

DISKETTES

SINGLE SIDED 5 1/4D (BOX 10) £30.00
DOUBLE SIDED D/D (BOX 10) £30.00
DISK LIBRARY CASE (HOLDS 10) £3.15

CASSETTE TAPES

C-20 BLANK CASKS IN CASES £0.40

PAPER

TRENDCOM ROLL PAPER £2.50
W. COL. ANADEX (LENGTH 1) £10.00
122 COL. (E) TELETYPE 43 £29.00
AXIDM ROLL PAPER £32.00
PR-40 ROLL PAPER £1.95

MANUALS

101 WORKBOOKS (SET 61) £18.00

PLEASE ADD 15% VAT TO PRICES SHOWN (UNLESS MANUALS)

INTEX DATALOG LIMITED,
EAGLESCLIFFE INDUSTRIAL ESTATE,
EAGLESCLIFFE,
CLEVELAND,
TS16 OPO.
TEL. 0642 781193
TELEX 58252

Personal Computer World Show
MEET THE LITTLE GENIUS AT STAND A9

If you find self-instruction manuals difficult to follow, come and meet our Little Genius.

Little Genius floppy diskettes are the fastest, easiest way to master your micro.

Little Genius will save you time and effort, teaching you to exploit all your micro’s facilities.

For a free demonstration of our first two courses visit Stand A9 at the PCW Show or phone Peter Brown on 01-580 6361.

Circle No. 265

Circle No. 266

Circle No. 267
U. K. — Micro Supplies — SCOTLAND 03374-795

FLOPPY DISCS MICROPOLIS

1041-11 315K drive + controller
  Cable + BASIC, ASSEMBLER,
  + EDITOR only  £595.00
1015-11 315K drive — add-on
  other products on application
  DS525-10 Pack of 10 5¼ in. floppy disk  £29.00

S100 BOARDS

SD Sales 32K Ram 375 ns Assm. + tested  £395
JADE Z80 2 mhz Assm. + tested  £140
MIKOS 15 slot Mother Board Assm. + tested  £110
MIKOS 2 Parallel/2 Serial Assm. + tested  £130
MIKOS 16K Krom (No 2708's) Assm. + tested  £110
MIKOS Extender Board Assm. + tested  £47
MIKOS Real time clock 2 interrupt Assm. + tested  £120
DSEL P.S.U. Kit + 8v ±16v 4A Assm. + tested  £175

V. D. U. S LEAR SIEGLER

ADM 3A Introductory Offer  £550.00
Hard disks 5-36 M6 POA
Volume discounts *special offer*

SOFTWARE

V. D. U. S LEAR SIEGLER

CP/M for Micropolis  £90
MACRO for above  £60
TAILORED Software for all applications

PRINTERS CENTRONICS

Centronics 779  £750.00
Centronics 701  £1210.00
Centronics 703  £1894.00

PRINTERS CENTRONICS

FULL SERVICE & BACK-UP FACILITIES AVAILABLE
Telephone for all Non-Listed items
OEM & DISCOUNTS on Application

DATA SYSTEMS SUPPLIES LTD.
SHORE HEAD ROAD, INDUSTRIAL ESTATE,
NEWBURGH, FIFE, SCOTLAND.

03374-795

• Circle No. 268

Micro-Facilities

127 High Street
Hampton Hill
Middlesex TW12 1NJ
01-979 4546
01-941 1197

MIDDLESEX & SW LONDON

As dealers for North Star Horizon and Commodore PET
Microcomputers we provide a fully comprehensive service for all
types of user:  * Personal  * Business  * Education  * Industry  * Scientific
We offer both a large range of software and the choice of
supporting peripherals.

Software Packages
Sales Ledger  Purchase Ledger
General Ledger  Stock Control
Incomplete Records
Loan Accounting  Mail Order
Payroll  Job Costing
Text Processing  CP/M

Systems & Programming
A professionally experienced team
of consultant analysts and
programmers offer you a complete
service for specifying, designing,
writing and testing programs to your
exact requirements. Our packages
can be tailored to your needs at
very low cost. Our programmers can
write in BASIC, COBOL, RPG, or
FORTRAN.

Financing
In addition to purchasing, we offer
you the choice of Rental, Leasing or
H.P. (subject to references).
Furthermore if you already have a
micro system then why not ask us
about part exchange.
Commodore PET computers are
available for hire from £4.75 per
day, disks interfaces and printers
are extra.

If you have a computer problem then ask Micro-Facilities for the solution.

NORTH STAR HORIZON

COMMODORE PET

• Circle No. 269

PRACTICAL COMPUTING November 1979
**THE VIDEO KEYBOARD**

- 72 key ultra-reliable contactless capacitive keyboard with cursor command keypad
- RS 232/V24 serial I/O up to 9600 bauds
- Composite video output for monitor or modified TV
- Built-in mains power supply

Although low-cost, the Video Keyboard is OEM built in the UK using only top-quality components. Other low-cost products use cheap, low MTBF contact-switch keyboards. The Video Keyboard uses the same professional quality ultra-reliable contactless keyboard used by top-flight UK terminal manufacturers.

### DETAILED SPECIFICATION

**MODEL VDP 10**

**VIDEO**
- One page memory
- 64 characters per line: 16 lines per page
- Full 128 ASCII character set
  - 96 upper and lower case characters
  - 32 control symbols
- Comprehensive cursor controls
  - Left/right/up/down CR/LF Clear/home/line-erase
- PROM translation of inbound characters, giving:
  - Programmable coding for cursor commands
  - Programmable display control for each input code
- Cursor command codes can be displayed using:
  - 'Display' key for protocol debugging
    - V24 input bit 8 under remote software control
- European compatible composite video out for:
  - TV monitor, or Modified TV set.

**V28 I/O**
- High/low rates externally switchable and jumper selectable from:
  - 9600/4800/2400/1200/600/300/150/75 bits/sec.
  - 220/110 bits/sec. (NOTE: at high receive speeds, remote software should allow 8.3 ms for CR, LF and 132 ms for Clear)
- Odd, Even or No Parity
- Full duplex or local mode
- One or two stop bits
- V24 serial I/O using standard 25 pin socket.

**KEYBOARD**
- 72 key ultra-reliable solid state contactless keyboard
- Standard ASCII layout plus programmable cursor control keypad
- QWERTY standard
- Full N key rollover
- Caps Lock with LED for TTY compatibility
- Repeat key.

**MAINS POWER SUPPLY**
- Built-in — needs 220-240V 50Hz.

### CABINET
- Tailor-made to house all electronics, keyboard, video and V24 sockets, switches and power supply.

### SWITCHES
- Power on/off
- On-line/Off-line
- Baud Rate Select
  - Medium/High/Low Normally set to 9600/1200/300
- Display Key
  - Displays control characters for easy protocol debugging

**AVAILABLE IN TWO VERSIONS** (Monitor/converted TV not included).

- Complete Video Keyboard . . . . £230+VAT (UK p&p paid)
- Stripped Video Keyboard . . . . . £190+VAT (UK p&p paid)

[stripped version excludes case, case hardware (switches, plugs), 240/9-0-9 VAC transformer but otherwise complete and tested]

Both versions are brand new with comprehensive manual and 12-month warranty.

