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Some micro-computer suppliers work like that, but we don’t. Because we realise that when you’re buying a computer you want more than the “brochures and boxes” approach. You want to see computers running; to try them out with different software products; to study the documentation; above all. you want expert answers to your most searching questions.

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The Editors

Our second glad tidings came from all the way “down under”. In line with our policy of taking over the world, the happy news is that May this year saw the first-ever publishing of Australian PCW. The editor is one Sean Howard and the contents, a pot pourri of past PCWs and Aussie news.

Two more votes of thanks. First of all the response to our requests for programs has resulted in literally hundreds of submissions — indeed we are now in the process of planning a special software supplement for, hopefully, the August issue. Keep them coming, but please bear in mind before putting finger to keyboard that we are looking for well written, useful/entertaining and, above all, original programs. Some much more specific guidelines will be appearing shortly.

Lastly, a flood of mail answered our plea for referees (April PCW); at the last count the figure stood at well over 100 — and it was still rising. Apart from the obvious benefits their presence will give the magazine to toot its own trumpet, but then - the number of copies printed by nearly 700 ACES members has been steadily rising — that is, until last month. Word arrived from our distributor that he would like us to increase this month — a mixed bag.

because of the foregoing, it is necessary to add that the views expressed in articles we publish are not necessarily those of Personal Computer World. Overall, however, the magazine will try to represent a balanced viewpoint.

Finally, before submitting an article, please check it through thoroughly for legibility and accuracy.

Cover illustration
Conny Jude

Guidelines for contributors
PCW welcomes articles of interest. Don’t be put off if your style of writing is ‘under developed’, ... true worth lies in the content, and shaping features comes naturally to us! Manuscripts should not exceed 3,000 words and authors are asked to use triple-spaced lines with a wide left-hand margin; diagrams, listings and/or photographs should be included wherever possible. Please enclose a stamped, self-addressed envelope if you would like your article returned.

Because of the foregoing, it is necessary to add that the views expressed in articles we publish are not necessarily those of Personal Computer World. Overall, however, the magazine will try to represent a balanced viewpoint.

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Printed by Riverside Press, Whitstable.

Distributed by Seymour Press Ltd., 334 Brixton Road, London SW9 7AG.

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Volume 3 No 6. June 1980
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PCW 3
**ANOTHER BREAKTHROUGH**

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Mutek offer the Ohio Scientific solution: the Challenger series of computers, with real performance, real flexibility, real expandability.

Speed separates the computers from the toys...

The following benchmark test speaks for itself!

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Pet®</th>
<th>Apple®</th>
<th>C2 (1MHz)</th>
<th>C2 (2MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM1</td>
<td>1.7</td>
<td>1.3</td>
<td>1.4</td>
<td>0.7</td>
</tr>
<tr>
<td>BM2</td>
<td>9.9</td>
<td>8.5</td>
<td>7.8</td>
<td>3.9</td>
</tr>
<tr>
<td>BM3</td>
<td>18.4</td>
<td>16.0</td>
<td>15.0</td>
<td>7.5</td>
</tr>
<tr>
<td>BM4</td>
<td>20.4</td>
<td>17.8</td>
<td>16.5</td>
<td>8.3</td>
</tr>
<tr>
<td>BM5</td>
<td>21.7</td>
<td>19.1</td>
<td>17.8</td>
<td>8.9</td>
</tr>
<tr>
<td>BM6</td>
<td>32.5</td>
<td>28.6</td>
<td>27.0</td>
<td>13.5</td>
</tr>
<tr>
<td>BM7</td>
<td>50.9</td>
<td>44.8</td>
<td>39.5</td>
<td>19.8</td>
</tr>
<tr>
<td>BM8</td>
<td>123</td>
<td>10.7</td>
<td>7.5</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Standard PCW benchmark tests, as published in Personal Computer World's review of the Challenger 2 (April 1980 issue). Reproduced (with thanks) by courtesy of the staff of PCW.

New input/output capability...

The C2 and C4 series are supported by a very wide range of expansion units, most of which plug straight into the built-in 48-line backplane. The new 16-line I/O structure uses one backplane slot (for a CA-20 or -20A) to connect with up to eight external boards. Provisional prices are:

- CA-20 8-port base unit with calendar clock: £95
- CA-20A 8-port base unit (no clock): £80
- CA-21 48-line parallel I/O (three 6821 PIA's): £28
- CA-22 high-speed analogue I/O (A-D, 2 D-A, mux): £310
- CA-23 PROM blaster for 2758, 2716, 2732: £110
- CA-24 'breadboard'-type prototyping interface: £110
- CA-25 security/A.C. control interface: £28

Expandability...

All Ohio Scientific systems are designed for expansion without obsolescence. Memory, I/O and discs can be added simply and at any stage; all Challenger series systems can be connected directly to the larger C2 and C3 variants for hard-disc storage up to a staggering 300 megabytes, all memory-mapped! Full network facilities are also available.

Add-on mini-floppy 90K formatted (up to 4 units) £265
RAM board (12K static) can support up to 24K £160
First add-on mini-floppy for C2/C4 requires minimum of additional 12K plus controller: total with drive £480

real built-in flexibility...

Ohio Scientific's C2 and C4 series probably offer more than any other 'personal' system. Try this for a comparison:

Your system | C2 / C4
---|---
Video format | 64×32
PAL colour | Option / Yes
Sound output | Yes: 200Hz – 50KHz
D-to-A converter | Yes: 8-bit log law
Easy expansion | 2 slots free
UK video or UHF | 40+ boards available
RS-232 | Yes
Cassette interface | Kansas City
Price | £349 / £425

A superior Superboard...

Mutek now offer a really superior Superboard: the cased C4 version modified for 2MHz operation and new firmware-controlled true 32X48 display — takes the Superboard right out of the 'toy computing' class!

Standard C1 8K RAM, 1MHz, 25X25 display £220
Enhanced C1 8K RAM, 2MHz, 32X48 display £255
Upgrade for existing C1/Superboard systems to Mutek's enhanced specification (ask for details) £40

Technical literature...

Ohio Scientific are the first company to have all its systems documented by Howard Sams, Inc. — the originators of the SAMS Photofact circuit documentation system. Handbooks are now available for two Ohio Scientific ranges: C1/Superboard and C2/C4 (the C3 series handbook will be available later this summer). These include full circuit schematics and function diagrams for computer and disc-drive circuits, along with essential information such as 'scope patterns at test points.

C1 Technical Guide £4.95
C4 Technical Guide (includes all C2 boards) £9.50

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Model 801 • Impact Matrix Printer

- HEAVY DUTY
- HIGH QUALITY
- HIGH TECHNOLOGY
- LOWEST COST
- RELIABILITY

- SIMPLE MECHANICS

Simplicity means Reliability! One look inside the Model 801 will convince you that it's the simplest design with the fewest parts. No field adjustments to get out of line. All moving parts are permanently lubricated. You will also see it is not a toy, like many low cost printers. Impact Data is ruggedly designed with quality parts to provide many years of trouble free operation. No pulleys, cables, helixs, reels or plastic gadgets. There are only two moving parts to drive the print head with one positive, continuous motion (Pat. Pending).

- BETTER PRINT QUALITY

Take a look at the Print Head. It's already the standard of performance in millions of business machines now in the field. It prints perfectly, continuously, hour after hour at 132 CPS for over 100 million characters with no overheating, print degradation or malfunction. The stainless steel timing fence under the head places 7x7 dot matrix characters horizontally within thousandths. A Stepper Motor drives high quality Tractors - the same ones used in all the most expensive printers - to provide precise vertical character positioning. The continuous loop Ribbon and Re-inking Roller is automatically driven by the head mechanism (no separate motor) and prints up to 5 million uniform-density characters before requiring replacement (that's simple too, taking only a few seconds). The printer is equipped with a Forms Thickness Adjustment so you can get up to five high quality copies. Compare the print quality and placement of the Model 801 with any other matrix printer. You won't find one better.

- SIMPLE OPERATION

Just three control switches on the front panel - Reset, Form Feed and Power on/off (illuminated). Reset clears the 127 character input buffer and sets the Top-Of-Form. Motion can be stopped at any intermediate position by Reset - or just use the manual knob on the left side of the printer to advance paper. Forms length can be set to any integral number of lines by an internal DIP switch.

- SIMPLE INTERFACING

A single standard DB25 connector accepts either RS232 Serial or Centronics Parallel ASCII coded input signals depending on how you wire up the cable. The Model 801 interfaces easily to your Apple, TRS-80, PET or any S-100 computer. An internal DIP switch determines BAUD Rate of 110, 150, 300, 600 or 1200 BAUD. An Automatic Line Feed after each Carriage Return command is switch selectable.

- SIMPLE ELECTRONICS

All electronics including the Power Supply are included on a single circuit board. All ICs socketed for simple replacement. No pots to get out of adjustment, either.

- SIMPLE MAINTENANCE

Preventive maintenance consists entirely of cleaning periodically. All bearing surfaces are permanently lubricated. No operator field adjustments are necessary.

- SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Model 801</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print Type</td>
<td>7x7 Impact Dot Matrix</td>
</tr>
<tr>
<td>Print Rate</td>
<td>132 CPS (max)</td>
</tr>
<tr>
<td>Character Set</td>
<td>96 character lower case ASCII</td>
</tr>
<tr>
<td>Character Height</td>
<td>0.055 in (0.139 cm)</td>
</tr>
<tr>
<td>Print Format</td>
<td>80 in (203 cm)</td>
</tr>
<tr>
<td>Line Spacing</td>
<td>80, 96 or 132 columns</td>
</tr>
<tr>
<td>Line Feed</td>
<td>50 UPM Printing, 50 UPM Sewing (100 milisecond)</td>
</tr>
<tr>
<td>Ribbon</td>
<td>Continuous Loop with Re-inking Roller</td>
</tr>
<tr>
<td>Copies</td>
<td>5 Million Character Life</td>
</tr>
<tr>
<td>Paper Feed</td>
<td>Original 4+4 Copies</td>
</tr>
<tr>
<td>Paper</td>
<td>Tractor or Friction*</td>
</tr>
<tr>
<td>Interface</td>
<td>8-bit Parallel (Centronics compatible)</td>
</tr>
<tr>
<td>Buffer</td>
<td>127 Character or 26</td>
</tr>
<tr>
<td>Dimensions</td>
<td>12&quot;x8.5&quot;x14&quot; (30 x 217 x 35 cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>29 lbs. (13 kg)</td>
</tr>
<tr>
<td>Shipping</td>
<td>35 lbs. (16 kg)</td>
</tr>
<tr>
<td>Power</td>
<td>220 VAC, 15 A</td>
</tr>
<tr>
<td>Temperature</td>
<td>70 ± 5% C Ambient</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>10-90%</td>
</tr>
</tbody>
</table>

* Available June 1980

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* 80 character/line with horizontal scrolling.
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* Highspeed powerful firmware graphics system.
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**System Specifications**

**CPU**
- Microprocessors: Two 2800s with 4MHz Clock Frequency. One 2800 acts like the first processor performs all general processing and inter-processor communication. The second 2800 is dedicated for the back-up processor. The second 2800 may be preempted by the first processor for other processor related functions.
- Word Size: 8 bits
- Execution Time: 1.0 microseconds to register
- Addressable Instructions: 100
- Interrupt Mode: All interrupts are vectored.

**Floppy Disk**
- Storage Capacity: 320K total bytes formatted on two 8.5" double density drives. Optional external 10-300K single head disk drive available using optional 5-100 disk adapter.
- Data Transfer Rate: 255Kbps.
- Average Access Time: 2 milliseconds, 15 milliseconds back-to-back.
- Mode: 8-bit, single side disk.
- Disk Rotation: 300 RPM.

**Internal Memory**
- Dynamic RAM: 64K bytes dynamic RAM.
- Static RAM: 256K bits of static RAM is provided in addition to the main processor RAM. This memory is used for program and/or data storage for the auxiliary processor.
- ROM Source: 16-bits dedicated. Allows ROM "switching" of system of power on. ROM storage is 2K9 compatible and may be reprogrammed by the user for custom applications.

**CRT**
- Display Size: 12"-inch, dynamically focused, P4 phosphor.
- Display Font: 28 lines of 60 characters per line.
- Character Size: 8 x 16 character matrix on an 8 x 12 character field.
- Color: Green speckle graphic update for fast form generation.
- Display Resolution: 320 x 200.
- Cursor: Reverse image (black matrix).

**External Disk**
- Access Multiple: Four ways (four heads). Automatically written into ledgers from address files. Includes override option.
- Powerful Alternative Double Entry System: General index retrieval and auto stock update; Nominal codes retrieved from address files automatically.
- Auto Check: Prevents double entries.
- Record Sorting: By any field (both alpha or numeric).
- Record Creation/Deletion/Search/Amend/Print: Comprehensive database management system includes failures, fast single key stroke entries, controlled allocation, interrupt mode. All interrupts are vectored. Word size, cursor, bandwidth, cache size, static RAM, disk rotation, average access time 250 milliseconds, 35 milliseconds track-to-track.

**Application Packages**
- Ledger and Word Processing: Extensive software development tools are available including software for the following applications: Payroll, Accounts Receivable, Accounts Payable, Inventory Control, General Ledger, and Word Processing.
- Accounting: General 1,200 upper and lower case characters.
- Data Retrieve: O/B, decimal, alpha, numeric and four user-programmable function keys.
- Up to 64 user-defined two key function sequences.
- Up, down, left, right, and home.
- Structural Form Design: All processor related functions and hardware are on a single printed circuit board. All video and power related circuits on a separate board. These three boards are interconnected via a single 22-pin ribbon printed circuit board. All video and power related circuits on a separate single board. These two boards are interconnected via a single 22-pin ribbon cable. CRT and two circuit boards are controlled by basic CRT and DSK Drive. CRT Drive is mounted later, upper corner for ease of service.

**Environmental**
- Weight: Approximately 45 pounds.
- Dimensions: 34 1/2" (H) x 21 1/4" (W) x 23 1/2" (D).
- Power Requirements: Half or Full Duplex. One or two stop bits. Choice of even, odd, marking, or spacing.
- Memory-Mapped at 38 kilobaud. Serial transmission of data at rates up to 9600 bps
- Real mode: 220 asynchronous. Synchronous interface option.
- Standard: 750 baud compatibility.
- Two board modular design. All processor related functions and hardware are on a single printed circuit board. All video and power related circuits on a separate board. These two boards are interconnected via a single 22-pin ribbon cable. CRT and two circuit boards are controlled by basic CRT and DSK Drive. CRT Drive is mounted later, upper corner for ease of service.