**DATA PRECISION (Equipment) LIMITED,**
81 Goldsworth Road, Woking, Surrey GU21 1LJ
Tel: Woking 64444/67420 Reg. in England No. 913775

Please send me:
- Complete Video Keyboards @ £264.50 each, inc. VAT and UK postage and packing
- Stripped Video Keyboards @ £218.50 each, inc. VAT and UK postage and packing
- Video Keyboard Manuals @ £2 each, inc. postage and packing (free with Keyboard)

[ ] I enclose my cheque
[ ] Charge to my VISA/ACCESS/DINERS Card

£Not VISA

Name: ____________________________

Address: ____________________________

Signature: ____________________________
PET

Pet 2001
From £345
NEW PET 2001 with large keyboard.
From £630.00

PET 2001-16N (16K RAM and New Large Keyboard) £630.00
PET 2001-32N (32K RAM and New Large Keyboard) £750.00
PET 2001-1 (Standard PET with 4K memory) £435.00
PET 2001-8 (Standard PET with 8K memory) £515.00
PET 2040 (Dual Drive mini-floppy 343K User Storage) £745.00
CBM 3022 (80 col. Printer with PET graphics--tractor feed) £605.00
IEEE/RS232 Serial Interface 'A' Output only £105.00
IEEE/RS232 Serial Interface 'B' Output only £186.00
IEEE-488/ Centronics type parallel Interface £45.00
PET CZN External Cassette Deck £53.00
Interface to $100 (4 slot motherboard) £112.00
IEEE to Pet Cable £19.00
IEEE to IEEE Cable £24.00

Sorcerer

Now with the $100 Bus Expansion Interface and Dual Drive mini-floppy disk
Sorcerer 16K RAM (inc.UHF Modulator) £740.00
Sorcerer 32K RAM (including UHF Modulator) £840.00
Exidy Video Monitor (High Resolution) £240.00
Exidy Dual Drive mini-floppy Disk (630K storage) £1195.00
Exidy $100 Bus with Interface +Motherboard +PSU £200.00
Exidy Mini-floppy Drive Disk (143K Storage) £495.00
CPM for Sorcerer on Disk £145.00

APPLE II/ITT 2020 /EUROAPPLE

Computer with PALSOFT in ROM (16K RAM) B/W £795.00
Computer with PALSOFT in ROM (16K RAM) Colour £895.00
Apple mini-floppy Disk Drive (116K storage) £425.00
Parallel Printer Interface Card £110.00
High Speed Serial (R232C) Card £110.00
RAM Upgrade (16-32K, 32-48K) £85.00
ITT 2020 & EUROAPPLE Authorised Dealers

Advanced Systems

Altair, Equinox, Billings, Heath, Rair, Horizon,
Installations to include hard disk, and multi tasking
P. O. A.

Terminals (Most Brands)
Pentland V1, 80 char./24 lines 2 page memory £550.00

Ansbacab 'PhoneMate' Telephone Answering Machine, voice operated twin cassette £190.00

Software

Petsoft COMPUSSETS Personal Software

Lifeboat Associates (Authorised Dealerships, Send for Catalogues)
PILOT (for TRS 80) text oriented language £18.00
CONIAO – Computerised Accounting for TRS 80 £50.00
STOCK CONTROL (TRS 80) Inventory, P/O & Invoicing £125.00
CPM for TRS 80 £95.00
CBASIC for TRS 80 & Sorcerer £75.00
Estate/Employment Agency Systems, Fortran 80, Cobol 80, Pascal Etc.

Etc.
Diskettes 5½ (blank) boxed (min. order 10) each from £3.00
C12 Cassette (Min. order 10) each £0.41
CBM KIM 1 Microcomputer System £94.00
Computalker Speech Synthesis for $100 £350.00
Books – Large range of Microcomputer related books & magazines.

If you don’t see it – ask if we have it.

T & V JOHNSON (MICROCOMPUTERS ETC) LTD.
Member of the TV Johnson Group of Companies
165 London Road, Camberley, Surrey GU15 3JS
48 Gloucester Road, Bristol BS7 8BH
148 Cowley Road, Oxford OX4 1JJ

Branches at: Birmingham, Bristol, Edinburgh, Leeds, London, Louth,
Newmarket, Nottingham, Oxford, Byfleet, Wokingham.

For Hardware, Software, Peripherals, Consultancy and Competitive Prices.
Everything you always wanted to plug into your PET,
APPLE or TRS-80*

TRS-80

HARDWARE

DOUBLE DENSITY DISK STORAGE
FOR THE TRS-80
(220% capacity of Radio Shack's)
TRS-80 owners can now increase their on-line mass storage capacity to 200K bytes. How? By using the 77 track
Micropolis model 1023-II dual drives.
Cost: only £1195 for two drives, to give 394K on-line.

How does it work? By writing on 77 tracks (instead of the
conventional 35) with precision head positioning.
How do I use it? TVJ Microcomputers Etc. provides you
with a special program to let your TRS-80 DOS know there
are extra tracks. This program was written especially
by Randy Cook, author of TRS-80 DOS.

Will the double density disk work with my Radio Shack
drives? Yes, except of course for copying an entire 77 track
disk to a 35 track drive.

NEW

Radio Shack Voice Synthesizer for TRS 80 provides the
ability to speak in English and limited foreign languages.
Capable of producing 62 phonemes (sound units) that are
the building blocks of spoken language. Includes audio
amp and speaker.

£345.

TRS 80 Printer Interface Cable - allows you to connect a
parallel printer (e.g. Centronics 700 series) directly to your
Level II Keyboard, i.e. Expansion Interface not required.

£69.

TRS 80 Numeric Keypad Mod. - Calculator Style Numeric
Key pad which sits to the right of the standard keypad; has editor, and linking loader.

£244.

Radio Shack Microprinter for TRS 80, 40 column 2½”
NEW DOS- As above but with further facilities: KBFIX,
electro static Printer, switch selectable RS232 Centronics
RENUN, Screen to Printer one step, DOS commands from
Parallel and TRS 80 BUS Interfaces.

£245.

TRENDCOM Printers for TRS 80, PET or APPLE. 40 cps, to end of
40 column Thermal Printer

£243.

TRS 80 Interface for Trenend com Printer

£79.

PET/APPLE Interface for Trenend com Printer

£49.

PET

APPLE

SPEECHLAB - provides voice control for the Apple. Train
Your Apple to understand and act upon the spoken word
(incl. microphone).

£165.00

REAL TIME CLOCK - 1/1000 sec. to 388 days with
interrupt;
Software controllable, Rechargeable Battery back-up when
A/C power off.

£165.00

GRAPHICS LIGHT PEN

£165.00

PASCAL CARD - Powerful new language for the Business
User.

COMMUNICATIONS CARD, allows APPLE to exchange
data with a remote computer over ordinary telephone lines
through a modem

£140.00

AC line controller - allows APPLE to monitor and control
AC devices remotely.

£270.00

T & V JOHNSON (MICROCOMPUTERS ETC) LTD.
Member of the TV Johnson Group of Companies
165 London Road, Camberley, Surrey GU15 3JS
48 Gloucester Road, Bristol BS7 8BH

Branches at: Birmingham, Bristol, Edinburgh, Leeds, London, Louth,
Newmarket, Nottingham, Oxford, Byfleet, Wokingham.

* Circle No. 271

PRACTICAL COMPUTING November 1979

DATA MANAGEMENT/REPORT GENERATOR - easily
formats disk files, allows entry, edit, delete & list of
records; and retrieves data for display or calculation on
screen or printer.

£200.

ELECTRIC PENCIL - powerful word processor allows full
cursor movement, insert/delete, string search, block move-
ment, adjustable line length, justification (on cassette). £65.
LOWER CASE MOD KIT FOR ABOVE

£28.

DISK BASED WORD PROCESSING PACKAGE, £124.95
RSM:2D DISK MONITOR - powerful system manipulates
disk data, has Z-80 breakpoint routine.

£25.

ESP-1 EDITOR/ASSEMBLER

£29.95.

RSM: MACH, LANGUAGE MONITOR, £23.95
DCV DISK CONVERSION UTILITY - use with TAPE-
Disk utility to save system tapes on disk (i.e.) Pencil. £9.95

UTILITY PACK 1 - a) Libloader merges from tapes
b) Renumber (spec. mem. size); Statement analysis for
debussing.......... £9.95 ea. all 3 for £24.95

SARGON CHESS - 16K IV II - the 1978 champ

£14.

library 100 - an assortment of 100 programs for

£39.

MAZE - random maze on the TRS-80 graphics.

£14.

MICROSHEC 1.5 by Jennings - 4K any lev

£14.

LIBRARY 100 - an assortment of 100 programs for

£39.

UTILITY PACK 1 - a) Libloader merges from tapes
b) Renumber (spec. mem. size); Statement analysis for
debussing........... £9.95 ea. all 3 for £24.95

NEW DOS - TRSDOS with corrections & enhancements

£170.

FORTAN IV FOR THE TRS-80 Finally, for high speed
calculations on your micro, MICROSOFT'S FORTAN can
now be used on the TRS-80.

£170.

RSM-2D DISK MONITOR - powerful system manipulates
disk data, has Z-80 breakpoint routine.

£14.

CONTINUOUS DATA BASE - a) RSM-1D Disk

£54.

EDUCATION PACK: A variety of programs for

£15.

BASIC, Level

£39.

JOYSTICK PACKAGE - complete with connector, soft-
ware, instruction.

£39.95 single,

£59.95 dual.

MICROCHEC 2.0 by Jennings

£14.

ASTROLOGY/NATAL PACKAGE - sophisticated chart
computation with PET graphics

£14.95

SUBS - best graphics yet - drop depth charges on the subs
below you and rack up points. Complete adjustability for
many same variations

£19.95.

SUPER MAZE - 2 games in 1: Tunnel vision lets you travel
through the maze in perspective with graphics, also Kat'n'
mouse chase

£19.95.

74 COMMON BASIC PROGRAMS on 1 tape

£15.

19 different games at

£9.95

PETACT BUSINESS SYSTEMS

P.O.A.

£39.

£14.

£54.

£14.

£14.

£14.

£14.

£14.

£14.

£14.

£14.

£14.
We take the confusion out of micros and make them work for you in your business.

We provide a flexible approach by utilising wide ranging, standard and compatible equipment from more than one manufacturer and make them into multi-purpose work-horses for your business.

A number of options are available for the micros including an excellent word processing system, a robust accounting system and an easy to use database for information storage and retrieval. For details of these and other options, phone Peter Cheesewright on 0895 57780.

Make an appointment to visit our permanent Exhibition and talk to our staff

METROTECH
Waterloo Road Uxbridge Middlesex

METROTECH is a member of the GRAND METROPOLITAN group of companies

---

TO COMMEMORATE THE AGE OF NEW TECHNOLOGY

The Silicon Chip has not only revolutionised the computers of to-day but all aspects of industry. Micro-electronics will be found increasingly more in our everyday lives, and will no doubt have a profound effect on society as we know it.

To commemorate the ‘Second Industrial Revolution’

S.A.S. have embedded an actual Silicon Chip in an acrylic monument which will provide a permanent display for either your home, office or school. The Christmas season is less than two months away, so order now, as this will be an ideal gift for your customers, colleagues, friends or even yourself.

THIS AMAZING OFFER AT A PRICE OF ONLY
£6.75 Includes VAT
Postal, and Packing
For companies wishing to use this for their own promotional aid, S.S.S. will present the company name and/or logo within the acrylic monument for a small additional cost.
Write to the Freepost Address for further details of this personalised service.

Post this coupon to:
S.A.S. Ltd (Dept. PB/1)
Freepost, Greenford, Middx UB6 8BR

Name
Address

Please send me ☐ Monuments.
I enclose Cheque/P.O’s for £
or charge my Access Card Number

Signed

Please allow 30 days for delivery

---

PRACTICAL COMPUTING November 1979
Listen, Westrex have more to offer than you realise.

Yes more new models. A bigger sales and service team. And plenty of new ideas. Give us a ring now and let's talk.

TALLY 1600 series micro controlled KSR 160 C.P.S. matrix printers.

TELETYPE MODEL 43 10/30 C.P.S. Keyboard send/receive terminal.

MANNESMANN MODEL 80 series receive only matrix printers.

TELETYPE MODEL 43 Automatic send/receive terminal with paper tape reader and punch.

PERKIN ELMER 550 BANTAM. Teletype compatible Visual Display unit.

SEE US AT COMPEC '79

Westrex Company Limited, 152 Coles Green Road, London NW2 7HE. Tel: 01-452 5401 and at Manchester Telephone: 061-764 0324 and Glasgow Telephone: 041-332 2052/3

* Circle No. 274
WE HAVE

MEMORIES

AM2708 1K x 8 EPROM
TMS2516 2K x 8 EPROM
TMS2716 2K x 8 EPROM
2102L 1K x 1 SRAM
2114-2 1K x 4 SRAM
4060 4K x 1 DRAM
4096-16 4K x 1 DRAM
4116-3 16K x 1 DRAM
Z-80 CPU 4MHz
Z-80 PIO 4MHz

Send S.A.E. for full list and prices

STRUTT
Electrical and Mechanical Engineering Ltd.
Electronic Component Distributors
3c Barley Market Street,
Tavistock, Devon PL19 05F
Tel: Tavistock (0822) 5439
Telex: 45263

* Circle No. 275

---

DDT MAINTENANCE LTD
12 Leeming Rd
Borehamwood
Herts. WD6 4DL
01-207 1717

5-6 Lower Church St
Chepstow
Gwent NP9 5HU
029 12 2183

Glasgow 041 221 9761
Telex 49290
Manchester Office Opens Shortly

Micro Systems Maintenance:
On Site / Time : Parts / Workshop Repair / BD Exchanges
All the above are available for most leading Micro Systems and their associated peripherals. For further details ring The Micro Maintenance Experts.

* SPECIAL OFFER *
9in. Unused American 110V Video Monitors in Cases £15.00 + VAT. Place your order now.

DDT MAINTENANCE LTD

* Circle No. 276

---

32K PET
The professional version ...
some power!!
Full size keyboard,
easy-on-the-eye green display.
Now at reduced price
only £725!
16K £625!

APPLE II
Best 6502 system! Up to
48K RAM on-board ...
Plug into own colour or
B/W TV & cassette.
48K only £970!
16K £870!
Memory expansions, discs and printers for all above from stock

EXIDY SORCERER
User-definable graphics. Plug-in interpreter ROMs. (Basic supplied).
Sophisticated Z80 system! Plug into own TV or monitor and cassette.
32K now only £790!
16K £690!

OHIO CHALLENGER
Sophisticated 6502 system! Plug into own TV or monitor! 20K RAM.
Interpreter Basic!
Ex-stock, with single mini-floppy
only £1200!
with dual mini-floppies, save at £1530!

Access and Barclaycard orders accepted by phone or letter, just quote number and print name and address.

Send for free list.

---

Send free list.
Add £5 Securicor carriage and 15% VAT to above prices.

* Circle No. 277

PRACTICAL COMPUTING November 1979
hi-tech electronics
1 Richmond Gardens, Highfield, Southampton SO2 1RY
Telephone (0703) 555072

OUR S 100 COLOUR VDU BOARD
WILL MAKE YOUR FRIENDS GREEN WITH ENVY AND OUR COMPETITORS SEE RED
AND ANY OTHER OF OUR FIFTEEN COLOURS

- HIGH DEFINITION, FULLY INTERLACED 625 LINE PAL COLOUR VDU
- 15 COLOURS, INCLUDING FULLY SATURATED RED, GREEN, BLUE, YELLOW,
  MAGENTA, CYAN, ETC.
- 24 LINES OF 40 CHARACTERS, MIXED GRAPHIC AND ALPHANUMERIC
- COLOUR GRAPHICS RESOLUTION OF 80 x 72
- UPPER AND LOWER-CASE COLOUR ALPHANUMERICS, WITH FULL CHARACTER
  RONDS TO 10 x 14
- ALL CHARACTERS CAN FLASH AND HAVE ANY HUE
- SEPARATE BACK AND FOREGROUND COLOURS, BOTH GRAPHS AND
  ALPHANUMERICS CAN BE DISPLAYED ON A COLOURED BACKGROUND
- ADJOINING AND NON-ADJOINING GRAPHIC SYMBOLS
- SELECTABLE DOUBLE HEIGHT CHARACTERS AND TWO PAGE MEMORY
- MEMORY MAPPED TO ANY 1K BOUNDARY
- BRITISH DESIGN FOR COMPATIBILITY WITH UK TV SETS
- MONITOR AND UHF OUTPUTS

PRISES INCLUDE P&P BUT NOT 15% VAT

- S100 COLOUR VDU BOARD
  £215.05
- S100 16K MEMORY, 250ns, FULLY BURNT-IN
  £210.95
- S100 PROTOTYPE WIRE-WRAP BOARDS
  £15.00

COMING SOON:
- S100 6 NOTE MUSIC SYNTHESIZER
- S100 8BCIVY TELETEXT DECODER
- S100 ULTRA-FAST NUMBER CRUNCHER
- LOTS MORE ON THE WAY

Circle No. 278

DATRON of SHEFFIELD
for
C Cromemco the ultimate name in micros

DATRON import direct from Cromemco, California.
DATRON can supply Nationwide.
DATRON can provide fast maintenance anywhere
by C.F.M.
DATRON can give you the best prices.
DATRON have in stock:
  System 2 46K £1995
  System 3 32K £2995
  System 3 64K £3292
DATRON have Z-2H Hard Disc coming soon.
DATRON have Systems 2 and 3 and Hard Disc with
Multi-User facility.
DATRON easily accessible - in the centre of the
country.

Write or telephone for FREE colour brochure on System 3 or Z-2H.
We use Cromemco for our own business why not call in for a demonstration.

DATRON MICRO CENTRE
Latham House, 243 London Road, Sheffield S2 4NF
Telephone 0742 - 585490. Telex 547151.