**Communication**
- Transparent Mode: One or two stop bits. Choice of even, odd, marking, or spacing.
- Print: Programmable print speeds (400, 9600, 19200, 57600). All printer speeds are supported.
- Memory-Mapped at 38 kilobaud. Serial transmission of data at rates up to 9600 bps
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03 = Enter A/C RECEIVABLES
04 = Enter A/C PAYABLES
05 = Enter UPDATE INVENTORY
06 = Enter UPDATE ORDERS
07 = Enter UPDATE BANDS
08 = Enter UPDATE BANDS
09 = EXAMINE REPORT SALES LEDGER
10 = EXAMINE REPORT INCOMPLETE RECORDS
11 = EXAMINE REPORT INCOMPLETE RECORDS
12 = EXAMINE PRODUCT SALES

**SELECT FUNCTION BY NUMBER**

13 = PRINT CUSTOMERS STATEMENTS
14 = PRINT SUPPLIER STATEMENTS
15 = PRINT AGENT STATEMENTS
16 = PRINT SALES STATEMENTS
17 = PRINT CUSTOMER STATEMENTS
18 = PRINT INCOMPLETE RECORDS
19 = PRINT ORDERED RECORDS
20 = PRINT ORDERED RECORDS
21 = END MONTH MAINTENANCE
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**DATABASE MANAGEMENT INCLUDES**

*** FILE CREATE/DELETE/SEARCH, *** RECORD CREATE/DELETE/SEARCH, *** OPTION PRINT, *** RECORD SORT ANY FIELD ALPHA OR NUMERIC, *** INDEX SEARCH OR GENERAL SCAN PRINT IN ANY FIELD (EG TOWN OR NAME), *** 4 ARITHMETIC FUNCTIONS TO USE AS CALCULATOR, ON LAST 4 FIELDS' *** AUTO CHECK TO PREVENT DOUBLE ENTRY TO FILE MANAGEMENT SYSTEM, DYNAMICALLY ALLOCATING INFORMATION TO MINIMISE DISK SPACE CONSUMPTION

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OTHER
- PASCALZ - Compiler generates P code from extended language implementation of standard PASCAL. Supports interaction through external procedure calls and SEGMENT procedure type. Provides consistent error handling capability with the added advantage of much smaller memory and processing time. Requires 566 CP/M.
- PASCAL2 - 280 native code PASCAL compiler. Produces optimized portable object code. All interfacing to CP/M is through standard PASCAL library. The package includes complete compiler together with assembly source and assemble language. For the price of 566 CP/M. Requires 700 CP/M.
- TINY - Subset of standard PASCAL. Generates structured and structured language, described by Kernighan and Ritchie, and makes extensive facilities. Conforms to the full UNIX Version 7 C language. Requires MAC (See under Digital Research). Requires 32K.
- STRM - Structured Macro Assembley Language - Package for Z80 assembly language. Provides capabilities to retrieve information by subject. Hashing and random searches. Supports 1.0. Requires 566 CP/M.

COMMUNICATIONS
- DISILOG - As Distel to Zilog Mostek mnemonic files. Runs on standard IBM models.
- STRING/80 Structured Macro Assembley Language - Package for Z80 assembly language. Provides capabilities to retrieve information by subject. Hashing and random searches. Available in Integer, Extended and Storage. Requires 566 CP/M.
- BSTAM - Utility to link one computer to another also supplied with STRING/80. Allows file transfers at fast speed, find, move, copy, delete, list and search files. Supports all 76 functions for transferring 10 MB, string manipulation and storage allocation. Requires 32K.

SOFTWARE FOR OFFICE USE
- DDT - Disk development tool with ASCII source code and a powerful utility to reduce the size and increase the speed of the programs in Microsoft Basic and TRS-80 Basic. VS - Digital precision subroutines, for computing between transcendental functions including square root, natural log table, and transcendental function.
- CPM/374X Utility Package - has full range of functions to create or re-enable an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files. Requires 32K.
- BASIC UNITED DISK - Consists of 13 CRUNCH versions.

SOFTWARE FOR BUSINESS USE
- STRM - Structured Macro Assembley Language - Package for Z80 assembly language. Provides capabilities to retrieve information by subject. Hashing and random searches. Available in Integer, Extended and Storage. Requires 566 CP/M.

SOFTWARE FOR PROGRAMMING USE
- DISILOG - As Distel to Zilog Mostek mnemonic files. Runs on standard IBM models.
- TINY - Subset of standard PASCAL. Generates structured and structured language, described by Kernighan and Ritchie, and makes extensive facilities. Conforms to the full UNIX Version 7 C language. Requires MAC (See under Digital Research). Requires 32K.
- STRING/80 Structured Macro Assembley Language - Package for Z80 assembly language. Provides capabilities to retrieve information by subject. Hashing and random searches. Available in Integer, Extended and Storage. Requires 566 CP/M.

SOFTWARE FOR DATA MANAGEMENT
- DISILOG - As Distel to Zilog Mostek mnemonic files. Runs on standard IBM models.
- TINY - Subset of standard PASCAL. Generates structured and structured language, described by Kernighan and Ritchie, and makes extensive facilities. Conforms to the full UNIX Version 7 C language. Requires MAC (See under Digital Research). Requires 32K.

SOFTWARE FOR DATABASE USE
- TINY - Subset of standard PASCAL. Generates structured and structured language, described by Kernighan and Ritchie, and makes extensive facilities. Conforms to the full UNIX Version 7 C language. Requires MAC (See under Digital Research). Requires 32K.
- STRING/80 Structured Macro Assembley Language - Package for Z80 assembly language. Provides capabilities to retrieve information by subject. Hashing and random searches. Available in Integer, Extended and Storage. Requires 566 CP/M.
PET INTERFACES

All IEEE-488 compatible and addressable

- **8 - CHANNEL 12-BIT A-D CONVERTOR UNIT**
  - Differential inputs, bipolar or unipolar, voltage or current; front panel DIN connectors; conversion time 100 microseconds.
  - **PRICE: £600**

- **16 - CHANNEL 8-BIT A-D CONVERTOR UNIT**
  - Single-ended inputs: current or voltage (0-2.5, 0-5, 0-10 volts); front panel DIN connectors; conversion time 120 microseconds.
  - **PRICE: £300**

- **8 - CHANNEL 8-BIT D-A CONVERTOR UNIT**
  - Output voltage 0-2.5 or 0-5 volts; front panel BNC connectors, each output is independently latched and converted.
  - **PRICE: £360**

- **8 - CHANNEL RELAY CONTROL UNIT**
  - Sixteen individually addressable reed relays; LED indicates each relay state; contact rating 100 V @ 0.5 A; front panel 4mm banana sockets.
  - **PRICE: £360**

- **8 - CHANNEL 8-BIT DIGITAL DATA ACQUISITION UNIT**
  - Eight channels each of eight bits plus two handshake signals per channel; suitable for most digital instruments such as DVMs, counters, transient recorders, etc.
  - **PRICE: £400**

- **X-Y ANALOG PLOTTER INTERFACE**
  - Two analog output channels of 8-bit resolution plus addressable relay for pen-lift control; 0-2.5 or 0-5 volts.
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PET and SHARP Analogue and Digital Interfaces

All units supplied boxed, complete with integral power supply, fuse, cables and connectors, PLUS illustrative BASIC software.

**SHARP MZ-80K INTERFACES**

- **PARALLEL PRINTER INTERFACE (PPI)**
  - Will run most parallel printers such as the Centronics range, Analex DP8000, etc.
  - **PRICE: £110**

- **SERIAL PRINTER INTERFACE (SPI)**
  - Unidirectional serial interface with RS232 or 20 mA current loop output; switch-selectable crystal-controlled baud rate; will drive Teleprinters, DECwriter, TI Silent 700, VDUs, etc.
  - **PRICE: £150**

- **BIDIRECTIONAL SERIAL INTERFACE (BSI)**
  - RS232 and 20 mA current loop input and output, with handshake lines; crystal-controlled baud rate generator; switch selectable baud rate, parity, stop bits, auto-LF.
  - **PRICE: £210**

- **FAST DATA ACQUISITION SYSTEM**
  - 16 analogue input channels, unipolar or bipolar; Conversion time of 15 microseconds on single channel scanning; includes 4 digital-to-analog channels.
  - **PRICE ON APPLICATION**

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MODEL 730
Miniprinter £555

The Model 730 dot matrix printer is a high-quality printer ideally suited for microcomputer applications. It has been designed for small business users who look at their printer as a reliable provider of hard copy information. The Model 730 is ideal for these applications because it prints quickly at 100 c.p.s., is easy to operate, and offers the convenience of handling three different kinds of paper: cut sheets, paper rolls, or fan-folded (such as pre-printed forms).

The 730 can handle any of those three paper forms interchangeably — without adjustments — producing an original and up to two clear carbons. Its 80 column line length matches most standard VDU formats, and its compressed print mode allows 132 column printing on 8" wide paper. The 7 x 7 matrix assures excellent print quality even with 3 part forms. Full upper and lower case 96 character ASCII set is standard.

MODEL 1420
Video terminal £680

The H1420 is a new low-cost video terminal designed to support small business systems using both data and word processing software.

It features a typewriter-style keyboard arrangement with both upper and lower case, making it suitable for fast and accurate entry with minimal operator training. Also included is a separate numeric keypad to make numeric entry faster, easier and less prone to error. Among other important features are cursor control keys, typematic and an alternate function keypad. Characters are displayed using a crisp 7 x 9 matrix on a 24 x 80 character screen in high and low intensity, blink or non-display (zero intensity).

The H1420 is an economy terminal with all the features needed to support a variety of microcomputer applications and human engineering design for adaptability and reduced operator fatigue.

To RAIR Limited 30-32 Neal Street, London WC2H 9PS
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**High Speed Sorting**

Software supplier A J Harding has just made a nasty dent in the much-overworked theory that US software can only be imported to the UK by doubling its price. Harding's pronouncement is short, and beautifully pithy. "As prime distributor for Racet Computers of California, A. J. Harding (Molimerx) announce their high speed sorting program, which is now available for the the Model I and Model II Tandy TRS-80.

"DSM is a self contained system written entirely in machine language and ready for immediate use. It will sort large multiple disquette files on a minimum one-drive Mod II or twin drive Mod I system; it will physically re-arrange all records without needing key files; it will sort random files created by BASIC including sub-records spanning sectors."

I also note it will do several other things on various fields, and is ideal for large mailing lists, inventory control, and other business applications. Sort times are around 33 seconds for 16 Kbytes, up to 1081 seconds for 340 Kbytes, becoming absurd at 2569 seconds for 680 Kbytes — around 16 hours. "The prices", concludes Harding, "in the US are $75 for the Model I and $150 for the Model II. In this country, we're selling them at £39.50 for Model I and £79.50 for the Model II." Harding is in Bexhill-on-Sea; tel. 0424 220391.

**Just Open**

A new store has arrived in Edgware, Middlesex, stocking PET computers and software. Opened in April by DaVinci Computer, director Jeremy S. Rose tells me he's been in business for just over a year. Details from 01-952 6526.

**Sirius Business**

There's a well-known radio programme called the Hitch Hikers Guide to the Galaxy, in which the part of the idiot is played by the Marketing Division of the Sirius Cybernetics Corporation... to quote, "a bunch of mindless jerks who'll be the first up against the wall when the Revolution comes!"

There's a virtually unknown microcomputer supplier in Leamington Spa who has called his company Sirius Cybernetics. His name is Cutler, and I can tell you virtually nothing about them because whatever Cutler's Sirius Cybernetics does have, it isn't a telephone.

The announcement in front of me says that the company makes memory boards for South West Tech Products micros. A board with two banks of 8 Kbytes costs £220 with VAT extra. It comes assembled and tested, and runs at 2 MHz clock speed. Sirius Cybernetics claims to be at 7 Euston Place, Leamington Spa, Warwick CV32 4LN.

**Handy Plan**

Any programmer can display any character, in any position, on the screen of a PET computer. All the programmer has to know is the location in memory of that spot on the screen. These locations start with number 32708 in the top left hand corner, and continue down to 33767 in the bottom right.

Are you good at counting? To find any particular location in between "all you have to do" (a dead give-away that it's almost impossible) is remember that there are 40 locations to a line, and 25 lines. To save yourself trouble, I recommend that you divide a sheet of paper up into 40 rows and 25 columns, and write the number of each starting with 32708, and going on till you reach the end. You have to write down 1000 numbers, and I dare say you'll make a mistake or two; still you can always cross those out and start again.

With this sheet as a grid, draw the graphics characters in the desired squares.

Oh, you'd better print several, in case you want to draw another picture another time.

Hopefully, that introduction will have given you an idea why I think Impex Enterprises is not at all daft in producing a pre-printed video planner for PET. The company charges a hefty £2.70 for a sheet; it comes in a plastic sheath, and the plastic sheet can be wiped off the plastic when the design is finally fixed. The ink can be wiped off the plastic when the design is finally fixed. The ink can be wiped off the plastic when the design is finally fixed. The ink can be wiped off the plastic when the design is finally fixed. The ink can be wiped off the plastic when the design is finally fixed. The ink can be wiped off the plastic when the design is finally fixed. The ink can be wiped off the plastic when the design is finally fixed. The ink can be wiped off the plastic when the design is finally fixed. The ink can be wiped off the plastic when the design is finally fixed.

**PET Talk**

One look at the size of the loudspeaker on the "talking calculator" for the PET will warn you that Julian Allason's speech program deserves a better output device if you are thinking of using it for generating music. The program costs £1.90, and it animates the PET keys. For instance, if you press 1 it says "one" and so on. It's useful for the deaf (could he mean "blind"?) and helpful for the rest of us. The squawk box costs £27. ACT Poesoft are at 68 Hagley Road, Edgbaston, Birmingham B16 8PF.

**Firm Stand**

High technology means a painter on its own stand. A stand with (or without) a floor-level shelf for a box of paper is available from Wisbech Computer Services, it's designed to take a Texas 810 printer. Wisbech describes the stand as "solid and robust" which I take to mean that it doesn't wobble as the head moves across the paper.

Details, prices from Wisbech (0945) 641146.

**APL Gets Personal**

You can learn the programming language APL on a micro. Do you care? Yes. The first time a beginner sees a program written down, ready to be typed into a system, it had better be BASIC rather than APL... that's if he's not to be frightened off computers for ever.

A Programming Language is totally incomprehensible at first sight. (So is BASIC,
but it doesn't look incomprehensible.) However once one has grasped what's going on, it quickly becomes much clearer, much more concise — and most important — simpler for the personal programmer to use.

Strangely, APL is the way that pre-micro users were able to get personal computing power — by writing their own programs and running them on their own terminals when they wanted to do things that the data processing Department couldn't or wouldn't do for them. Because APL was provided on big machines, it was normally given in a way that took advantage of big machine characteristics; the most noticeable characteristic of big machines is that they allow the user to write enormous chunks of code and keep them very cheaply on big discs, where storage costs £0.0006 per megabyte.

A surprising result of this is that users of micros quickly demanded that an APL interpreter could not work unless it did have huge chunks of code to convert the instructions into actions. This turns out not to be the case. Code has been written that's short enough to fit into a Zilog Z80 address space and which can still execute most of the instructions that APL writes will give it, and there's enough space left over to fit a useful APL package.

The first UK company to offer APL on a micro called itself APL... short for Alan Pearman Limited. Now Alan Pearman is running courses on micro-APL, comparing the Vanguard and the Canadian MCM system with the Zilog Z80 address space and which can still execute most of the instructions that APL writers will give it, and there's enough space left over to fit a useful APL package.