Circle No. 279

ELECTROVALUE LTD
Dept. PC 479, 28 St Jades Rd, Englefield Green, Egham,
Surrey TW10 OHB.
Phone Egham (389 from London: STD 0784-3) 3603; Telex 264475.
Northern Branch (Personal shopp-ers only) 680 Burnage Lane, Bur-
nage, Manchester M19 1NA Phone (061) 432 4945.

ELECTROVALUE FOR A GOOD DEAL BETTER THAN MOST
ESPECIALLY WHEN IT COMES TO

Nascom Microcomputers

★ At new reduced prices
★ Appointed national distributors
★ Full ranges of available Nascom items for prompt delivery
★ Backed by Electrovalue service

PRICE LIST AND INFORMATION
Gladly sent on request. Your name will be fed to our com-
puter for you to be sent future information automatically

FREE FOR
THE ASKING

ELECTROVALUE CATALOGUE 9
Latest 120 page catalogue — ICs, Semi - conductors,
Onton-devices, Component, Hardware, Connectors Tools, etc.

Write or telephone for FREE colour brochure on System 3 or Z-2H.
We use Cromemco for our own business why not call in for a demonstration.

PRACTICAL COMPUTING November 1979

Circle No. 280
VERBATIM MAGNETIC MEDIA

THE BEST THAT MONEY CAN BUY.

VERBATIM — the world's finest and best known range of magnetic data storage products — includes Floppy Discs, Mini-Floppies, Cassettes, Mini-Cassettes, cartridges and cards. All are 100% tested during manufacture, all are certified error free. We stock all types, including all varieties of the popular 5¼-inch floppy discs.

If you are a dealer:
Start stocking VERBATIM products — your customers will appreciate a better quality product at better prices. Call BFI Electronics for a comprehensive catalogue, dealer price list, and details of display material and retail packaging.

If you are a user:
Your system is only as good as its data storage — so don’t be content with inferior products. Insist on VERBATIM by name, as indeed do some of the biggest names in the computer business!

BFI Electronics Limited
516 Walton Road,
West Molesey,
Surrey KT8 0QF
Tel: 01-941 4066
Telex: 261395

Circle No. 281

INFORMEX-LONDON
Informex-London Ltd, in association with the Institute of Data Processing Management, present a two-day seminar on:

Microprocessors
Speakers include experts from: MOTOROLA, TEXAS INSTRUMENTS, COMMODORE, FERRANTI, PLESSEY, CAP, ICL

Venue
Cafe Royal, Regent Street, London W1

Fees
£78 + VAT
(including lunch & refreshments)

Date
20–21 November 1979
(hours: 10.30 am – 5 pm & 9.30 am – 5 pm)

MICROPROCESSORS
The technological revolution. What are Microprocessors and Microcomputer Systems? Non-technical introduction — the technology — Components — Hardware — Software — etc.

APPLICATION
for Business, Industry, Government and Education,
Small Business Systems — Word Processing — Control Systems — etc.

Places are also available on the following courses:
(all held in Central London — hotel bookings can be arranged)

Microcomputer Appreciation — 2 days
£78 + VAT
(Dates: 2 October, 23 October, 6 November, and 4 December 1979)
(including lunch at Cafe Royal)

Microcomputer Fundamentals — 5 days £128 + VAT
(Dates: 26 November 1979, 18 February, 17 March, 12 May, 21 July and 15 September 1980)

Computer Systems Fundamentals — 5 days £128 + VAT
(Dates: 5 November 1979, 10 March, 14 April, 7 July and 1 September 1980)

Systems Analysis & Design — 10 days £258 + VAT
(Dates: 12 November 1979, 4 February, 17 March, 14 April, 7 July and 15 September 1980)

Principles of Accounting — 5 days £128 + VAT
(Dates: 29 October, 26 November 1979, 18 February, 14 April, 7 July and 15 September 1980)

COBOL Programming — 10 days £256 + VAT
(Dates: 12 November 1979, 17 March, 14 July and 8 September 1980)

Assembler Programming — 10 days £256 + VAT
(Dates: 1 October, 3 December 1979, 18 February, 12 May, 21 July and 1 September 1980)

For further details or telephone reservations, please phone (or write to):
Course Registrar, 01-309 7799 or 01-300 0380
(24 hour answering)
Informex-London Ltd.
Freepost, Sidcup, Kent, DA15 9BR

Circle No. 282

PRACTICAL COMPUTING November 1979
* Up to 4 Megabytes of disc storage
* 64 Kilobytes of read/write memory
* Choice of dot matrix or NEC correspondence quality Spinwriter printers
* Choice of three different VDUs.

Software
In addition to CP/M, FORTRAN, BASIC, COBOL and PASCAL we offer the unique 'Insta' software which enables tailor-made applications packages to be configured in a very short time by the computer itself! 'Insta' applications programs can be altered to suit your changing requirements at any time by operators with no knowledge of computer programming but who know what they want it to do.

If you have not seen 'Insta' software, ask for a demonstration. We promise you that you will have never seen anything that even comes close to matching it in business applications.
VT Monitor & Keyboard Kits

Available now ex-stock

Keyboard
*Full 128 character ASCII encoding
*+5 volt only
*Positive or negative strobe
*Circuit, layout and full assembly instructions
*Two-key roll over
*Price £285.00 50p p/p

Monitor
*Resolution - 80 charo/line
*Video response - 20 MHz
*All inputs TTL compatible
*9" diagonal high resolution tube, P4 (white) phosphor
*625 or 525 line standard
*+11v @ 1A input
*Price £85 + £2 p/p

Coming soon - boxed, built and tested VDU full cursor control, 16 x 64 format, keyboard & display included - price £280.

All prices include VAT - discounts available

Video Terminals
197 Hornbeams, Harlow, Essex
Tel 0279 30132

SORCERER'S APPRENTICE

Wide range of software available for the Sorcerer
BASIC — illustrates the use of Basic instructions. £ 6.50
RENUMBER — rennumbers your Basic programs. £ 6.50
WHITE — sets graphics to display characters on a white background ........... £ 6.50
DRAW — allows freehand drawings on the screen ................. £ 4.60
MATHS — sets problems of varying difficulty .... £ 4.60
STATISTICS — a comprehensive package ... £17.75
CASSETTES computer quality with case ...... 50p each

All above prices include VAT

Business programs and software from
LIFEBOAT ASSOCIATES
Send SAE for our full list
WE PUBLISH PROGRAMS
Good royalties available for quality original software
Please send copy for inspection

Exidy Products — full range supplied
Printers — wide selection available

MICROPUTE
7 Westbourne Grove Manchester 20
Tel. 0625 612818

RE-FURBISHED
IBM SELECTRIC TYPEWRITER TERMINALS
From £695 + VAT.

Built in RS232 interface allows it to be connected to an Apple II, PET, TRS-80.
In addition to its function as an on-line terminal, the unit can also serve as a standard Selectric office typewriter.
* Labour and parts 30 days
* 30 days approval for postal orders
* Maintenance agreement available.
For further information contact:
Vlasak Electronics Ltd., Thames Building, Dedmere Road, Marlow, Bucks.
Tel: Marlow 74789. Telex: 847008.

As major Apple distributors we can supply a variety of proven software packages for both the enthusiast and businessman. Our range of fully documented packages include:

<table>
<thead>
<tr>
<th>Package</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Ledger</td>
<td>£315</td>
</tr>
<tr>
<td>Purchase Ledger</td>
<td>£315</td>
</tr>
<tr>
<td>Nominal Ledger</td>
<td>£225</td>
</tr>
<tr>
<td>General Ledger</td>
<td>£360</td>
</tr>
<tr>
<td>Payroll</td>
<td>£360</td>
</tr>
<tr>
<td>Stock Programs</td>
<td>£285</td>
</tr>
<tr>
<td>Word-Processing/</td>
<td></td>
</tr>
<tr>
<td>Letter Writer</td>
<td>£240</td>
</tr>
<tr>
<td>Estate Agent</td>
<td></td>
</tr>
<tr>
<td>Program</td>
<td>£240</td>
</tr>
</tbody>
</table>

All prices include an in-house users' instruction course.
For less than 25p an hour for just one year you can COMPUTERISE YOUR BUSINESS NOW! EVERYTHING YOU REQUIRE TO START COMPLETE – READY TO OPERATE. Incl. VAT, Pkg. & Delivery. Nothing extra to pay.