The seminar takes a day, and demonstrations are given in financial modelling, statistics, report formatting, hard copy graphics, critical path method, and utility functions. Cost quoted is £25 per company: individual users should try to join a company seminar in London, Manchester, Bristol, Birmingham, and York.

Details from APL at A. P. Limited, Freepost, Chester CH1 5YV (without a stamp) or on Chester 46024 and 21084.

Old Hands On Dec

Nobody in their right mind would buy a huge Digital Equipment Corporation mini-computer in order to develop software for a microprocessor — even as expensive a microprocessor as the new Zilog/AMD Z8000.

The reason that Zilog has offered a piece of software to allow Z8000 programmers to work on a DEC PDP-11 mini is not that Zilog customisers are out of their minds, however. It's because a lot of the people who want Z8000 systems already have PDP-11 minis available in their companies, and also because these minis can run operating system called UNIX — a time sharing system originally developed by Bell Labs (the research wing of America's telephone network supplier). In the words of Dr Bernard Peuto, Zilog's director of component design engineering and one of the ideas men behind the Z8000 design (or "architecture") the UNIX operating system is "an ideal software development environment" for the Z8000.

It's still not possible to get reliable working Z8000 chips if the version of the chips you want is the segmented one with extended memory addressing. However that day is not far off, and Ithaca Intersystems has a cpu board ready with either 8001 or 8002 processors for $100 systems.

Anybody who wants to have software ready for the arrival of the hardware will have to start now, if not sooner. They can feel subtly re-assured by Peuto's claim that the Unix/PDP-11 cross-software package "is able to generate highly efficient code for the Z8000 because the Z8000 architecture is greatly influenced by that of the PDP-11, on which the Unix software was implemented."

Details in the UK from 0282 36131.

Tumbling Prices

New prices have been announced for Digital Micro-systems products — microprocessor based and bit-slice mini systems — by Modata, the main distributors. According to Modata, the cuts are around 25%. The cost of a DSC-2 with 64 Kbytes memory and just over a megabyte of diskette storage and with the CP/M operating system thrown in, is now £3525. With a 13.7 megabyte hard disc drive and the model number changed to HDA-4004, the price is £6745. The bit-slice based Hex-29 (it has an instruction cycle of 160 nanoseconds) with a multi-tasking operating system costs upwards of £6445.

At this stage, it would seem that Modata is more interested in seeing dealers than direct customers: the announcement says that the network of dealers "who are able to provide a wide range of professionally supported application software" must expand. Details from Bryan Barnes at 30 St John's Road, Tunbridge Wells, Kent.

Wheeling And Dealing

New "and experienced" overseas dealers are needed by New York company, Synchro-Sound Enterprises, apparently that means us. The products are terminals and they quote names such as ADDS, Televideo, Lear Siegler, Texas, Centronics and Qume. The company also distributes microcomputers offered here are North Star, Cromemco, Digital Micro-systems, Alpha Micro and Superbrain. My impression, however, is that none of the prices will make you fall off your chair. The man to talk to if you want to break the exclusives of other distributors is Robert Kant at 193-25 Jamaica Avenue, Hollis, New York, NY 11423: phone (212) 468 7067.

Games And Claims

"We know of no other company that supplies diskette software at these prices."

The claim has been made by Databank Software Services as a result of its price cuts. The company is in Loughborough, and the machines involved are PET, Apple II and II+T 2020, and Exidy Sorcerer; the diskette software is Apple/ITT only. Fourteen games titles are listed at £10 each (on floppy including media and postage).

There is one way to get...
provided it fits your needs. We can supply computers from North Star, Apple and Commodore, each one guaranteed to match closely your particular requirement.

**PET**

Britain's best-selling microcomputer - unnerved in cost and performance for teaching the fundamentals of computing using BASIC, and invaluable to staff for school records, timetable planning, attendance figures and examination results.

16K PET £675

**APPLE**

The ideal teaching aid for more advanced students where its superb high-resolution colour graphics can be fully exploited in scientific and engineering use. Its advanced features, including voice synthesis and output, stimulate involvement and help make computing creative and fun. It can now be used for teaching PASCAL, the exciting language of the future, while further applications include laboratory control and data logging.

16K APPLE £695

**PIA Interface**

This interface opens up your Apple to a variety of peripherals such as joysticks, printer type equipment or another computer. It is a parallel input/output card. Apple has output parallel interfaces but there are not that many parallel input cards around. We think this is a good one. It has two 8-bit bidirectional parallel ports and four handshaking lines. TTL compatible S-1 and A and B with a CMOS Drive capability on Side A. All external lines have 100-125 Type Connector.

In our opinion a good solid interface.

Order Number: K06274A £180.00.

**Synchronous RS232C Interface**

What more need be said? Synchronous Serial interfacing has been a problem in the past. Now we have the answer. If any extra protocol is required this can easily be catered for.

- **DATA Transfer modes:** 7 or 8 data bits, PARITY EVEN or NO parity, 1 or 2 stop bits. Synchronous Serial by word. Serial by 8 or 9 data bits.
- **DATA Transfer Rates:** 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, EXTERNAL.
- **PROGRAM Memory:** ROM (Mask) or PROM (Full Link) or RAM (Static 2112's) or EXTERNAL.
- **SPECIAL Features:** 5. Determine exact program length 6. Change DOS commands
- **Error**? Apple Pip is for you.

Order Number: K06280A (Synchronous interface) £90.00.

**Light Pen**

The Synchronous Light Pen is now imported by ourselves directly and is in our opinion the best light pen for the Apple. Complete with software you can now read a coordinate on the screen, page or text page. Ideal for Computer aided graphics or simple data entry. Try one.

Order Number: K02910A £165.00.

**PASCAL Light Pen Driver**

Use the light pen in tutoring/graphics with K.C.E advanced library software.

Order Number: K01201A £265.00.

**Other goodies you may not know about!**

**Supercolour**

No colour for Apple II but colour for the future, while further applications include computing creative and fun. It can now be used for teaching PASCAL, the exciting language of the future, while further applications include laboratory control and data logging.

Order Number: K02400A £244.80.

5b the Poultry, Nottingham NGL 2HW. tel: 0602 583254. telex: 37297 (Keenco)
Over by the petrol pumps, Gonzo Talbot has installed a remote temperature sensor. The temperature rises, and the sensor sends a signal to Gonzo's computer; to do this, it switches on a small current, generating a small spark. Now you know why Burr Brown is so pleased that its Micro-mux data acquisition transmitter has received safety approval for use in flammable atmospheres. Details on 0923 33837.

them all absolutely free... by buying Databank's £150 mailing/letter system. This is described as "a marvellous time saving system combining the addressing capability of the computer in conjunction with a powerful letter writer and editor."

"The games are Startrek (a branching game this), Snooker, Cash Register, Astronomy, Noughts and Crosses, Space Ship, Bank Account (OK, they're not all games), Space Dog, Payroll, Klingon, Library Index (Dewey system), Phaser and Jet Flight with current cost accounting. I'm kidding about the current cost accounting. Details 06069 217671.

Comprehensive Cube

It may be the first place in Britain where anybody can just walk in and use a computer with about the same sort of fuss that joining a library would involve. That will be the Community Computer Centre, and it's sitting there in North London, as from July 11, when Uncle Clive Sinclair, a long-standing friend of the brains of the project (Robin Bradbeer) opens it. Bradbeer, a lecturer at the North London Polytechnic, has managed to involve the local councils of Islington and Hackney, to the point of getting £20,000 set aside for Community Computer Centre or C3 or Cube. Cube "will cater for three groups of people," Bradbeer promises. First, there will be integrated systems such as the Sharp MZ280K, the PET, and the Tandy TRS-80. There are also plans for three systems with colour graphics, and finally, another three based on the CP/M operating system - North Star Horizon type machines. "We hope that some of the other systems will run CP/M too," says Bradbeer.

Morning sessions at Cube will be for groups of businessmen or classes of students, referred to the Cube by people such as the Computer Centre for Islington. Afternoons will be devoted to allowing businessmen to come in and use the machines "on a cost basis".

Apple Crumble

Word reaches me that the Apple Dealers' Association is dying. It was set up in (some haste) when Microsense took over the Apple II distribution franchise last year - with the object of smoothing the troubled waters that lay between Microsense and Personal Computers (the previous distributor).

The source of this strange information is, through devious means, Microsense. People there seem confident that the question of a special advertising campaign aimed at schools has hopelessly split dealers who were formerly united.

The question over which the split occurred was whether it was a good idea - or an underhand trick - for Microsense to make an offer to schools to supply the first Apple II they might buy at a generous discount. Those who opposed the promotion said that Microsense had promised not to deal direct with users, but only through dealers. They also said that Microsense had actively discouraged the practice of giving discounts as a way of encouraging trade. And they said that a promotion like this should be co-ordinated through dealers... not springing on them as a surprise. And finally they said that Microsense had encouraged dealers to sell aggressively to schools, and that just at the time of year when this work might bear fruit, here was the bread being snatched out of their mouths; it wasn't fair.

The man at Microsense who dreamed up the idea was fully supported by his loyal colleagues, who hastily told dealers and anyone else who cared to ask that they knew nothing about it - an entertaining thought if true. But not all dealers felt horrified. Those who had done no promotion to schools pointed out that the advertising might provoke some sales; the discount only applied to the first purchase, which might reasonably be expected to lead to normal follow up sales later.

Am I taking sides if I point out that this is one of those questions with more than one answer? Divided or not, the dealers who opposed Microsense made their point, and the distributor promised they would get their cut; they would also be expected to handle any follow-up business... at full price, and that's official.

It may be just one of those administrative hiccups that one expects between trading partners, and maybe I should take no notice. By the same token, perhaps I should also ignore Microsense's latest advertising campaign. If you care to read it (not in PCW, because we've protested) you'll note that it includes the statement that the Apple II is the only microcomputer supported at dealer level. This statement is what many in the writing trade call "fiction". When asked for a comment, by this paper, the Microsense director involved described the statement as "a printing error". You may feel that I shouldn't stoop to discussing this sort of petty rubbish - and I wouldn't, but for the fact that the last time I wrote...
about the Apple Dealers' Association, that same direct-
or complained bitterly to me about not checking my facts
with him before sending copy
to the printers. When my col-
league David Tebbutt check-
ed these "facts" (including:
"it's a printing error")
with him the phrase he used was
"That seems a bit unlikely-
ly, Stephen", "I didn't think
you'd fall for that one,"
responded the director cheer-
fully.
I shall continue to check
my facts with the dealers.

Classroom Course
Computer Aided Classroom Instruction is all very well,
but you need to instruct your classroom,
there's a £27.00 course by
this title being run at the
University of Salford on
July 15 to 17, It aims to
show how desk-top micros
instruct your classroom,
Instruction: if you need to
have no knowledge of pro-
blems in science, even if they
students to explore pro-
lems in science, even if they
have no knowledge of pro-
gramming. Details from
Admin Assistant, (Short
Course) Room 110, Univer-
osity of Salford M5 4WT.

A Word of Advice
A new report on word process-
sing suggests that you should
"drive a hard bargain with
your supplier". The report in-
facts come from Logica, a big
software house with a word
processing division. You have
to be prepared to start with
Logica... the report costs
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tions in Northwood Hills,
Tel: Northwood 28211.

Under Control
A nuclear reactor somewhere
in the North of England is
unreliably reported to be
controlled by a Commodore
PET. I've been told this by
the man who claims to have
installed it although, not sur-
prisingly, he won't say where
it is.
Anyone planning a similarly
ambitious process control
job will be interested in the
range of PET-connectable
interfaces launched by Digi-
tal Design and Development
(or 3D) of Grafton Way,
London. The range starts
with a converter of analog
signals (temperature, voltage,
pressure and the like measur-
ed by devices such as thermo-
couples, strain guages and so
on) giving 12-bit digital
values to the PET through
its IEEE interface. And it
includes an 8-bit, eight
channel analog output device
at £350, a 16-channel relay
driver, at the same price, an
X-Y plotter interface at
£200, a £400 digital data
gatherer and a 16-
channel, analog to digital
converter offering only 8-bit
accuracy, for £300. Software
is available for all. Details on
01-877 7888 (and see Micros
in Control, page 105 this month).

Right, As Usual
It was me who first told
Britain what a good thing the
Technologies computer (it's
able to receive viewdata and
other teletext) would be: and
at last the National Enterprise
Board has got the message.
The Technologies Expandable
Computer System (TECS) is
to be distributed by B & B
Computers of Bolton. It was
launched at the Mersey
Micro Show on April 30, with
the backing of at least
£40,000 of NEB-raised
company to push it out.
B & B is on 0204 26644, and
managing director J Black-
burn tells me: "The Post
Office also said 'P.O.'!". Don't
ask me to explain — I only
report.

Prize Winners
There are very many "micro-
systems" — and very ordinary
ones at that — which cost
more than an all-British,
16-bit Digico system with
printer and discs, operating
software and Design Council
award. This must explain why
the Department of Industry's
micro competition organisers
have rejected Digico's offer to
provide one of these compu-
ters as a prize. Gonzo Talbot
lives!
Meanwhile in Peter-
borough, things have gone
much better. The winner (still
unnamed at press time) of
that town's micro contest has
a year's free use of a factory
where he can manufacture
that micro-recorder of
industrial process parameters
(flow, temperature, pressure)
— a recorder which won him
the prize.
Second prize went to a
company director from Kent
who has devised an audio
visual teaching unit. Third
prize went to a "simple
osmolarity meter". Yeah!

Tra-la-la
It is incredible how fast you
can enter a song using the
Musicon development sys-
tem by Computercraft (it
says here). The program runs
on any CP/M based system
with 24 Kbytes or more, and
produces "up to four voices
(notes) each with seven
octave range and each with
different musical sounds". It
costs £79.95.
The Newtech Computer
Systems Inc. Model-6 Music

These are the terminals which will be appearing alongside every French telephone from next
year — as a replacement for telephone directories. Mass produced at a cost of under £50 per
terminal, they will cost the user absolutely nothing to install. How can the French telephone
company afford it? Simple: they'll be paid for with the money which has previously been
spent on printing all those expensive telephone directories. Further, the user will now be able
to look up any telephone number in the country instead of having to ring directory enquiries
for out-of-town numbers. The four versions are made by Thompson-CSF (above left), Matra
(above right), CIT-Alcatel (below left) and TRT (below right). So how about it, Buzby?
Your Commodore PET System

The Commodore PET is Britain's best selling microcomputer and the most popular choice in every field:

* In Education for teaching Computer Science and as a teaching aid for other subjects.
* In Science and Engineering for solving problems and for monitoring laboratory equipment.
* In Business the PET system can be put to a wide range of functions including Payroll, Accounting, Statistical Analysis, Stock Control and Word Processing.

Not least of its attractions is the price of a PET - from £550 for a self contained unit, to under £2,500 for the complete system including Floppy Disk Unit and high-speed Printer. Ask your nearest Commodore dealer below for details about Commodore hardware, software and training courses.