£2,300

- MICROCOMPUTER WITH 48K RAM (Memory)
- DUAL DISK DRIVES (Storage up to 400K)
- DOS DISKETTE (Disk Operating System)
- BOX OF 10 BLANK DISKETTES
- PRINTER WITH TRACTOR FEED
- BOX OF CONTINUOUS STATIONERY/LABELS
- EVERYTHING COMPLETE WITH MANUALS

+ FREE Programs worth over £500 on Diskettes in a Library Case

SOFTWARE

 SOFTWARE

 We are pleased to announce that we have been appointed Exclusive Distributor for UK, Europe & the World for

 GRAMA WINTER SOFTWARE

 for TRS 80, Apple, ITT 2020. Also dealer for Pet, Z80, SWTP.

 Fully integrated suite of 30 complete business programs.

 Usual cost of such Quality Programs would be £2500+.

 Write for details.

 CONSULTANCY

 Please write or telephone if you require advice on BEGINNING or EXPANDING your computer installation. Software programs customised to your requirements.

 OUR BUSINESS EXISTS ON IMPROVING YOUR BUSINESS.

 Please send Full Details & Price Lists My requirements are for:

 HOME HOBBIES STUDENT BUSINESS

 Name: Street: Town: County: Post Code: Telephone: Name of Co: Position: PO/Chq No: (Payment by Barclaycard / Trustcard / Access etc., can be arranged)

 Requirements: Description: inc. VAT

 Microcomputer Upgrade Kit Interface Disk Drive Printer Cable/Interface Cluster System Colour TV Media Stationery Software Post/Pkg/Ins (please tel. for cost) TOTAL:

 ENSIGN

13-19 MILFORD STREET, SWINDON WILTSHIRE SN1 1DW Tel: (0793) 42615 Telex: 449703

Make more time available to enhance the quality of your life and improve your business

COMPUTER SALES • HARDWARE • SOFTWARE • CONSULTANCY • MEDIA • STATIONERY ETC

PRACTICAL COMPUTING November 1979
*** 8-BITS OR 16-BITS ***

Do you want a microcomputer kit based on a 16-bit microprocessor? Or an 8-bit microprocessor with a microassembler? Supply your own ASCII-encoded keyboard? No need to look further as BL Microelectronics has developed the BIPROC microcomputer kit with a choice of two microprocessors on a common PTH board.

**MICROPROCCESSORS**
- 16-bits TMS9980-BB instructions including multiply and divide
- 7 addressing modes including indirect and memory to memory
- 16 general-purpose registers file positioned anywhere in memory.
- 8-bits Z-80 firmly established in the hobby and academic fields.

**BOARD FEATURES**
- Monitor and microassembler resident in EPROM.
- 4K User RAM, up to 4K EPROM.
- TV, cassette and RS232C memory-mapped interface.
- 16 lines of 64 characters each on TV screen.
- Programmable character generator.
- Interface for ASCII-encoded keyboard.
- Copyable * Manual — some useful programs listed.

**PRICE**
- BIPROC Kit 1 Z-80 only £164 + VAT
- BIPROC Kit 2 TMS9980 only £169 + VAT
- BIPROC Kit 3 Z-80 & TMS9980 £195 + VAT
- Keyboard not included in above kits.
- Expansion board for up to 4K RAM £30 + VAT

Details and demonstration at:
- Watford Electronics, 33/35 Cardiff Rd., Watford, Herts.
- WD1 8ED
- Tel: Watford 40588/9

**Microcomputer Mail Order**

All your microcomputer requirements can be bought with confidence by mail order from MICRODIGITAL, one of the largest and longest established computer stores.

Most orders are despatched same day as receipt, if not a note explaining what the supply situation is. If we cannot supply within 30 days we will, on request, make an immediate cash refund.

Access and Barclaycard orders are welcome either in writing or over the phone. Your account will not be charged until the goods are despatched.

Official orders of over £10 are also welcome. With normal 30 days trade credit extended to bona fide commercial and government organisations.

If you do not have our brochures, write or phone today for free copies by return.

**PETRAID**

PETRAID is a file based utility program designed to help people develop their own file based programs in a fraction of the time it takes to write them in Basic.

**PETRAID Version 1**
- Weeks of Programming become Hours
- All your programs will perform to the same high standard
- All your programs will operate as professionally written commercial software
- With PETRAID CREATE Your Own:
  - Suppliers Files
  - Customer Files
  - Making Lists
  - Personnel Files
  - Address Book
  - Amenities File
  - Diary File
  - Price Lists
  - Part List
  - Stock File
  - Sales Lead Lists
  - Retiring Registers
- Etc Etc

**NOW AVAILABLE!**
- Tape based version £80 — Commodore Disk based version £120 (Seq. files) — Documentation £10

**FUTURE Versions of PETRAID:**
1. Random Access
2. Print generators
3. Search & Extract an index/new file/print
4. Sort Utilities
5. Transaction Handling
6. Word Processor package
7. Other commercial packages.

**STAGE ONE COMPUTERS**

6 Criterion Arcade
Old Christchurch Road
Bournemouth
Tel. 23570

**Circle No. 288**

**Circle No. 289**

**PRACTICAL COMPUTING November 1979**
PRACTICAL COMPUTING November 1979

AMERICAN EXPRESS

of books ordered. Make cheques, PO's etc. payable to: -

TRADE ENQUIRIES WELCOME

Prices subject to change without notice

HOW TO ORDER

Please note our book magazine prices include postage and packing, but not insurance. If wanted add 12p for every £10 of books ordered. Make cheques, PO's etc. payable to: -

L P Enterprises, CREDIT CARDS accepted

BARCLAYCARD VISA/ACCESS/DINERS CLUB/AMERICAN EXPRESS

Phone: 01-553 1001 for Credit Card orders (24 hr answering service)

All publications are published in U.S.A. and shipped into Britain air-freight by L.P. Enterprises. In unusual cases, processing may exceed 30 days.

TRADE ENQUIRIES WELCOME

ISBN 0-00-000000-0

PRACTICAL COMPUTING November 1979

175
CPS DATA SYSTEMS

The Midlands Micro Sales Centre

Established by CPS to ensure that you buy the micro best suited to your particular need. During your visit you can see, and try at leisure a whole range of microcomputers. Expert advice is always on hand to guide you through our hardware, software and back-up services.

We're Authorised Dealers for Pet, Apple, Rair and Transdata microcomputers; Decision Data and Datac printers; and Lear Siegler terminals — all available off-the-shelf;

phone us today, to arrange your visit, or for product information

Telephone: 021-707 3866

V&T ELECTRONICS

V&T SUPERDECK

The cost-effective answer to mass data storage and retrieval; stores two megabytes per C60 cassette; data transfer rate 5,000 baud; full search facilities in fast-forward and fast-reverse modes under our operating system (Z-80 software only) allows you to:

1. Retrieve a named file (searches at up to 50 inches per second).
2. Write a file
3. Write a write-protected file
4. Replace a file
5. Delete a file

Error rate less than 1 per 10^8 bits, in the unlikely event of an error the operating system will re-read the file completely automatically. Requires connection to a P.I.O and a UART. Supplied ready-built including 240V AC mains supply.

Price £110 + 15% VAT + £2.00 Postage
82 Chester Rd London N19
Tel. 01-263 2643

POWER-ONE

D.C. POWER SUPPLIES

Now, like Intel, Motorola and National you can buy Power-One open frame power supplies and enjoy quality and reliability at LOW LOW prices. Over 70 different models to choose from.

Floppy Disc Drive Supplies
- with connectors and cables for Shugart drives if required.
CP-249 — drives one mini drive £33.00
CP-323 — drives two mini drives £60.00
CP-205 — drives one Shugart SA800 or equivalent 8” drive £56.00
CP-206 — drives two SA800 £76.00

Single Output
- 5V at 2.7A w/OVP £19.50
- 5V at 5.4A w/OVP £41.50
- 12V at 6A £67.50
- 15V at 5.4A £67.50

Dual Output
- ± 12 to 15V at 1.5A £41.00
- ± 18 to 24V at 0.4A £32.50
- ± 9 at 5.4A w/OVP £78.00

Triple Output
- 5V, 9-15V, ±5, ±12, ±15V at 1.8A to 10.8A from £41.00 to £137.00

SPECIAL* Beat this for value. TRS-80 compatible floppy disk kits — including Shugart SA 400 drive power supply and all cables. Simple drive kit £283. Dual drive kit £484.