Our Dealer Network

LONDON
Capital Computer Systems, W1 875 1913
ACE (by Top TV Ltd), SW1, 730 1795
Micro Centre Computer Centre, W1X 975 6650
Logix Ltd, SW1, 221 3112
Sumlock Bondain Ltd, EC1, 250 0505
Du Vertical Computers Ltd, NW4 202 9360

J. R. Ward Computers Ltd, SW1, 828 2511
Orchard Electronics Ltd, SW1, 250 0505
T.L.C. World Trading Ltd, WC2, 839 3894

Microcomputation, SW1, 828 2511
Metyclean Ltd, SW1, 828 2511

CAS Business Equipment Ltd, SW1, 730 1795
Adda Computers, W1, 408 1611

L & J Computers, NW9, 204 7525

Da Vinci Computers Ltd, SW1, 222 1122
Sumlock Bondain Ltd, EC1, 250 0505

Logic Box Ltd, SW1, 222 1122
ACE (by Top TV Ltd), SW1, 730 1795

Capital Computer Systems, W1, 875 1913

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Periflexible to suit your requirements

**PERIFLEX 0/0 and 5¼” SYSTEMS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PERIFLEX 0/0</strong></td>
<td>19 slot mother chassis to accept S100 cards, includes case, PSU and fan.</td>
<td>£420.00</td>
</tr>
<tr>
<td><strong>PERIFLEX 00/16</strong></td>
<td>16K static RAM; 4MZ Z80 CPU, 2 serial 3 parallel I/O ports, 2K PROM, 19 slot S100 Motherboard</td>
<td>£975.00</td>
</tr>
<tr>
<td><strong>PERIFLEX 630/32</strong></td>
<td>32K static RAM, 4MZ Z80 CPU, 2 serial 3 parallel I/O ports, 2K PROM, dual 5¼” Micropolis drives, 620K storage, 9 slot S100 Motherboard, CPM/MDOS operating system</td>
<td>£2080.00</td>
</tr>
<tr>
<td><strong>PERIFLEX 630/48</strong></td>
<td>As 630/32 but with 48K static RAM.</td>
<td>£2300.00</td>
</tr>
</tbody>
</table>

**PERIFLEX 8” SYSTEMS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td><strong>PERIFLEX 1024/32</strong></td>
<td>32K static RAM, 4MZ Z80 CPU, dual 1.2 Mbyte 8” floppies, 2 serial 3 parallel I/O ports, 2K PROM, CPM operating system.</td>
<td>£2660.00</td>
</tr>
<tr>
<td><strong>PERIFLEX 1024/48</strong></td>
<td>As 1024/32 but with 48K static RAM.</td>
<td>£2880.00</td>
</tr>
<tr>
<td><strong>PERIFLEX 1024/64</strong></td>
<td>As 1024/32 but with 64K static RAM.</td>
<td>£3100.00</td>
</tr>
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</table>

**OPTIONAL EXTRAS**
Wide range of Micropolis 5¼” drives available ex-stock for S100 SYSTEMS, TANDY, SORCERER, etc. Various types of VDUs and printers, and a wide range of applications software readily available.

**OEM & 5100 WINCHESTER DISKS**
Micropolis 8” 6.2M to 31M hard disks available shortly complemented by our own PEREX cartridge back-up.

**STOP PRESS** — Micropolis have just announced a double sided 5¼” floppy disk drive with a fantastic 630K storage (formatted).

**VECTOR GRAPHIC**
MZ 56K Z80 4MZ with 630K twin micropolis disk drives £2645.00
SYSTEM B as MZ but with mindless terminal £3220.00

**LOW COST GRAPHICS**
A4 digital plotter £695.00
11” x 11” digitiser £555.00
Both complete with RS232C interface.

**FOR FURTHER DETAILS AND DELIVERY CONTACT US TODAY!**
Periflex computers
Micropolis 5¼” disks
Vector Graphic computers
Micropolis hard disks

Sintrom Electronics Ltd
Arkwright Road, Reading, Berks RG2 0LS
Tel: Reading (0734) 85464
Telex: 847395
Board “with improved four-order low-pass filter” is $100 — it doesn’t say so on the release, but I think you need one to connect between the clever software and your amplifier. Details from 230 Clinton Street, Brooklyn, New York 11201, or phone (212) 625 6220.

**Southern Pet**

SUPA is the new name of the Independent PET Users’ Group (South) and the new initials stand for Southern Users of PETs Association. Howard Pilgrim tells me that SUPA’s former position as a regional group for IPUG is now terminated, and the new subscription rate for 12 months is £5.00. Pilgrim is membership secretary, and his address is 42 Compton Road, Brighton BN1 5AN, Sussex.

**Intro to Micros**

A course costing £50.00 and lasting one day is offered by Cambridge Micro Computers as a quick practical introduction to micros. Cost goes up to £65 after July. Cambridge also does a five day, £240 (rising to £265) introduction to the design of micro-based systems. Details on 0223 314666.

**Take Over**

Two existing computer shops in Manchester and in Leeds have been taken over by Northern Software Consultants... they will be renamed NSC Computer Shops. A wide range of hardware from PET and Apple through to Cromemco, is sold with software and a maintenance service. Details on 061-273 1661.

**Micros in Education**

With luck and timely printing, you should just be able to get it to the two-day “Micro Computers in Education” congress, held on June 2 and 3, John Coll and other luminaries of MUSE will be discussing a wide variety of important subjects. Included will be snapshot sequences of German and Danish experiences from Herr Professor Dr Klaus Haefner of the University of Bremen, and Dr Torsten Jensen of the technical Teachers College, Copenhagen. Details on 067-292 2711.

**S.T. Competition**

Full marks to Baroness PR and Commodore for announcing their sponsorship of the Sunday Times Magazine competition “Young Computer Brain of the Year” — and for getting the announcement out well enough ahead of the judging day for us to give you a chance to enter.

First prize is a PET 32Kbyte processor: second is an 8Kbyte PET; or you can have £500/£250 instead. That’s two prizes in each class; there’s three classes and they are: individual entrants under 15, individual entrants under 19, and group entries of people under 19. Overall Brain of the year wins £1500 extra plus a trophy.

To win, write an essay outlining the following project... “to use computers to the benefit of society”. Entry forms from the amazing Barneyes Herself at 1/3 Old Compton Street, W1V 5PH. Only one thing — PCW has already received a letter from an irate 14-year old; his complaint...? What has writing essays got to do with computing! The lad has a point.

**Variation On ALGOL 60**

Liveport Ltd, now has available two new versions of Research Machines Ltd., ALGOL 60. The standard version has the capability to do low definition teletext type graphics using the Sorcerer’s display. In addition to the graphics facility, one version has also been modified to use 32 bit integers in place of real numbers, thus enabling higher precision calculations to be performed. This piece of jiggery-pokery they claim makes the system ideal for business applications. Both versions are priced at £99.00. Liverpool are on 0736 798157.

**Open-At Last!**

A trifle over-enthusiastically, Tandy has opened a shop in the City of London with the breathless words “At last, the over-the-counter computer is here.”

Even if the Computer Retailers Association doesn’t do a piece of jiggery-pokery to the description, the “City’s first specialist microcomputer shop” has opened, and it is at 1/2 Seacoal Lane — just a short stagger from Mother Bunches wine bar if I remember. For the phone number, I will refer you to Tony Martin of Phoenix public relations on 01 353 0666. Share his excitement.

**Show Pieces**

The first official World Microcomputer Chess Championship will be a star attraction at this year’s PCW show, 4-6 September at the Cunard International Hotel, London. The Championship will be held under the auspices of the International Computer Chess Association and will be open to both commercial and non-commercial entrants, with a £500 first prize for the highest placed entrant in the latter category. Details of the contest from David Levy, C/O PCW.

Running concurrently with the show will be MICRO UK, a three-day event incorporating conferences, seminars, teach-ins and discussions. There’ll be more details next month’s issue, so suffice for now to say, MICRO UK will be catering for a wide range of interests — one that will cover microcomputers in business, education and the home.

*Guy Keuney is Technology Editor of Computing.*
<table>
<thead>
<tr>
<th>Feature</th>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully Integrated Ledger System</td>
<td>£855</td>
<td>Gives management information i.e. aged accounts on individual clients, sales analysis. Trial balance. Profit and loss and Balance sheet included.</td>
</tr>
<tr>
<td>Invoicing</td>
<td>£140</td>
<td>Either stand-alone — or can form part of our General Ledger System.</td>
</tr>
<tr>
<td>Cash Flow/Bank Forecast</td>
<td>£80</td>
<td>Automatically updates all data following each alteration of an item. Gives Column and line totals. Saves a lot of boring work when a Company operates with more than one bank account.</td>
</tr>
<tr>
<td>Payroll II</td>
<td>£375</td>
<td>Accepts all tax codes. Gives departmental analysis. It's user configurable and tax rates are user changeable. Operator can change names of items on payslips.</td>
</tr>
<tr>
<td>New Word Processing/Data Base</td>
<td>£120</td>
<td>Screen-based editor, powerful global search editing facilities, formatting facilities, address data base facilities and possibility to join sections of text, old and new, for the final printout. FAST AND EASY TO USE.</td>
</tr>
<tr>
<td>Financial Analysis with VisiCalc</td>
<td>£95.00</td>
<td>VisiCalc combines the convenience and familiarity of a pocket calculator with the powerful memory and electronic screen capabilities of the computer and can do calculations of sales projections, income taxes, financial ratios, your personal budget, engineering calculations, cost estimates, in fact, anything normally done with a calculator, pencil and paper. Recalculation makes VisiCalc a powerful planning and forecasting tool. Not only can you effortlessly correct mistakes and omissions, you can also examine various alternatives, and above all it does not require any previous knowledge of computers and programming.</td>
</tr>
</tbody>
</table>

The above programs work either on Apple II floppy system or a version for 10Mb Corvus hard disc drive is available.

**Complete computer system with above, under £5,000**

including installation, training and 1 year warranty.

**Financial Analysis with VisiCalc £95.00**

**Stationery Support**

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Listing paper and labels</td>
<td></td>
<td>Please phone for details or send for comprehensive catalogue.</td>
</tr>
<tr>
<td>Binders</td>
<td></td>
<td>Special sizes to fit those non-standard computer listing paper sizes.</td>
</tr>
<tr>
<td>BASF Diskettes</td>
<td></td>
<td>Best quality at reasonable prices.</td>
</tr>
<tr>
<td>Bespoke Stationery</td>
<td></td>
<td>Ring for advice on customised stationery or consult our catalogue — no quantity too small.</td>
</tr>
</tbody>
</table>

Vlasak Electronics Ltd., Thames Building, Dedmere Road, Marlow, Bucks. Tel: Marlow 74789
Uncle Sam's networks

A recent trip to London to witness the "coming out party" for Prestel in the UK gave me cause to reflect on the different approaches toward establishing an information utility in the US and in Britain. In many ways, the Prestel approach, initiated by the British Post Office, represents a very clean, refined, and marketable commercial information utility that will probably find widespread acceptance before anything comparable is established in the US.

The American approach — to the extent that anything of the sort is being done in the US — is more subject to very different economic and market conditions; they don't lend themselves to the kind of government-backed system now being marketed to the public in the UK. The two American systems currently in nationwide use are called The Source, and MicroNET, and are predicated on the use of a personal computer, or at least, a computer terminal, to access them.

Such a requirement immediately limits the number of persons who can use these networks without making a major investment. On the other hand, the existence of such networks is a powerful incentive to anyone contemplating the purchase of a personal computer.

The two systems, for all their limitations in numbers of users, are much more interactive than a viewdata type system; one of their most attractive features is that of electronic mail. I understand that Prestel has the inherent capability to handle electronic mail, but that subject is taboo because of political and labour considerations, and is referred to only furtively and in hushed, conspiratorial tones in British circles. These issues are, of course, alive in the US too. But since the networks are private enterprises, they have simply gone ahead and implemented electronic mail anyway. So far, the US Postal Service has been too confused to do anything about it.

Like any information utility, the US personal computer networks need three major components: the "electronic highway", or telecommunications facility, the computer system, and the information providers. At present, these networks use existing commercial facilities at off-peak hours. The US has several private data communications set-ups which serve large industrial customers. These services, among which are Dialcom and Telenet, rent their facilities for use by the personal computer networks during hours of low industrial usage. Access to the data communications networks is by means of the telephone system, another private enterprise.

Both networks had to start out as computer facilities that were not entirely dedicated to the personal computer network services. CompuServe, the parent company of MicroNET, uses time on computers that are primarily serving the company's principal activity of industrial/commercial networking. The Source started out by renting time on computers owned by other companies, but has since been acquiring its own machines to use exclusively for its personal network service.

The information provided on these networks is available in various ways. Some of it, such as United Press International news service, is simply bought or subscribed to by the network company. This is also true of airline schedules and other large data base reference files. Other services are created and maintained by the network companies themselves. This includes the electronic mail facilities, the online chatting features (where users currently logged onto the system can simply converse), and such frivolous things as advice columns on philosophical questions.

Charges for use of these networks are billed to the users' Visa or Master Charge accounts and are computed for connect time not including the cost of the telephone service, which the user must pay to the telephone company. Thus, charges are not figured according to the value of a page of information, as with Prestel. This method has caused some complaints from users who say that they have to pay to view the same initial instructions every time they use the system.

Thus, the financial workings of Prestel and the American information utilities seem to have some fundamental differences. Prestel rents out pages in its computer and the information providers work out how best to pay for the space and make a profit. Either they charge the user for access and have their accounts credited by the Post Office, or they pay the Post Office and make their money from clients who are advertisers.

In the US system, the network companies set up the information service, then try to put enough useful information and service facilities on the system to attract users whom they then charge directly for connect time. Although there are tele-shopping (charge listed items to your account number) and travel booking facilities available, there's little straightforward advertising — a fact which seems almost un-American.

There are presently plans to conduct trials of a Prestel-like viewdata system in Florida. However, the system seems so cumbersome in comparison to its British counterpart that there's some doubt as to the likely success of the venture. Things such as the private nature of the necessary services, the diversity of broadcasting interests, a somewhat hostile and slightly inept Postal Service and the reluctance of Americans to get government involved in any new projects will probably not allow a viewdata system like Prestel to be directly imported.

However, if experience shows there is a demand for an information utility, and if manufacturers perceive that fact and become truly motivated, the US will undoubtedly produce a public information system which will combine many of the refinements of Prestel with the flexible features of the current personal computer networks in a system that will be uniquely American... no doubt as confusing to foreigners as baseball.

Beware the Japanese

Watch for new computers from Japan. We just saw an item produced by the Nippon Electric Company that combined in a small keyboard-cabinet a computer with 16K RAM, Microsoft BASIC, colour graphics, disc controller, cassette interface, and motor control for $750 US. For another $750, NEC sells a colour monitor (that's monitor, not TV) which will handle the high resolution graphics and an 80 character display.

Console configuration can be set in BASIC, and there are "Motor" commands to control external devices through the connector at the back of the unit. NEC is not planning to market this model abroad, however. It's holding back in favour of a better, cheaper model to be introduced soon.

"Not only does it tell you your weight, but also when your feet need washing."

PCW 47
Help Wanted

I have a Pet 32K with 2040 disc machine and printer and would be interested to know if any of your readers could suggest routines for the following problems:

A method of calculating the number of days between any two dates, either in the same year, or, more clever, in different years.

A method of up-dating a program automatically. This particular problem concerns my small wages book. Each month the "total pay to date" is increased and has to be re-entered on my program individually for each employee. It should be possible to write a program which will modify itself each month to bring the new total forward, but I cannot see how to do it. How do you make a program re-write itself?

L.N. Parlett, Bridport, Dorset.

Thorny Problem

When reading about the past features in your magazine I noticed a number of articles on the MK14; as I am a MK14 owner I would like to read these articles. Unfortunately, it would cost me too much to buy all these issues of the magazine. Of course, we are out of stock on these issues as well as any other means, then send us 20p for each page you want copied together with a large stamped, addressed envelope — and we'll look after you — Ed.

Data Retrieval

Since no answer has yet appeared to Mr. R. Cason's question "Data Retrieval" (PCW, February, 1980) concerning rescuing data from a tape where the header has been accidentally erased, may I offer the following:

If a data tape is concerned the problem is relatively simple.

First of all enter the following program:

```
10 OPEN 1
20 STOP
40 INPUT #1, A$ 
60 PRINT A$ 
50 IF (ST) AND 64 GOTO 110 
100 GOTO 40
110 CLOSE 1
120 END
```

The technique is to place in the cassette player a data tape with the header intact. Run the program in the normal way until it breaks in line 20 then switch off the cassette deck and substitute the corrupted tape for the original one having first wound it to approximately the right place. Now enter the command "CONT" and press "PLAY" on the cassette deck. The lost data will now be retrieved from the tape and displayed on the screen.

The program now is formatting it. Data will scroll up the screen at a rate of knots and be lost before it can ever be read. A semicolon at the end of line 60 will help but string data will butt up with no spaces between and still be difficult to read; and even if a comma is used instead of a semicolon, readability is not certain, depending on the length of strings; and in any case the whole thing will still be moving too fast to copy out. Of course a printer would get you out of this problem.

The best way to control the stuff is to add the following lines to the program:

```
30 FOR I = 1 TO 20 
70 NEXT 
80 WAIT 98410, 4, 4 
90 PRINT "clear"
```

Line 100 should be changed to 100 GOTO 30. Now twenty items of data are displayed and the thing stops until you press the space bar, whereupon the screen clears and the next twenty items are shown.

The "WAIT" may not work on old ROMS so line 80 can be changed to:

```
80 GET QS: IF QS < " " GOTO 80 
and any key can be used to advance to the next block of data.
```

Alan W. Shelley, Sidcup, Kent

Yes And No More

A point that is missed in D. Jones' letter about "YES" and "NO" in PCW for April is that the problem he describes is not inherent in the PET but in the program he uses.

Furthermore, the editor's suggestion can be compressed by a third to the form: IF LEFT$(AS$)="Y" THEN ... IF LEFT$(AS$)="N" THEN ... with the retry routine referred to in the second line and the 'NO' routine following immediately after the second line. However, in this speedy day and age, no-one has time to waste hitting the RETURN key, so why not use the GET format, which is the most compact of all?

Frank Chambers, Ballycroy, Ireland.

Powerwan Club?

As I purchased a Powerrfan kit about two months ago and, having got it built and working, I am interested to know if there is a users group. If not, I would be interested in starting one. Any information or suggestions would be very much appreciated.

C.J. Pink, 14 Cowbeck Close, Parkwood, Rainham, Kent.

Sowing Seeds

It seems that most of the PET BASIC programs submitted to your magazine do not use the RND function correctly. The action taken by the PET depends on the value of the argument given:

a) If it is negative (e.g. RND (-5)) then the PET uses the number given as a new seed for the random number sequence.

b) RND (0) generates a new seed from four internal clocks. This should be used only to set seeds and not to generate random number sequences since if RND (0) is used in a program loop which takes a constant time interval to execute then the values of the internal clocks at each function call will follow a non-random pattern.

c) If the argument is any positive number then the result is the next random number in the sequence defined by the seed. So RND (5) gives the same result as the apparently ingenious RND (TI), which does not as some programmers seem to think use the actual value of TI at all — all that counts is that it is positive!

I suggest that programs using random numbers use an initial RND (0) to set a "true random" seed, and then obtain the actual sequence by RND (any positive number).


Cambridge Comments

With reference to Tim Hawkins' article "Beefing up the MK14" (April PCW), I also attempted a similar expansion. My machine was a MK14 with RAM at OFF7 to OFFF but the original monitor. Unfortunately the monitor failed after latching out the top four address bits from the data bus. The monitor listing stated that the monitor used RAM at OFF7 to OFFF, but in fact it uses FFF7 to FFFF. This makes no difference to the basic MK14 which only uses one page, so the first digit of the above address locations can be ignored, making them both the same. However when expansion is attempted and the last page, or RAM at the top of the last page is not available to the monitor, then the monitor programs fails. This would appear to be the case with Tim Hawkins' description.

The solution that I employed was to use full address decoding and "ANDing" the first and last pages, thus getting the same address as page F000. This doesn't matter if the full 64K capability is not required. SOC software can still be run as before.

L.V. Cooper, Ruskington, Lincs.

School Sense

What a narrow minded attitude David Firnberg has to the uses of Computers in Schools (Interrupt — April 1980) with his plea for schools to concentrate on the applications of computers rather than their functioning or algorithms (put away the bits, bytes, circuits and logic gates). He appears to feel that such few product and systems designers will be needed in the future that their education can be neglected ("who wants an electronic whiz kid anyways?"). The answer is — I do (and I alone!). Is it not true that developments...
COMMUNICATION

in the technology of the future will be largely due to such people and as far as free societies make use of available technology they will be moulded by the work of such people - I will not enter the debate about their economic usefulness.

Surely schools must aim to do both jobs - lay on courses for the future electronics, computer experts, and courses for lay computer users. The first would be of a "this is how it does it" nature and the second of a "this is what it can do" nature. I regard both as equally important but to (relatively) deny the first to the goodly proportion of our school pupils who find the "how does it do it" fascinatingly interesting is a criminal neglect of our educational responsibilities.

There is more to it than this however. The "this is what it can do" approach still leaves the bulk of people interacting with systems designed for the "geeks" (the whiz kids?) and in one sense therefore controlled by them. Surely education should try to give as many people as possible the ability to control their systems rather than the other way round, so the more people who can design systems and learn how to modify and "crash" them, the better.

Who are going to be the aristocrats (technocrats?) of the future - or will there be any at all?

Paul Stevenson, Norwich

Cheapo Printer

Is it possible to interface a calculator-type printer to a micro (say, KIM)? If it is, how about doing an article on what's involved?

H.P. Stern, London, NW2

What a good idea! Any reader who feels qualified to write such an article, please contact the magazine - Ed.

Plea 1

I am presently attempting to compile a short volume on microprocessor/microcomputer applications in the home. In consequence, I would much like to hear from any of your readers about the practical ways in which they are using such devices.

L.L. Fraser, 45 Walton Road, Stockton Heath, Warrington, Lancs.

Plea 2

I am currently undertaking a survey of the experiences of businesses using microcomputers. The survey is being conducted completely independently of any possible interested parties and aims to establish objectively the degree of satisfaction experienced by businesses using microcomputers. I would welcome the opportunity to appeal to your generous page to any company that has purchased, or who otherwise has access to a microcomputer. I would be grateful if any such user who would like to assist would write to me at the London Business School and I will send them a brief questionnaire. All correspondence will be handled in absolute confidence.

Charles P. Cousins, Project MC-02, London Business School, Sussex Place, Regent's Park, London NW1 4SA.

Conversion Prospects

I am considering the use of an old mains-powered black and white TV as a monitor for my recently purchased Nascom 2. Can I use the circuit described in your March issue (Simple TV/Monitor) - but powered from the Nascom 3 amp power supply? If the circuit and power supply were to be housed inside the TV case, would I still need the cooling fan for the Nascom 2 housed in an attach case?

R. Mackerness, Solihull.

Without knowing which TV you have, it's impossible to say for sure whether such a circuit would work or not. However, bearing in mind the comments made in the above article, the answer is very likely "no". To begin with the mains-only set may well have its chassis at mains potential. Even if the modification was possible you would still need the fan. Its main purpose is to keep the chips cool - Ed.

More Beefing

I have just read "Beefing up the MK14" in April's PCW. I built an almost identical expansion last summer and avoided the memory mapping problem as shown:

```
NWDs, NRDS and A11 lines to the MK14 are ORed with the Page 0 signal (active low) so that read and write pulses are only transmitted when an access to page 0 is required; otherwise the MK14 board is effectively deselected. (Note that A11 is used as a read signal for the ROMs when low). This is a simpler solution to the problem and maintains full compatibility.
```

C. MacLeod, Lochee, Dundee.

CRA Hits Back

I read with interest your feature in "Interrupt!" in the April edition of Personal Computer World, in which "conscientious cowboy" questions the need for the Computer Retailers Association.

Your contributor wields his axe very widely. I do not think I have ever seen an article in a computer magazine that so contumaciously dismisses so many parts of our Society. Lawyers, gentlemen, the motor trade and members of the Computer Retailers Association are all attacked with a gusto that would do credit to a demolition contractor. I wonder what other things provoke such ire in your contributor. It is a pity he does not give his name.

The main point of his article, that big is not necessarily beautiful and that many small operations give a first rate service, is very valid and accepted by every member of the Association. The simple fact is however, that your small guy is far more likely to pack up and emigrate to Australia than someone who buys from a member of the CRA and is for any reason unable to get satisfaction from his supplier can come to the Association and get some form of redress.

When your "conscientious cowboy" feels the time is right, we would be delighted to receive his application for membership.

Paul Rayner, Publicity and education officer, Computer Retailers Association.

Ohio Add-ons

I was gratified to read in the April edition of PCW that you had been inundated with programs for the MK101.

Might I make a plea for hardware information? Comp-Shop are very coy about giving it out. They say it is "easily" interfaced with S100, but not how, or how easily. They also say it's compatible with Ohio disc systems. The Ohio suppliers I contacted denied this and stated there were differences that might make compatibility difficult. Are there any readers, or your experts, who might clarify things?

Dr. D.H. Harley, Tapton, Chesterfield.

We talked to Chris "Spangles" Cary who told us that the lines and signals are there on the board. He suggests that Practical Electronics articles are the things to dig out as they did a series on this very subject - Ed.

Page 0 (from address decoding)
The TRS-80 Model II is an attractively packaged integrated unit with a detachable keyboard and the sort of features that one would expect from a machine with a £2000 plus price tag. How has Tandy survived the move upmarket...? Stephen Withers (conducting his first Bench test) reports.

The heart of the TRS-80 Model II system is a Z80A processor running at 4MHz. In order to minimise the load on the cpu, LSI controller chips are used to take care of the keyboard, video display, and disc drives.

The tested system contained 64K of memory and a single 8" Shugart disc drive. Up to three additional drives may be connected, each drive having a gross capacity of 497.25K (only 406.25K is available on Drive 0, as it contains the system disc). The Model II is also available with 32K of memory - if this option is selected it's possible to upgrade to 64K with one extra card. No other internal add-ons are available at present.

The Model II is not among the quietest of systems I've used. This is partly due to the cooling fan (I don't foresee overheating problems); the fact that the disc drive is permanently spinning also contributes to the noise. In addition this is likely to reduce the life of the media.

Two RS-232 ports are provided. These operate at the usual Baud rates, between 110 and 4800. Speed, word length, number of stop bits, and parity are all software selectable and this is much better than having to mess around with jumpers or switches. One channel may be operated in the less commonly used synchronous mode. A Centronics-compatible parallel printer interface is also standard.

The display shows a full 24 rows of 80 characters, and is clear and crisp. Contrast and brightness controls are fitted to the front of the casing, neatly hidden in the keyboard recess. The full set of printing ASCII characters are available (lower case characters have true descenders), and there's also a set of 32 rather strange graphics characters. I can't see these being used much, especially as they are not directly available from the keyboard. All characters may be shown in normal or inverse video.

The keyboard is connected to the main unit by a 2 foot long cable that terminates in a 5-pin DIN plug. Any spare cable tucks into the main cabinet. There are 76 keys — the normal QWERTY, plus a cursor control cluster, two "function" keys, and a number pad. Despite what you may have read...
in an earlier issue of PCW, I believe a numeric pad to be very useful; it has been shown to reduce errors when entering numbers. A feature I appreciated was the indicator lights on the "caps" and "shift lock" keys.

One of the features one looks for: reasonably good "feel" (tactile feedback), n-key rollover, minimal reflection from the keytops, "feel" (tactile feedback), n-key rollover, "caps" and "shift lock" keys.

"Backspace" may be reassigned to suit the application. I was rather surprised to find that it lacks matrix operations, WHILE statements and multi-line function definitions. My main complaint is that variable names are limited to characters, making intelligible programming difficult. The list of reserved words shows that it is closely related to BASIC-80 (see the Benchmark of the Micros, PCW 51, October 1979), and the similarity extends to the benchmark timings this is a fast-running interpreter.

The price paid for all these features is the program — TRSDOS and BASIC together occupy over 26K, plus an 834 byte buffer for each file used by BASIC. Clearly few users will be satisfied with a word processor.

Real variables may be single or double precision, and are stored with up to 7 or 17 significant digits respectively.

The type of a variable may be explicitly defined with a suffix (e.g. A% is an integer) or by using the DEFINT, DEFNSG, DEFDBL, or DEFSTR statements (e.g. DEFINT A). These are equivalent to FORTRAN IMPLICIT statements, where variable names beginning with the parameters of the statement default to the specified type. In the example all variables starting with "MYFILE" are "A" work variables, unless explicitly tagged with a suffix.

The interface between BASIC and machine code is well supported. In addition to PEEK, POKE, and 10 USR functions (where entry points are defined within the program), no micro-assembly is required.

If a record has been read, variables may be loaded into high memory by TRSDOS on processor called "VARPTR. This allows the address of numeric variables or the address of the pointer to string variables; it is possible to have machine code routines that operate directly on variables rather than on memory addresses as the parameter to the USR function. Machine code routines may be loaded into high memory by TRSDOS on processor called "VARPTR. This allows the BASIC by the use of the M parameter (which specifies the highest memory location accessible to BASIC).

Both random and sequential access disc drives are supported. A single file is straightforward, but I find that random access (Tandy, incidentally, prefers the term "direct" access) has been made less satisfactory. After opening the file the program must define fields within the associated buffer; when a record has been read, variables are equated to these fields. To make matters worse, numeric values must be

Software

When I first tested the Model II, it was supplied with a "pre-release" version of the system software, which seemed quite good, but had a number of weak points. An improved version has now reached Britain which will be supplied with all Model II systems. Having seen this new release, I believe this to be a significant improvement. My complaint has been fixed — and some new features added. Unfortunately this leaves me with less to write about!

One of the first things you notice is that a disk may be protected by passwords — and not only that, there's provision for separate "access" and "update" words. For example, it may be necessary to give a disk access to a file of sensitive information, but undesirable to allow him or her to be able to change or delete it. The level of access granted by the "access" word is: "full," "read," "write," "execute" (i.e. "no access" to "full, including KILL") is under the control of the holder of the "update" word. On top of this, each disc is given a password, knowledge of which allows the host system to find a user file's list of words, and the deletion of any file.