HAL COMPUTERS LTD.,
133 Woodham Lane, Now TV, Weybridge, Surrey KT15 3LJ. Telex: 8813487.

* Circle No. 293

PRACTICAL COMPUTING November 1979
I-EEE to RS232 Bi-directional Interface for Pet

£140 plus VAT

110 Baud to 9600 Baud (switch selectable)

I-EEE connector reproduced on rear panel for other devices

Standard RS232 – D25 connector

Switch selectable I-EEE address and parity

Complete with manual and power supply

CMC 1200

Uni-directional RS232 interface £89 plus VAT Complete

New 625 Video Adaptor a vastly improved 625 video convertor for Pet, works extremely well £25

Stack Page Printer Interface copies screen contents onto 20m. loop complete with software £25

APPLE

Apple II (colour) 16k £985

Apple plus (b&w) 16k £830

ITTI 2020 (colour) 16k £950

16k RAM upgrade £85

Printer Card £110

Communication Card £140

High Speed Serial Card £110

Disk Drive with DOS £425

Extra Disk Drive £375

Diskettes (10’s) £30

SORCEROR

Sorcerer 16k £760

Sorcerer 32k £859

AIM 65 £249.45

NASCOM £165

KIM I £99.95

MANUALS New Pet user manual £5

6500 Programming manual £5

6500 Hardware manual £5

PRINTERS

Teletype 43 pinfeed RS232 £860

friction RS232 £885

pin and friction RS232 £520

Anadex DP8000 £575

Perkins Elmer Pussycat CRT copier £839

Also Centronics Range, Texas Instruments, Lear Siegler

Ring us for a quote on individual models

Consumables

(All paper add £5 carriage per box)

Anadex DP8000 paper (2000 sheets) 9.5" x 11" drop £15

Teletype 43 pinfeed paper (2000 sheets) 12" x 11" drop £15

8.5 inch friction roll Box ‘A’ quality (12 x 3.5" diam rolls) £20

Box ‘B’ quality (12 x 3.5" diam rolls) £15

Box ‘A’ quality (6 x 5" diam rolls) £20

Box ‘B’ quality (6 x 5" diam rolls) £15

Cassettes

C15 cassettes, high quality tape, 5 screw cassette cases, per 10 £4.40

Disk and Diskettes

We supply 8" and 5.25" diskettes for all disk drives. Please state your machine and we can give you a quotation.

e.g. Pet 2040 £30 per 10

Comptihink £30 per 10

Apple £30 per 10

Horizon £30 per 10

Sorcerer £30 per 10

Many others in stock, both hard and soft sectored.

Connectors

PET User Port/I-EEE Port £1.10 each

Pet 2nd Cassette Port 85p each

Hoods for User/I-EEE connectors £2.25

D.25 RS232 Connectors (State Male or Female) £3.00

D.25 Hoods £2.25

Demagnetiser

Curved head £4.00

If any requirements are not listed please ring us as we may have them in stock.

New 625 Video Adaptor a vastly improved 625 video convertor for Pet, handles reverse field graphics, exceptional picture. £25 complete plus VAT

PET

Disk Units

Compatiink 400k Random and Sequential complete to fit 6k Pet (via expansion) £795

to fit 16/32n Pet (direct fitting) £540

Memory Expansion

24k Exandalment for Pet £320

Interfaces

Uni-direct I-EEE to RS232 £89

Bi-direct I-EEE to RS232 £140

Bi-direct 2 ported I-EEE to RS232 £175

A/D Converters

AIM 161 channel A/D converter for Apple, Aim, Nascom etc £130

Petset 1, AIM 161 including all interfacing requirements for Pet, complete £166

Stack Peripherals

Stack Joystick a balanced, calibrated unit supplied with software and examples of use, complete £25

All prices are + VAT at 15% and include carriage (unless otherwise stated). Please make cheques payable to Stack Computer Services Ltd.
WE OFFER:
PETS AT TOP DISCOUNTS e.g. 4K £414; 8K £495; 16K £608; 32K £716
NEW APPLE II 16K £810, DISC DRIVE & CONTROLLER £425
Coming soon new PASCAL card.
EUROC Full professional business system, yet simple to use. 12 months service included in price. £7,995.
COMPUCOR Top quality microprocessor systems with built-in floppy FROM £3,000.
TECS Prestel/Ceefax/Oracle microprocessor decoder allows editing and hardcopy via additional printer. A must for companies, conference centres etc.

SCIENCE
* CONTROL
* PERSONAL COMPUTING

CADDIS INTERFACES Full range for professional and hobbyist applications e.g. IEEE488 to RS232C; PARALLEL I/O; analogue I/O etc.
PERIPHERALS e.g. Teletype 43 £845; Decwriter 34 £875.
SOFTWARE Full range of PETSOFT/PETAC/HIPPOSOFT Education, Games, and Business programs.

DESIGN Our team of professional engineers will design interfaces, software packages, or systems to your requirements.
LEASING facilities available to suitable clients on any of our systems.
DELIVERY by RED STAR or SECURICOR can be arranged.

WE SELL SOLUTIONS. Have you discovered that your problems really begin after you've bought the hardware? Either you've bought the wrong hardware or no software exists to make it work properly. We specialise in providing total solutions to problems and professional after-sales support of hardware and software. We have the resources successfully to implement commercial, scientific and instrumentation/control projects.

COMMERCIAL. Typical of our recent projects in this area was the connection of 12 remote stations to a central unit. This was achieved by using Commodore Pats as the remote stations allowing a degree of local processing linked via modems to a central S100 microcomputer with substantial disk storage capacity. This type of configuration is ideal where a limited amount of local accounting is required at each site but with a central collection of information on stock, payroll, etc.

SCIENTIFIC. Our scientific packages are currently in use by a number of major multi-national companies. Typical of these packages is our Chemical Graphics System used by pharmaceutical companies in drug design. This is designed to run on PDP-11 configuration but a subset of the facilities is available on microcomputers.

INSTRUMENTATION/CONTROL. We can supply a complete range of hardware and software packages covering analog, digital and graphical input/output and logging using fast microprocessor-based systems.

COST. Due to our familiarity with a wide range of hardware we can supply systems either optimised for minimum price or maximum performance -- you decide on the price/performance mix.

Contact us at:
39 Hope St., Glasgow G1. 041-339-6782

In addition to consultancy and turnkey packages we offer the following proprietary products:

FASTLIB. This package is based on the AMD9511 arithmetic chip and is a complete hardware/software system. Use of FASTLIB is completely transparent to the user of Microsoft FORTRAN and BASIC. The software is totally integrated with the FORTRAN/BASIC compiler and simply by replacing the Microsoft-supplied library by FASTLIB existing programs can run 5 – 20 times faster without any modification. The hardware requires a single S100 slot. In addition to enhancing the speed of execution of the existing FORTRAN/BASIC functions and operations, additional functions have been implemented -- NINT, TAN, ASIN, ACOS, SINH, COSH, TRIG etc (a pseudo-random number generator).

GLIB. A graphics library enabling complex pictures to be produced from a series of simple subroutine calls such as : VECTOR (draws a line between any two (x,y) points); CIRCLE (draws a circle of any radius centred on any (x,y) point); TEXT (plots a 6x6-character ASCII text); STEXT (plots Greek and Mathematical symbols) etc. Plots can be saved on or retrieved from disk by single subroutine calls. The standard package uses the Vector Graphic High-Resolution Graphics board but the software can be configured for any graphics board or device. Microsoft FORTRAN, MACRO or BASIC is also required.

GRAPH. For either an arbitrary polygonal or a cubic spline to a set of (x,y) points. The spline routine is for drawing (smooth) curves through a series of points while polygonal finds the analytical form of the function corresponding to the (x,y) points.

SFGC. This is a communications program which enables connection of any two computers over a serial line (modem or dedicated). This has been used, for example, to link a microcomputer running CP/M to a PDP-11/LSI-11 running RT-11/RSX-11M and a PDP-11/LSI-11 to an IBM 370; DEC – 10 etc. mainframe.
WHY BUY A MICRO-COMPUTER FROM

PETALECT ELECTRONIC SERVICING LTD.

BECAUSE

1) Established company trading since 1971
2) Electronic servicing is our speciality
3) We have in-house programmers/systems analysts
4) We have our own service engineers
5) We will demonstrate the PET at your premises
6) We can customise the PET to your requirements
7) We can arrange finance
8) We offer, after the three-month warranty, a service contract from £69.50
9) You benefit from our experience of having sold over 450 micro-computers to industrial, educational and business, personal users.
10) We specialise in programs and interfaces for weighing applications for average weight control and counting etc.