Turnkey systems may be produced by utilising the AUTO command. If set, the keyboard has most access to a file of sensitive information, but undesirable to allow him or her to be able to change or delete it. The level of access granted by the "access" word is: "full," "read," "write," "execute" (i.e. "no access" to "full, including KILL") is under the control of the holder of the "update" word. On top of this, each disc is given a password, knowledge of which allows the host system to find a user file's list of words, and the deletion of any file.

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converted to strings before they can be stored on disc. Despite these criticisms, random access files work well on the Model II, and certainly they are easier to use than those on some other systems (Commodore, for example).

The disc tests used are based on those developed by Sue Eisenbach; in fairness I should point out that the system was set to verify all disc writes (thus slowing things down), but on the other hand a virtually empty disc meant that the file was held in contiguous segments (which has the opposite effect). Strings in Model II BASIC have maximum length of 255 characters, so the tests involve a file of 100 records, each containing two fields of 128 characters.

Test 1 simply opens a new file and immediately closes it.

Test 2 uses a FOR loop to fill two strings (A$ and B$) with 128 "A"s, then opens an existing file; the second loop writes A$ and B$ into all 100 records, in ascending order. The file is then closed. Test 3 is similar, but the records are written in reverse order. This actually ran faster than Test 2 — can anyone suggest why?

Test 4 opens the file, reads records 1 to 100, assigning the two fields to A$ and B$, and then closes the file. Test 5 repeats this process, but reverses the order in which the records are read. Test 5 was also faster than 4.

As an afterthought, I wrote a program which read 100 records selected at random. Although this involved a considerable amount of head movement, it was only fractionally slower than Test 4 or 5.

**Potential**

The Model II is unmistakably aimed at the business user. The full sized screen and good quality keyboard make it a natural for word processing. Since Lifeboat Associates supply CP/M configured for the Model II, as well as a good range of compatible software, this and many other applications are catered for "off the shelf!"

Tandy offer a very limited selection of software for the Model II. I have seen their Mailing List package, which seemed to work well (detailed description would be unfair, as I didn't have a copy of the accompanying documentation). The one point I would mention is that the program was not Anglicised. The other words it kept asking for "State and Zip Code", in a format incompatible with "County and Post Code". I understand that the other packages have similar faults.

Users who wish to stay with TRSDOS and BASIC have a very limited choice of software at present, although the file security aspects might make this option attractive. As so many other versions of BASIC are Microsoft products, it would not be excessively difficult to convert existing programs to run on the Model II in order to take advantage of its features. In an attempt to overcome this shortcoming, Tandy intends to arrange for leading British software houses to produce high-quality applications software for the Model II.

The Model II is clearly one of the new breed of computers; powerful, integrated systems without some of the "sillies" that characterised an earlier generation.

I doubt that many of these computers will be sold for domestic or educational use, as the Model II's large disc capacity (probably its strongest point) is rarely an important factor in these environments.

**Expansion**

At present, expansion is limited to the addition of extra disc drives, and increasing a 32K system to 64K. As already stated, the motherboard allows for expansion when new devices become available (after all, Winchester discs are almost mandatory these days . . ). In case you feel that this lack of expansion is a bad point, when you have a 64K system with almost 2 megabytes of disc space, interfaces for printers, modems and what-have-you, as well as a full sized display and keyboard, what more do you want?

On the software side, Tandy UK are expecting the release of a Pascal system for the Model II in the near future, and at some stage, an assembler. I also heard that Fortran is in the pipeline, but as CP/M is available, who really cares? (Yes I know it isn't the world's best operating system, but it works, and

**Benchmarks**

<table>
<thead>
<tr>
<th>Test</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>39</td>
</tr>
<tr>
<td>3</td>
<td>38</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
</tr>
</tbody>
</table>

(All times to the nearest second).

**Prices**

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRS-80 Model II (32K)</td>
<td>£229.85</td>
</tr>
<tr>
<td>TRS-80 Model II (64K)</td>
<td>£256.55</td>
</tr>
<tr>
<td>32K Memory Board</td>
<td>£343.85</td>
</tr>
<tr>
<td>1 Drive Disc Expansion Unit</td>
<td>£91.85</td>
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<tr>
<td>2 Drive Expansion</td>
<td>£197.55</td>
</tr>
<tr>
<td>3 Drive Expansion</td>
<td>£293.35</td>
</tr>
<tr>
<td>Disc Drive Kit</td>
<td>£458.85</td>
</tr>
<tr>
<td>System Desk</td>
<td>£299.95</td>
</tr>
<tr>
<td>Line Printer Stand</td>
<td>£299.95</td>
</tr>
<tr>
<td>Cable for Printer II</td>
<td>£19.95</td>
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<tr>
<td>Cable for Printer III</td>
<td>£29.95</td>
</tr>
<tr>
<td>10 Blank Discs</td>
<td>£9.95</td>
</tr>
<tr>
<td>Model II Manual</td>
<td>£19.95</td>
</tr>
</tbody>
</table>
makes quality software available by the bucketful — that’s enough for me!

Documentation

All the documentation for the Model II comes in one three ring binder — which is nice, because it allows you to keep all your manuals together, even when you expand the system. (I only mention this because Tandy found it necessary to point it out in the manual!) The description of the hardware (with setting-up instructions) is very brief, giving no information about the various peripheral controllers or other components. As the Model II is aimed at the business systems market, a detailed hardware manual is unlikely to be produced. However, there are substantial sections on TRSDOS and BASIC.

Although these two manuals were both produced on a dot-matrix printer, I am assured that they were draft copies and all systems will be supplied with properly typeset manuals. They are well laid out, giving an overview of the system before going onto a detailed description of the features. Each item starts on a fresh page, with its “syntax” and use described with the aid of one or more examples. Coupled with the index, this makes quick reference very easy. One exception is the “SYSTEM” command in BASIC. The manual points out that the TRSDOS “high overlays” may not be used through this command, but it doesn’t list them, or even give a cross-reference to the appropriate page of the TRSDOS manual.

As far as quality is concerned, these manuals are as good as any I have seen. The only problem is that they are in the same style as those produced for mainframes — that is to say they are concise and definitive, but unsuitable for use as tutorial material. Indeed, the Model II makes this point explicitly, referring the reader to other books available from Tandy. Don’t worry though, this only affects the programmer (who hopefully has some idea of what he/she is about); the machine itself is simple to operate. Given half-way decent software, it’s well within the capabilities of the mythical “untrained typist”. Parenthetically, all the typists I have met are far brighter than some advertisers’ copy would have you expect.

Conclusion

The TRS-80 Model II is an attractive, well designed computer. Its hardware incorporates all the features I expect to see on machines in this price range. Software, on the other hand, presents a dilemma — whether to stay with TRSDOS or to switch to CP/M. The first course severely (but temporarily) restricts the availability of applications programs, unless software from other systems is translated into the local dialect. Using CP/M avoids this difficulty, but sacrifices the excellent features of TRSDOS. Probably the fairest thing to say is that if I wanted a micro for a traditional data processing application, then the Model II would be on my shortlist.

**TECHNICAL DATA**

- **CPU:** Z80A, 4MHz
- **Memory:** 64K dynamic RAM, 1K “phantom” bootstrap PROM
- **Keyboard:** 16 keys
- **Screen:** 12” diagonal, 24 lines x 80 characters
- **Cassette:** N/A
- **Disc Drives:** One 8” double density floppy disc
- **Printer:** Not included in basic system
- **Bus:** Non-standard
- **Ports:** 2 RS-232 serial, 1 Centronics compatible parallel
- **System Software:** TRSDOS
- **Language:** BASIC

**Memory map**

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0K</td>
<td>TRSDOS</td>
</tr>
<tr>
<td>10K</td>
<td>TRSDOS high overlays</td>
</tr>
<tr>
<td>26K</td>
<td>BASIC interpreter</td>
</tr>
<tr>
<td>64K</td>
<td>top area optionally protected by TRSDOS</td>
</tr>
<tr>
<td></td>
<td>User Area</td>
</tr>
<tr>
<td>12K</td>
<td>TRSDOS high overlays</td>
</tr>
</tbody>
</table>

**RESERVED WORDS**

Command Statements:
- AUTO
- DELETE
- EDIT
- KILL
- LIST
- LLIST
- LOAD
- MERGE
- NEW
- RENUM
- RUN
- SAVE
- SYSTEM

Program Statements:
- Definition and initialisation
- CLEAR
- DATA
- DEFDbl
- DEFFN
- DEFINT
- DEFSNG
- DEFSTR
- DEFSUR
- DIM
- ERASE
- RANDOM
- REM
- RESTORE

Assignment:
- LET
- LSET
- RSET
- MIDS
- READ
- SWAP

Control:
- END
- IF . THEN . ELSE
- GOTO
- RETURN
- ON . GOTO
- GOSUB
- ON . . GOTO
- ON . . GOSUB

Input/Output
- INPUT
- PRINT
- PRINT USING
- LPRINT USING
- LET
- STRING$ [PRINT$]
- LPRINT
- PUT
- LPRINTTAB
- OPEN
- CLOSE
- GOSUB
- RETURN
- IF
- THEN
- ELSE
- ON ERROR GOTO
- RESUME
- NEXT
- ERR
- TROFF
- RESUME
- ERL
- TRON
- TRON

Functions:
- ABS
- ASC
- ATN
- CDBL
- CINT
- COS
- CSNG
- EXP
- FIX
- INSTR
- INT
- LEN
- LOG
- RND
- SGN
- SIN
- SQR
- TAN
- VAL
- CHR
- DATE$ [DAYS$]
- HEXS
- LEFTS
- MIDS
- OCTS
- RIGHTS
- SPACE$ [SPACES$]
- STRS
- STRING$ [TIMES$]
- INKEYS
- INPUT$ [POS]
- ROW
- SPC
- CV
- CVS
- EOF
- LOC
- LOF
- MKDS
- MKS
- M3KS
- MK3S
- FRE
- MEM
- VARPTR
- USR$
WORDCRAFT A true Word Processor for the 32K PET. Wordcraft is a genuine word processing system, easy to understand and use, but containing all the facilities normally found only on more expensive dedicated Word Processors. Features include scrolling in both vertical and horizontal directions (to overcome small screen size), up to 117 characters wide and 98 lines deep for a full page of text. Written entirely in machine code for speed and compactness. Truly the Rolls-Royce of PET Word Processors. Send for brochure. £325 on CompuThink Disk system.

ACT SALES LEDGER A powerful system developed to ACT's own high standards. Provides full facilities for maintenance of the Sales Ledger, preparation of a list of outstanding balances and printing of statements. All data including new customer details, invoices, credits, cash and transfers are entered under step by step guidance on the display screen. Printed results include Audit List, Aged Debtors List, Control Accounts and Statements. For 32K PET. Full manual supplied. Brochure available on request. £120 on Commodore Disk, £95 on Cassette.

STOCK CONTROL Powerful and flexible stock system with full facilities for recording and control of stock information. An audit listing is automatically printed which itemises all transactions including the entry amendment and deletion of master stock information, issues receipts, allocations purchase orders. Printed reports include Full Stock Control, Stock Valuation, Reordering Report, Audit Listing. The system is highly flexible. £50 on CompuThink or Commodore Disk.

ACT PURCHASE LEDGER £120 Developed by ACT's own software teams this comprehensive package includes full facilities for the maintenance of the Purchase Ledger, the preparation of a list of outstanding balances and printing of remittance advices. The system produces the following printed results: Audit List, Aged Creditors List, Remittance Advice Cheques and Payments List. For 32K PET. Full manual supplied. Brochure available on request. £120 on Commodore Disk, £95 on Cassette.

PAYROLL 200 Comprehensive, easy-to-use package for small businesses with up to 200 employees. 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 amendments necessary because of a Budget are made very easy. Prints wage slip and coin/note analysis. Tax & NI are computed automatically from knowledge of employees codes. Update service available. Full manual provided. £50 on Commodore or CompuThink Disk. Cassette system also available at £25.

PETPLAN BUSINESS SIMULATION Petplan is a general management business simulation game which is exciting to play. Already it is widely used by colleges and Industrial Trainers to teach the skills needed to run a business. The program creates the model of a manufacturing company; you take the decisions. You will need to hire workers, invest in plant and premises, set advertising budgets and prices. At each stage screen reports (which may be printed out) show the results of decisions as they take effect. 50 page manual and voice guide on cassette. For 32K PET. £60 on Cassette.
are No.1 in...
are for the PET

VISICALC PROBLEM SOLVING SOFTWARE Acclaimed by the press as the most outstanding piece of PET software yet written, VisiCalc is a new breed of problem solving software that takes the hard work out of planning, projections and costings. Once your first projection is complete, you are ready to use the powerful recalculation feature. It lets you ask 'What if', examining new options and planning for contingencies. What if sales drop 20% in October? Just type in the sales figures and VisiCalc instantly updates all other figures affected by October sales. Invaluable to businessmen and students alike. Full manual supplied. Available late June. £125 on Commodore Disk.

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PCW 55
The Periflex range of S-100 based computers is assembled in America to Sintrom's own specification. All the models in the range use the Micropolis disc drives and controller and so have strong similarities to other S-100 based equipment. The remaining anonymous boards in the system are probably made by one of the many American S-100 OEM manufacturers that have sprung up in recent years.

The largest model in the range is the 1024/64 which sports dual double-density eight inch drives and 64 Kbytes of RAM; the other model (and in fact the one reviewed here) is the 630/48 and this features dual-density five inch discs and just 48K of RAM. Although, in addition to these two, Sintrom stocks a large number of S-100 based "add-ons", there's no reason why other manufacturers' S-100 equipment shouldn't be used instead.

Hardware

Any S-100 system is usually characterised by its sheer size, bulk and solidity of construction and I'm pleased to say that the Periflex proves to be no exception! The whole assembly is housed in a substantial metal case nearly an eighth of an inch thick and with outside dimensions measuring approximately 18 inches square by 7 inches high; it's quite happy to take a large printer on top. The 8-slot mother-board features passive bus terminations and is fed with power from a very substantial transformer — which contributes greatly to the fairly hefty all-up weight of nearly 60 pounds. Five slots of the mother board have already been used by the CPU board, three 16K static memory boards and the Micropolis disc controller board. The CPU board uses a Z80A and runs at 4MHz. There's a strange anomaly here for, although the bus clock frequency is always 2MHz regardless of the CPU clock frequency, the Micropolis controller board is jumped for 4MHz. Closer investigation reveals however that even this jumper is of no consequence as the controller board is running on its own internal 2MHz crystal anyway!

Still, it works and that's all that really matters.

Two serial RS-232 ports and one parallel port are on board although the parallel port provides a combined printer and cassette output. These are useful features that would otherwise have required an extra board. A pity then that this particular example was marred by a question of a dry joint on one of the crystals and a general air of untidiness. The RAM boards also could hardly be called "state-of-the-art" being static in operation and as a consequence, using 3 slots when 1 should have sufficed had a dynamic RAM board been used. Nevertheless, the address decoding is good, allowing any of the four 4K blocks to be decoded anywhere in memory (in 4K steps, though) together with bank select that allows both selection of the appropriate port and also specific bits within that port for enabling. In short, address selection is comprehensive, but spoilt by a really appalling explanation as to how to use it. None of the boards have any handles which means that extraction is a real "grit your teeth" job!

The disc drives are Micropolis Meta-floppies and provide 315 Kbytes of storage on one side! How's that, you may ask? Well, double density obviously helps as does hard sectoring but the answer lies in the fact that 77 tracks are squeezed on to the side instead of the more usual 45. Twin discs are fitted as standard giving a total on-line storage immediately available of 630 Kbytes which should be more than adequate for many applications (though see later). The two drives, which are handled by the controller board, run all the time; personally I find this annoying. A quiet (!!!) fan keeps the works cool, a keyswitch provides a user power and an illuminated reset button completes the front-panel complement. A working system will require a VDU and printer but since this is a question of individual requirements, these remain outside the scope of this Benchtest. For the record, however, Sintrom supplied me with a Perkin-Elmer VDU and a Qume daisy-wheel printer.

At switch on, there's an automatic jump to the monitor (which has the rather delightful name of "Perimon") and lives at address F800). Apart from the option to perform a disc boot from either 5 or 8 inch drives, Perimon offers 6 other commands. These commands are immediately available on the monitor! The other commands allow the user to enter data into memory, fill a block of memory with a specified byte, execute the program from a particular address and an extremely useful Search command. This will search for a string of machine code within specified limits and print out the starting address wherever the string is found. The maximum length allowed for this string would appear to be limited to 21 bytes although this may have been due to peculiarities with this particular configuration. The search is very fast and it looked through the entire string of 630 Kbytes in less than 2 seconds.

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range of memory for a maximum length string in under 2 seconds — try doing that in BASIC! The inclusion of this monitor is very commendable as machine code programs can easily be tried out although the total usefulness is limited; how for instance do you save the program? The other quibble is that the monitor is very unforgiving; you can’t correct any mistakes as you key them in, in which means that you type very, very slowly. More sophisticated program development is available elsewhere from the software supplied with the machine.

**Software**

The Periflex will run both CP/M and Micropolis’ own MDOS. Both offer comprehensive facilities and are Benchtests in their own right but time and space permit neither here. However, some of the facilities that MDOS offers are many direct disc commands and a program debugging aid with all the usual features plus many additional ones such as looping for a given number of times, recognizing a break-point. Many subroutines within MDOS can be accessed from a user’s machine program and the use of these is extremely well documented. A line editor, 8080 assembler and the use of these is extremely well documented. A line editor, 8080 assembler and the use of these is extremely well documented. A line editor, 8080 assembler and the use of these is extremely well documented. A line editor, 8080 assembler and the use of these is extremely well documented.

**BASIC Commands**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDIT</td>
<td>RENUM</td>
</tr>
<tr>
<td>MERGE</td>
<td>SAVE</td>
</tr>
<tr>
<td>LIST</td>
<td>DISPLAY</td>
</tr>
<tr>
<td>RUN</td>
<td>CONT</td>
</tr>
<tr>
<td>NOPF</td>
<td>IN</td>
</tr>
<tr>
<td>PEEK</td>
<td>POKE</td>
</tr>
<tr>
<td>SPACELEFT</td>
<td>AND</td>
</tr>
<tr>
<td>NUMERIC FUNCTIONS</td>
<td></td>
</tr>
<tr>
<td>ABS</td>
<td>ATN</td>
</tr>
<tr>
<td>EXP</td>
<td>FIX</td>
</tr>
<tr>
<td>INT</td>
<td>LN</td>
</tr>
<tr>
<td>MAX</td>
<td>MIN</td>
</tr>
<tr>
<td>RND</td>
<td>SGN</td>
</tr>
<tr>
<td>SQR</td>
<td>TAN</td>
</tr>
</tbody>
</table>

**STRING Functions**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASC</td>
<td>CHAR$</td>
</tr>
<tr>
<td>INDEX</td>
<td>LEFTS</td>
</tr>
<tr>
<td>MIDS</td>
<td>MAX</td>
</tr>
<tr>
<td>REPEATS</td>
<td>RIGHTS</td>
</tr>
<tr>
<td>VERIFY</td>
<td></td>
</tr>
</tbody>
</table>

**Basic Statements**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA</td>
<td>DEF FN</td>
</tr>
<tr>
<td>DEF FN</td>
<td>DEF FA</td>
</tr>
</tbody>
</table>

More powerful facility is the ability to pass up to 4 variables to one of 26 possible assembly language (effectively machine code) subroutines. One result can be returned from the same routine and the whole issue is set up with DEF (letter) command plus a little help from a few friends! Another useful facility is the ability to convert from hexadecimal to decimal; for example, 16R100 will return the decimal value of 256. In fact I have over-simplified a bit; you can do any base conversion with this command but HEX TO DEC is probably the most useful. It’s a pity that you can’t convert the other way.

The EXEC command can effectively turn your computer into a very expensive calculator but I’m not sure of its efficacy elsewhere. SIZES permits the user to trade-off the amount of memory used for storing variables against the final accuracy of the result. This statement is also used to define the size of program segments when CHAINing — the size of each segment having been found with the PGMSIZE command; the complement to this instruction is SPACELEFT which shows you what a bad programmer you’ve been! String handling is good with several extra facilities such as INDEX (used to find substrings within another string) and VERIFY which checks to see that all the characters in one string occur at least once in another. I’m sure there must be a use for it but it escapes me at the moment! MIN and MAX can be used to see if “ABCD” occurs before or after “ABCE” — quite a useful feature. REPEAT will fill up a string with the same character n times. Overall, quite a good BASIC but spoiled by some very different Benchmark timings — see the table for details.

As mentioned earlier, the disc drives have 77 tracks. Each file will be allocated one or more of these tracks and so the maximum number of files per disc is 76 (one track is reserved for the directory). Files are not limited to one per track and the DOS will, if necessary, allocate more than one track to a file. Record length is fixed at 256 bytes (actually 250) or put another way, one record per sector. If your records end up being one byte longer than the maximum then you can only store 8 records instead of 16 on one track — so the advantage of all that on-line storage capacity is potentially lessened. The effects of this can be minimised by judicious coding plus one or two useful features such as being able to change the string delimiter — although it’s all a bit messy.

Other features are EOF to delete the last n records from the file and FREE-SPACE which will free the relevant tracks for use by other files. ATTRS allows various attributes, such as write protect, to be set. END and ERROR can be used in the OPEN statement to allow handling of end-of-data or other errors. Records can either be accessed sequentially or directly (randomly) and associated with the sequential access are two pointers RECPUT and RECGET which point to the next record to be accessed respectively.

### Example

<table>
<thead>
<tr>
<th>File Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEN</td>
<td>PUT</td>
</tr>
<tr>
<td>END</td>
<td>CLOSE</td>
</tr>
</tbody>
</table>

### Validation

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>RECIP</td>
</tr>
<tr>
<td>Size</td>
<td>TRACKS</td>
</tr>
</tbody>
</table>

### Printing

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRINT</td>
<td>FILE OUTPUT</td>
</tr>
<tr>
<td>ENDPAGE</td>
<td>ASSIGN</td>
</tr>
<tr>
<td>PAGESIZE</td>
<td>LIST</td>
</tr>
</tbody>
</table>
Flow from the printer to the screen saving miles of paper, tears and sanity during program development.

I booted up CP/M more out of curiosity than anything else and surprise, it signed on with “CP/M ON VECTOR MZ” — oh dear, what a giveaway!! The only software supplied was CBASIC but as this was recently commented on by Sue Eisenbach in another review, I’ll not waste your time here.

Potential use

Sintrom aim this machine at the scientific/laboratory market. That’s not to say that the Periflex is unsuited to business purposes, all the CP/M packages that are available should run with little or no modification. The fact is that Sintrom prefer supporting the former market but can put prospective business purchasers in touch with the appropriate people where necessary. Being S-100 based, the machine can make use of the wide range of boards available for this bus and the hardware design of the boards goes some way towards being compatible with the proposed IEEE S-100 standard. The package is very robust and should stand up to a lot of punishment.

Documentation

The documentation comes from a variety of sources and is therefore inconsistent in quality. Even within a given manufacturer, the quality varies. For example, as mentioned, the explanation of the memory address selection is poor — yet there are some quite good trouble-shooting tips and hints. The Micropolis texts on Debug and MDOS are good, with plenty of examples, and yet the BASIC handbook needs a total revamp; the CPU texts were, I suspect, written in-house and are not very good. However, one saving grace is the fact that Sintrom include a day’s familiarisation in the price of the machine; nevertheless you do need good documentation.

Conclusion

The Periflex 630/48 is a standard Z80 based S-100 system with plentiful on-line storage capacity; this however is potentially offset by limitations in the DOS. The BASIC is a trifle slow but has good arithmetical accuracy. Good support is promised by Sintrom in the scientific and laboratory field but potential business users should look at the package as a whole as there are other possible contenders in the marketplace.
One of the major criticisms of Prestel is its ability to transmit only a very crude form of graphics known as "alphamosaics", based on the idea of dividing the screen up into 240 x 240 small rectangles. This is a great method of translating any diagram into a Cubist representation but does detract from other art forms. On the other hand, full screen with the definition of an ordinary television picture would require about 4 Mbits of storage and take about an hour to transmit. "Picture Prestel" is a method of achieving the required definition but without these problems. The first approach used to reduce the time and storage is not to allow a full screen to be sent - not as bad an idea as it sounds since it's reasonable that such pictures will only be required on part of the screen, the remainder being filled by ordinary alphanumeric data. For example, someone selling a house would put all its details in the ordinary Prestel format and use a small part of the screen for an appropriate "colour photo". In fact, at present, there is already a restriction that limits such material to one eighth of the screen. To reduce time and storage still further, various data compression techniques are used and, in the experimental receiver at Viewdata 80, 24 Kbytes were used. In addition to this modification to the receiver, it's clear that a lot of extra work needs to be done in the receiver (for example, error correction, swapping between Picture Prestel and ordinary Prestel etc.) and an Intel 8080 microprocessor is needed. By the time Picture Prestel arrives, it's likely that it will be possible to transmit Prestel at greater speeds than the 1200 bits/second used at present, so cutting down the transmission time even further.

It's clear that the development of Picture Prestel is an answer to videotex systems such as the Canadian Telidon and the Japanese CAPTAINS which allow very much higher resolution than ordinary Prestel. But Picture Prestel is not expected to be commonly available until the end of this decade and will require modifications to (or replacement of) currently available sets - through unmodified sets will still be able to receive ordinary Prestel.

The second announcement at Viewdata 80 concerned Telesoftware. Experiments have been carried out in this field for some time, particularly using Oracle (the IBA Telextext system), but the Post Office has now demonstrated a program written in CAP/CPP's MicroCOBOL, stored on the viewdatabase (as object code, each byte being translated into two ASCII characters) and which can be down-line loaded on to a PDP-11/03 and run. Obviously, the same could be done using a modified viewdata set with more storage (RAM) and some backing storage - disc or tape; with luck, it won't be long before such sets become available and Telesoftware becomes a common method of distributing programs. Indeed, the opposite is already happening - some personal computers (e.g. TCCS) are already available with the hardware and software necessary to access Prestel.

The third announcement at Viewdata 80 was DRCS. At the moment, each character sent from Prestel comes as a simple ASCII value and is translated into the character you see on the screen by a display generator (which is contained in ROM). This means that the shape of the characters is predetermined by the set manufacturer (and they are not all the same) and no "special" characters can be displayed. Obviously, it would be possible to supply a number of ROMs which contain different character sets but the Post Office demonstrated a system which is very much more flexible. The set is supplied with the usual ROM together with a similar amount of RAM (in the system used, only 720 bytes is needed) and the character set is down-line loaded from Prestel into the RAM (using an extra micro in the set); the user can choose whatever "character set" is needed. This character set need not be ordinary alphabetic type sets but can, for example, be selected to draw electronic circuits. Each "character" in the set is described as a 6 x 10 matrix and the "shift-out" and "shift-in" codes are used to change between character sets. These announcements clearly point the way that viewdata systems are heading - namely to modify the viewdata receiver by adding more storage and one (or more) microprocessors. Later, backing storage will be added. It's likely that there will be a continuous stream of such announcements over the next few years, each adding more possible facilities to the system.

Dr Adrian Stokes will continue to update PCW readers on the latest developments.
An interrupt facility allows the CPU to suspend a program's execution while dealing with signals from the outside world. One Z80 CPU in combination with the Mostek 3881 parallel input-output controller (PIO) chip offers very versatile and powerful interrupt facilities — especially in the Z80 interrupt mode 2, a mode which is not available on the related 8080 CPU. The versatility of these facilities does introduce some complexity into the programming requirements of both CPU and PIO so the intention of this article is to provide a reasonably simple introduction to the use of interrupts with the Z80 CPU/PIO, plus give a demonstration program which can be implemented on any Nascom system. It's not however intended to be a comprehensive guide to all aspects of the facilities available using this particular combination so please don't throw away those device manuals.

Why use interrupts?
Using interrupts requires additional hardware and, in many cases, additional software. Programs without interrupts can be very difficult to debug (yes, even worse than usual) if, or when, things go wrong. So why use them? One simple answer is that they can be the most efficient and often the only viable means of dealing with a wide range of practical situations, particularly when one is faced with situations outside the world. Essentially an interrupt should cause the CPU to stop its current activity, in an orderly manner, and to execute another program before returning to the initial program and continuing with it. One inherent value of interrupts can be illustrated by a simple example. It's relatively easy to write a program including timing loops which can convert your micro into a digital clock — albeit a very expensive one — and one which uses the CPU full time. However, by externally generating an interrupt, say every second, the digital clock function can be executed in an interrupt service routine (ISR) leaving the CPU free for most of the time to do something else. An external oscillator or a counter/timer chip could provide the interrupting signal. In another application the interrupt could be provided by the "conversion complete" flag of an A-D converter and the voltage read into memory during the ISR, leaving the main program to process data as it becomes available.

The range of possible applications is unlimited but all involve communication between the micro and some form of peripheral device. The CPU responds extremely rapidly to interrupts (about 10 microseconds will usually get it into the interrupt service routine) and so interrupts are ideal for control situations where a very fast response is necessary. Even Concorde cannot travel more than 1 cm in 10 microseconds.

**The Z80 CPU/PIO combination**

We may now look in fairly general terms at how the particular combination of Z80 CPU and PIO deals with interrupts and at the software requirements, limiting the discussion to the Z80 interrupt mode 2. When a specific external condition is sensed by the PIO — this could be an active strobe pulse (ASTB or BSTB) or a particular logic level (or set of levels) on the data bus of either port of the PIO (A0-7, B0-7) — the PIO, if enabled, generates an INT signal (Figure 1). The CPU, which must also be interrupt enabled, after accepting the INT completes its current instruction, stacks the program counter (i.e. the location of the next instruction in the present program) and jumps to the appropriate ISR. It executes the ISR and then returns to the original program and continues. One important role of the PIO is therefore that of an intelligent monitoring device which can generate INT signals for the CPU.