Large Keyboard PETS in stock 32K PET £795.00
New ROM 400K
New ROM 400K £795.00
New ROM 800K £995.00
All + VAT

Petact authorised distributors for central Southern England for the full range of Computhink disc systems (dealer enquiries welcome)

Computhink Old ROM 400K £795.00
" New ROM 400K £795.00
" New ROM 800K £995.00
All + VAT

Specialists in applications requiring interfaces for electronic balances (Sartorius, Metler, Oertling, Salter) also instruments like Pye Unicam SP8 100 Spectrophotometre, other interfaces are available by special manufacture.

Stockists for Petact Business Systems (Sales accounting, purchase invoicing, payroll, Stock Control, Nominal Ledger and management information.
A wide range of Printers available i.e. Teletype 43, Anadex C.B.M., Printer etc.

COMPUTER BOOKS — for professionals, hobbyists, businessmen and newcomers.

ACCESS, BARCLAYCARD
We also supply: Apple II 16K, 32K or 48K, mini-disk drives, interface cards and software.

If you require any more information or demonstration regarding the PET 2001/8 or any associated equipment, programs, etc., please contact Mr. P.J.A. Watts or Mr. D.W. Randall at:

PETALECT ELECTRONIC SERVICES LTD
33/35 Portugal Road,
Woking,
Surrey.
Tel. Woking 69032/68497

Shop at:
PETALECT
Chertsey Road,
Woking,
Surrey.
Tel. Woking 21776/23637

* Circle No. 298


Unbeatable capability.

The Paper Tiger prints just about any paper form you need. From address labels to multi-copy invoices and legal-size reports.

Adjust the tractor width from 1-3/4 to 9-1/2 inches. Choose from 8 switch-selectable forms lengths. Print 6 or 8 lines per inch.

Unmatched versatility.

Want graphics? Add the Paper Tiger's software-selectable full dot plotting graphics. Print illustrations, block letters, charts, graphs, and more.

Need a bigger buffer? The Paper Tiger features an optional 2K-byte memory that holds a full 24-by-80 CRT screen.

And there's more.

The Paper Tiger is small, lightweight, and compact. That's because it's designed especially to work in small computer systems.

And it's built rugged and simple. For high reliability and easy maintenance. Just like the thousands of IDS printers already in the field.

The Paper Tiger is here.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Printer</th>
<th>Integral Data Systems, Inc.</th>
<th>Anadex</th>
<th>Heathkit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columns</td>
<td>132</td>
<td>80</td>
<td>132</td>
<td></td>
</tr>
<tr>
<td>Software Selectable Characters</td>
<td>8</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>True Tractor Drive</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Parallel and RS232 Serial Interfaces</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>115-230 Volt 50-60 Hz Switch Selectable</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Full Dot Plotting Graphics</td>
<td>OPTION</td>
<td>NO</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Selectable ½-Line Increments</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Six or Eight Lines Per Inch Selectable</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Software Select/Deselect</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Re-Inking Ribbon</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Power-on Diagnostics</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Automatic Paper Out Detection</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>CRT Screen Buffer</td>
<td>OPTION</td>
<td>OPTION</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>UNIT PRICE</td>
<td>£575</td>
<td>£575</td>
<td>£553</td>
<td></td>
</tr>
</tbody>
</table>

Comparison data from available manufacturer's literature.

See for yourself.

Check the comparison chart. Find out why this Paper Tiger just set a new standard for low-cost impact printers.

Whether you are a potential end-user or a dealer, why not ask for our free brochure? We will also send dealers details of our unique support service.

Kingston Computers,
Scarborough House,
Scarborough Road,
Bridlington.
Tel: (0262) 73036 Telex 52642
A Member of the Dale Group of Companies

* Circle No. 299 |
THE COMPANY

Kode Services Limited, part of the British-owned Kode International Group of Companies, is rapidly becoming a major U.K. service operation specialising on a whole range of equipment from basic terminals to microprocessor-based systems. Over 100 Field Service Engineers nationwide, coupled with full depot and workshop facilities, are available to support the following equipments: Model 33, 40, 43 TT, Lear Siegler ADM1A, 2A, 3A, ADM42 and 31, Microstar V, Anadex DB000 Printer. We have the capability to service new products and are always evaluating new DP equipment. Fully-comprehensive maintenance contracts or a full depot repair service can be offered.

THE CAREER

Opportunities are available for experienced professionals and gifted amateurs who have a full understanding of TTL logic and digital techniques, and wish to move into a service-orientated career applying their knowledge to the servicing of sophisticated electronic equipment.

For further details on maintenance or job prospects, please call or write to Mr C. Marklew on 0249 813771.

Kode Services Ltd.,
Station Road,
Cherne,
Wiltshire.

---

FIVE EXCITING TYPES AVAILABLE NOW

TOOL KITS TO YOUR SPECIFICATION

OR CASES CAN BE SUPPLIED WITHOUT TOOLS

Full Details From:

A. MILLS (ACTON) LIMITED

CHURCHFIELD ROAD, ACTON, LONDON W3 6ED

Telephone 01-992 4835/7, 01-993 2241/7
Telex 24224-305

Established 1918
TRS80 EXPANSION INTERFACE
upgrade your system as your needs increase. contains sockets for cassette use. Features a Centronics parallel port, real-time clock, and a connector for an RS-232C interface or whatever. Requires Level II Basic, 220VAC. 0 RAM £229, 4K RAM £287

ANAXEX DP8000
only £540 + VAT
PET Connector - £49
The DP 8000 prints the 96-character ASCII text, single or double width at 54 lines per minute. it offers the ability to print a 5 x 7 matrix on multiple copy, pin-fed plain paper. This model accepts RS-232C or current loop serial data at baud rates switchable from 110 to 9600 and parallel 8 bit data input at over 1000 characters per second.
- standard storage capacity of 256 characters
- Other features include out of Paper Detector, top of form Programming and Skip Over Perforation Control.

THE NEW ITT APPLE (2020)
16K
32K
£880 + VAT
48K
£925 + VAT
ITT MICRO COMPUTER
* Full colour - UHF output * Audio cassette tape interface * Up to 48K RAM on board * BASIC in ROM (graphics commands include COLOUR, VLIN, HLIN, PLOT and SCRN) * Built in loudspeaker * Buckets of software available * disk System (110K byte per drive - includes controller) only £450 + VAT EX-STOCK

HITACHI PROFESSIONAL MONITORS
9" - £129 + VAT
12" - £199
- 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 at 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.

video 100
12" Black and White Low Cost video monitor
- ideal for home, personal and business computer systems
- 12" diagonal video monitor
- Composite video input
- Compatible with many computer systems
- Solid state circuitry for a stable & sharp picture
- Video bandwidth - 12MHz = 500 lines
- Input impedance - 75 Ohms
- Uses NTSC lines Minimum in Central 80% of CRT, 550 Lines Minimum beyond central 80%

Only £79 + VAT

SQRUSER SPEAKS YOUR LANGUAGE
For personal or business use. The best value for money around.
* 512 by 256 point screen resolution * 16K or 32K User RAM * Centronics Parallel Port * RS232C Serial Port * Composite IV peak to peak video output * T.V. output supplied as extra. *64 programmable graphics * 64 standard PE graphics * 79 key keyboard including 16 key numeric keypad. * Expansion bus for connection to S100 expansion box. 16K sorcerer £890.00 + VAT, 32K Sorcerer £970.00 + VAT. S100 expansion box £210 + VAT, Development Pac £70, Word Processing pac £70.

Break the language barrier £138
At a price equivalent to learning one language, LEXICON offers you, English, Spanish, French, German, Italian and Greek. The LK3000 comes to you with the person module which contains 6 languages, de-luxe carrying case and a charger adaptor giving 4 - 5 hours continuous use, and can easily be re-charged from the mains supply.

THE TRS80 (Special Scoop)
Low Priced, Ready to Go!

PET COSTS LESS AT COMP and it's a pedegree
8K - Comes complete with integral cassette deck. Full manuals supplied. Powerful 8K Microsoft Basic in ROM. Masses of software available - £499 + VAT. 16K - Same as above but with new improved keyboard and cassette supplied as extra. Machine code monitor on board so you can program in 6502 machine code - £590 + VAT. 32K - for a little extra get 32K memory providing greater storage capacity for programs or data - £690 + VAT.
External Cassette decks for 8K, 16K or 32K - £55 + VAT complete with cable and connector.

TRILITON EXPANSION BOX
only £210 + VAT

PLUGS INTO YOUR OWN TV
Use your own cassette
LEVEL II BASIC WITH 16K USES 8 RAM provides you with possible the most powerful micro around. All our TRS80s are fully converted to English Television Standard and include a U.K. Power Supply. Cassette Leads, Sample Tape, Level II & Level II programming manuals, and special lead that enables you to connect direct into your own television.
Special features of Level II Basic enable you to:
- set or reset any point on the screen. - Test for the presence of a point on the screen (these features enable easy animation). - Save or load data from cassette under program control. - File handling capabilities on cassette using named files. - Graphics blocks as standard - design your own pictures and many many more features for only £399 + VAT

PET EXPANSION
only £55 + VAT

S100 Expansion Box - £210 + VAT

video 100
12" Black and White Low Cost video monitor
- ideal for home, personal and business computer systems
- 12" diagonal video monitor
- Composite video input
- Compatible with many computer systems
- Solid state circuitry for a stable & sharp picture
- Video bandwidth - 12MHz = 500 lines
- Input impedance - 75 Ohms
- Uses NTSC lines Minimum in Central 80% of CRT, 550 Lines Minimum beyond central 80%

Only £79 + VAT

words Processing Pac and Development Pac now available.

Word Processing Pac - £70
Development Pac - £70

JUST COMPARE OUR CASH AND CARRY PRICES!
**COMPUKIT UK101**

**LOW COST SUPERBOARD IN KIT FORM**

The Compukit UK101 has everything a one board "superboard" should have:
- Uses ultra-powerful 6502 microprocessor
- 50Hz frame refresh for steady clear picture (U.S.A. products with 60Hz frame refresh always included in price of display)
- 48 chars by 16 lines — 1K memory mapped video system providing high speed access to screen display enabling animated games and graphs.
- Extensive 256 character set which includes full upper and lower case alphabetics. Greek symbols for mathematical constants and numerous graphic characters enabling you to form almost any shape you desire anywhere on the screen.
- Video output and UHF High grade modulator (8M Bandwidth) which connects direct to the aerial socket of your TV. Channel 3/4 UHF.
- Fully stabilised 5V power supply including transformer on board.
- Standard KANSAS city tape interface providing high reliability program storage — use on any standard domestic tape or cassette recorder.
- 4K user RAM expandable to 8K on board £49 extra.
- 40 line expansion interface socket on board for attachment of extendor card containing 24 RAM and disk controller. (Ohio Scientific compatible).
- 6502 machine code accessible through powerful 2K machine code monitor on board.
- High quality thru plated P.C.B. with all I.C.'s mounted on sockets.
- Professional 52 key keyboard in 3 colours — software polled meaning that all debouncing and key decoding done in software.
- 8K Microsoft Basic means conversion to and from Pet, Apple and Sorcerer easy.
- Many compatible programs already in print. SPECIAL CHARACTERS @ Erases line being typed, then provides carriage return, line feed.
- Erases last character typed.
- CR Carriage Return — must be at the end of each line.
- Breaks statements on line.
- CONTROLO Execution or printing of a list is interrupted at the end of a line: "BREAK IN LINE XXX" is printed, indicating line number of next statement to be executed or printed.
- CONTROL0 No outputs occur until return made to command mode. If an input statement is encountered, either another CONTROL0 is typed, or an error occurs.
- Equivalent to PRINT

*Extra to kit.*

**EXTRAS AVAILABLE SOON**

**WIN YOURSELF AN ANADP8000 LINE PRINTER**

There’s never enough good software around. That’s why COMPUKIT LTD, are sponsoring a software contest. There are 2 categories:

1) Business and Education
2) Fun and Games

One lineprinter will be awarded to the winner of each category. Send or bring along to the address shown below the following:

1) The program on cassette in the format used by the COMPUKIT UK101
2) Any documentation that you have for the program (source listing not necessary)
3) A signed copy of the rules and conditions of the competition.

**RULES:**

1) Entries, including documentation, must be printed by computer or typed double spaced, with your name on every page.
2) Send or bring your entries to the address shown below.
3) Entries must be received by midnight on 29/2/80, any received after this time are void.
4) Winners will be notified by post before 31/3/80.
5) You warrant by your signature that all programs and documentation material included is entirely your own creation, and that no notice to it have been given or sold to any other party, and you agree to allow COMPUKIT LTD. to use, publish, distribute, modify, and edit it as it sees fit.

**Sample Tape with Extended Machine Code Monitor and Disassembler Included Free**

**No Extras Needed Just Hit ‘Return’ and Go.**

Build, understand, and program your own computer for only a small outlay.

**Kit Only £219 + VAT**

Including RF Modulator & Power Supply.

Absolutely no extras.

Available ready assembled and tested, ready to go for £269 + VAT

**Extras Available Soon**

**AD-A-RAM EXTENDER CARD** provides up to 32K Dynamic RAM Expansion, 8 Eprom sockets for 2708’s or 2716’s. Parallel Port (centronics compatible) and an RS232c serial port.

**Available in kit form**

Send large s.a.e. for our 1979 catalogue

**Win Yourself an Anadex DP8000 Line Printer**

There’s never enough good software around. That’s why COMPUKIT LTD, are sponsoring a software contest. There are 2 categories:

1) Business and Education
2) Fun and Games

One lineprinter will be awarded to the winner of each category. Send or bring along to the address shown below the following:

1) The program on cassette in the format used by the COMPUKIT UK101
2) Any documentation that you have for the program (source listing not necessary)
3) A signed copy of the rules and conditions of the competition.

**RULES:**

1) Entries, including documentation, must be printed by computer or typed double spaced, with your name on every page.
2) Send or bring your entries to the address shown below.
3) Entries must be received by midnight on 29/2/80, any received after this time are void.
4) Winners will be notified by post before 31/3/80.
5) You warrant by your signature that all programs and documentation material included is entirely your own creation, and that no notice to it have been given or sold to any other party, and you agree to allow COMPUKIT LTD. to use, publish, distribute, modify, and edit it as it sees fit.

I agree to abide by the above mentioned rules.

Signature

**COMPUKIT**

**COMP UNIT**

14 STATION ROAD, NEW BARNET, HERTFORDSHIRE

CLOSE TO NEW BARNET BR STATION — MOORGATE LINE

TELEPHONE: 01441 2922 (Sales)

TELEX: 298755

All Products Ex-Stock Please check availability

(Part of the Compishop Ltd. Group)

183

**Europes Fastest Selling One Board Computer — Just Check The Specs.**

**No Extras Needed Just Hit ‘Return’ And Go.**

Build, understand, and program your own computer for only a small outlay.

**Kit Only £219 + VAT**

Including RF Modulator & Power Supply.

Absolutely no extras.
The definitions are becoming blurred. There used to be ways of telling them apart, such as the word size, the direct memory addressing capability, the number of addressing modes and instructions of the processor, or even by the number of peripherals attached.

We are not sure about our new S/09 so we're just going to call it a computer system and let you judge for yourself.

- Direct addressing of up to 768K bytes RAM—No bank switching necessary.
- Motorola 6809 processor uses both 8- and 16-bit instructions and with its 10 addressing modes allows the use of modern programming techniques such as position independent code, re-entrancy and recursion.
- Dynamic memory management system can allocate available RAM in as small as 4K blocks.
- Both Multi-user and Multi-tasking/Multi-user operating systems available.
- Scientific BASIC and Business BASIC, PASCAL, PILOT, Assembler, Editor, and DEBUG programs available. FORTRAN to be released shortly.
- Business BASIC includes Virtual Array, Record I/O, and Index Sequential file handling and 14 significant digit accuracy.
- 3-day Industrial Training Courses by Cambridge Microprocessor Courses at Cambridge University Engineering Department available now, including 'hands-on' use on 10 SWTPc 6809 systems.
- Expandable from a 5in. Dual Minifloppy Disc-based system for less than £2,000 to a massive multi-user configuration for under £40,000.

What you can get for under £40,000.

S/09 Computer System with 768K RAM.
65 Million character Disc Storage.
10 Intelligent Terminals with built-in graphics and 'soft' keys.
2 Daisywheel Printers.
2 Intelligent 132-column Printers.
2 80-column Printers.

Southwest Technical Products Co.
38 DOVER STREET · LONDON · W1X 3RB · Telephone: 01-491 7507 · Telex: 268913