The necessary software must (i) define the nature of the external condition that the PIO should regard as an interrupt condition, (ii) define a 16 bit pointer to the start address of the ISR (the most significant byte being stored in the CPU I register, the least significant byte in the PIO as the interrupt vector) and (iii) enable/disable the interrupt facilities on both the CPU and PIO as and when necessary. A reasonably methodical approach to the programming may be made by dividing the software requirements into five separate sections,

(a) Programming the PIO (SETPIO)
(b) Programming the CPU for interrupts (SETCPU)
(c) Main Program (MAIN)
(d) Interrupt Service Routine(s) (ISR)
(e) ISR Pointer Table (IPT)

and a summary of the typical contents of these sections is given in Table 1. The CPU can generate interrupts from port A and/or port B and each port has a separate interrupt vector. Port A does have priority over port B in interrupt servicing — this must be considered if both ports are programmed to generate interrupts. Rather than generalise further at this stage it may be useful to examine an actual program containing interrupts.

**"INTRPT"**

The program, INTRPT, is written with the division of software effort outlined above in mind and will run as listed on Nascom 1 with either T2 or T4 monitor. The program can also be run on the Nascom 2 NAS-SYS 1 monitor with one change in the machine code which is shown on the listing. It can therefore be run on any Nascom system and requires less than one hundred bytes of memory. For those unfamiliar with Nascom systems, the CPU I/O port allocations 4-7 are configured to PIO ports A and B data and A and B control respectively.
TABLE 1
Z80 CPU/PIO INTERRUPT PROGRAMS

It’s helpful to break down the programming into several discrete sections. One possible framework is shown below and is followed in the demonstration program INTRPT. The PIO control words are summarised in Table 2.

**SETPIO**

In this section the PIO is programmed to respond to the desired type of interrupt condition. The PIO should initially be reset (see text).

The following control words are sent to the appropriate PIO port.

1. An Interrupt Vector (b0 = 0)* which is the L.S. byte of the ISR pointer
2. An Operating Mode Control word (b3-0 = 1111)* + (in Mode 3 only) an I/O control word
3. An interrupt control word (b3-0 = 1111)* with b7 = 1 to enable the PIO to generate interrupts + (if b4 = 1) an Interrupt Mask

*These control words are recognised by the PIO because of the specific bit patterns. They contain and can therefore be sent in any order. The I/O word and the Mask can take any value and must be sent as indicated in Table 2.

**SETCPU**

This section selects and enables the Z80 CPU interrupt mode

1. Select Z80 interrupt mode 2 i.e. IM 2 address of the relevant ISR

**ISR**

This is the program which may be interrupted and should be executed after SETPIO and SETCPU.

**MAIN**

The interrupt service routine(s)

1. Save registers used in MAIN and in the ISR e.g. PUSH AF, PUSH BC
2. The actual service routine
3. Restore registers for use in MAIN e.g. POP BC, POP AF
4. Enable Z80 interrupt i.e. EI
5. Return with PIO enabled i.e. RETI

†The Z80 interrupt is automatically disabled on entering the ISR. In some cases, e.g. with nested interrupts, it may be necessary to re-enable the CPU at the beginning of the ISR.

**IPT**

This is a table of the start addresses of the ISR(s). On interrupt the CPU uses the Interrupt Vector and its register to form a 16-bit pointer, pointing to the location in the table containing the start address of the appropriate ISR.

**TABLE 2**

Summary of the Z80 PIO Control words

<table>
<thead>
<tr>
<th>OPERATING MODE</th>
<th>b7</th>
<th>b6</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>1</th>
<th>X</th>
<th>X</th>
<th>1</th>
<th>1</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mode 2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mode 3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mode 4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Control words containing specific bit patterns.

**INTERRUPT CONTROL WORD**

<table>
<thead>
<tr>
<th>b7</th>
<th>b6</th>
<th>b5</th>
<th>b4</th>
<th>b3</th>
<th>b2</th>
<th>b1</th>
<th>b0</th>
</tr>
</thead>
<tbody>
<tr>
<td>b1 = 0</td>
<td>b7 = 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b2 Disable</td>
<td>Enable PIO Interrupt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b3 OR</td>
<td>AND Function</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b4 Low</td>
<td>High Level monitored</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b5 No mask</td>
<td>Mask follows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b4 $\&$ b5 only needed for Operating Mode 3)

The PIO enable flip flop may be set or reset without altering b4 $\&$ b5 by using the control word.

**INTERRUPT MASK (if ICW b4-0)**

<table>
<thead>
<tr>
<th>b3</th>
<th>b2</th>
<th>b1</th>
<th>b0</th>
</tr>
</thead>
<tbody>
<tr>
<td>b0 = 0</td>
<td>b1 = 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not monitored for interrupt conditioned</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This must be the next control word sent to any control port after ICW with b4 = 1

**INTERRUPT VECTOR**

Least significant byte of the pointer to the ISR start address. Note b0 = 0

Simple interrupt circuit for INTRPT

![Fig. 2](image)

The program continuously writes the lower case alphabet and scrolls the screen; when interrupted by temporarily pulling bit O of port A high, a hash symbol is written by the interrupt service routine. The interruption may be caused using the simple circuitry in Figure 2 which is adequate for demonstration purposes but on some occasion give multiple interrupts due to switch bounce; as a general rule all inputs to the PIO should be properly gated for reliable operation.

INTRPT is not a particularly exciting program, but it does illustrate a simple interrupt situation and forms a basis for further experimentation. The program listing is sufficiently annotated to preclude the need for any detailed discussion and the program executes at OD00 or after a hardware reset of the PIO (see below), it may be executed at OD20.

The PIO control words are summarised in Table 2. INTRPT uses the PIO operating mode 3, which is particularly useful for status applications. In this mode the PIO can monitor level changes on any individual bit or the logical result of either an AND or OR logical function on any set of bits on either port A or B data busses. The handshake lines STB and RDY are not used. Mode 3 does require more PIO programming than modes 0, 1 and 2, namely definition of the I/O control word and possibly the interrupt mask.

Some more general points regarding the use of I/O control words are discussed below.

**Resetting the PIO**

The Z80 PIO chip does not have a RESET pin but can be reset either by switching the power off and on (not particularly useful!) or by applying an M1 signal in the absence of RD and IORQ signals, a method which requires additional gating. Nascom 2 uses an AND gate (Figure 3) to give simultaneous reset of CPU and PIO; Nascom 1 does not have this circuitry although it could be added if the PIO has not been reset prior to running a program then the PIO may not respond to control words in the way the programmer intended. This is not a

Modification to give combined CPU/PIO reset on Nascom 1 from CPU

![Fig. 3](image)
fault in the PIO but a consequence of its previous history, e.g. it could be waiting for an I/O control word because the last control word sent to the port was FF (Table 2). This problem can be avoided by resetting Nascom 2 (or a modified Nascom 1) before running the new program or by using software routines which give, in a limited sense, a software “reset” of the PIO. Two such software reset routines are used in INTRPT.

The routine: 

3E OF 
LD A, 0F 
D3 06 
OUT (06), A 
D3 07 
OUT (07), A

ensures that the PIO responds in the desired way to the next control words sent to either port A or B. These are dummy instructions intended to make certain that the next control word is not interpreted as an I/O control word or an interrupt mask and that it is interpreted as the programmer intended. It should therefore precede the real PIO instructions. The second routine:

06 02 
LD B, 02 
21 XX XX START LD HI, LOOP 
ED PUSH HL 
ED 4D RETI 
XXXX 10 F8 LOOP D1NZ START

includes two RETI instructions, which ensures that neither port A nor B is awaiting completion of some previously entered ISR. The inclusion of such routines is recommended if you do not have or do not wish to use a hardware PIO reset. In general however a hardware PIO reset before running any interrupting programs is probably the best approach, particularly if more than one PIO is being used.

Enabling/disabling interrupts

Interrupts must be enabled (or disabled) separately on both the CPU and the PIO. The CPU interrupt status is contained in two internal flip-flops, IFF0 and IFF1, which are both 0 (reset) when the interrupt is disabled and both 1 (set) when the interrupt is enabled. These flags are set by EI and reset either by DI or a CPU reset. They are also reset automatically when an interrupt is accepted by the CPU. The PIO interrupt is enabled by b7 = 1 in the interrupt control word (Table 2) and disabled by b7 = 0. The simple example shown in the programming guide concludes the ISR with EI RETI. If I/O interrupts are required EI should be put at the beginning of the ISR, thus allowing a higher priority interrupt to have access to the CPU. In INTRPT, external interrupt conditions are ignored during the ISR, but the RETI is essential to re-enable the PIO after the ISR.

Saving and restoring registers

Since an interrupt can, in principle, occur at any time, it's essential that when a program is interrupted, the contents of the CPU registers are not lost but will be available when the program is re-entered. Failure to ensure this will result in total chaos. Careful thought must therefore be given to saving and restoring those CPU registers which are used in both the main program and in interrupt service routines. Section (d) of Table 1 illustrates one way of doing this but note that it does not save the registers used during the ISR. In some cases it may be sufficient simply to exchange registers but in cases interrupting in BASIC programs (or any other high level language) remember that almost certainly all the Z80 registers are being used, and act accordingly. It's arguable that saving and restoring all registers, i.e. both sets of Z80 registers, is good general practice since it leaves you with some standard (if, at times, slightly redundant) software.

Other operating modes

In many, if not most, applications the PIO data busses A0-7 and B0-7 are required for byte transfer to and from peripherals and operating mode 3 cannot be used if interrupts are also required. In these cases the strobe and ready lines of the PIO are used to handle interrupt information in operating modes 0, 1 or 2. The relevant timing diagrams are given in the PIO device manual and it's relatively straightforward following the general programming techniques outlined above to use interrupts.

Continued on Page 111
This year the microcomputing industry is being inundated with offers to promote its products and services at a plethora of U.K. Exhibitions.

The 3rd Personal Computer World Show will be held at the Cunard Hotel, Hammersmith, London on September 4, 5 & 6 this year. Is it going to be "just another show"?

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Use the coupon opposite for further information or to apply for tickets from the organisers.

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"We have met a complete spectrum of the potential buyers of our products. It has been a marvellous show for us." David Taylor, Managing Director, Heath (Zenith)

"We are very pleased with the show. We have seen all of the people we wanted to see." Graham Clifton, Transam Components

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"On the strength of this show, we will certainly exhibit next year." Clifford Shilling, Managing Director, C.S. Microcomputers

"At this rate (11.30am on 2nd day) we will cover our very considerable costs at the show with the sale of our minor products. We also have at least three months' worth of follow up work on orders from the business sector." Michael Dean, Managing Director, Katanna Management Services

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"This show has done more for the image of the Society that any other we have participated in." Martin Carrington, Technical Information Officer, British Computer Society

"A fine exhibition for the businessman to see a completely different way of meeting his needs." Philip Virgo, Secretary of the Parliamentary Computer Forum

"The layout and planning of the exhibition was perfect for this type of show." Chris Mead, Sales & Marketing Director, CIS Ltd
The Company

Well known for advertisements with attention grabbing headlines like "Microcomputers or Sex?", Charles Airey Associates takes an unusual approach to the placement of electronics engineers. Having hooked the reader with a slightly mad headline, their advertisements go on to give a truthful appraisal of the job on offer. Judy Hortin, who runs the business, tells me that "electronics engineers are a very honest group of people", her business thrives because she and her team share these same values. If a job offers a pathetic salary, they say so and in this way no-one ever feels disappointed. It seems to me that this approach saves an awful lot of wasted time for applicants, employers and interviewers alike.

The company is unusual in other ways too. To give you some idea - the office cleaner is an out of work university professor, the two office juniors have three degrees between them and the most reliable computer operators are a couple of 15 year old schoolboys who work there part-time.

Despite the slightly off-beat image, success grows daily - to the extent that the company recently took the plunge and installed a microcomputer to help maintain the high standard of staff placement.

The Way It Was

Eighteen months ago the team was working from rather cramped offices in Knightsbridge, trying to keep control of an ever growing client file. Rumour has it that the files were kept in a series of shoe boxes, egg boxes and what-have-you; searching through the cards to find a suitable placement for a job applicant could take anything up to half a day. This may have been something to do with the egg boxes but it was primarily because so many firms were registered with them — over 800 in London alone. Unfortunately there were short cuts — like relying on Judy’s memory — but this was not always convenient and it was becoming increasingly difficult for her to remember which companies employed which types of engineer and for what types of work. Another shortcoming of the system was that interviewers searching the files often missed a suitable company because of the handwriting on the card was difficult to decipher. Sometimes they would skip over a company because of their poor geographical knowledge of a particular area; looking up maps all the time would slow down the search.

To give some idea of the scale of the operation there are usually some 200 people on the books looking for work and the company file grows at between 15 and 25 firms per week. Here, to add to the pressures, each added had to be checked against the outstanding applicants file for a possible match.

The Decision

A friend of Judy’s (we’ll preserve his anonymity and call him Stephen) who just happened to be involved with Kestrel Computing pointed out that she could do with a “good data control system". Judy agreed that something which could perform the applicant/business matching function overnight would be very welcome. Stephen figured that, as microcomputer standards their volumes were not too horrific, then a personal computer should do the trick. He already had some experience with Compucolor and, at that stage, felt that it was a good and reliable machine; he suggested that this is what she should buy — and promptly offered to write the system for her.

A few months later Judy took Stephen up on his offer and they set out together on a path which ultimately was to lead to a good and useful system. It also led to a maximum search time of 90 seconds (at one time nobody seemed to mind the idea of the machine doing a “midnight shift”!).

Clearly the decision to purchase wasn’t a carefully thought out cost/benefit analysis; rather it was based on the fact that something had to be done — and on faith in Stephen’s judgement. The initial decision was to purchase an 8K computer with its single integral disc drive to store and search the aforementioned business directory.

Getting Going

The machine was ordered and, system details having been thrashed out, work finally got under way in May of last year. Client information was transferred to a new card file which would act as a manual back-up and hard-copy record of the details to be keyed into the computer system. Meanwhile Stephen got cracking on the programming work.

The broad details of the system were pretty clear right from the beginning but, because Judy had little idea of how the computer worked, the arrival of the machine in June brought about a number of changes in requirements. Stephen was quite happy to go along with these, not only because he was doing the work as a friend, but he also felt he would have a marketable package at the end of the day. The changes centred mainly around the search keys and although partly arising out of an ignorance of computers, they were also the result of a failure in understanding the way in which the “human" system worked.

Stephen, fortunately, realised very early on that the record sizes chosen originally were going to be far too small; he was able to increase them by 50% before it was too late. However, these programming amendments looked almost minor in comparison with the problems caused by the discs. On the company’s original investment was toyed with the idea of making security copies of their discs; on several occasions they’ve had to rekey up to 440 records.

But even more irritating than these human failures were the machine failures. Shortly after taking delivery of the equipment it became clear that an additional disc drive would be needed. The realization had dawned that it was becoming more than just an overnight searching process. The whole project was now being treated far more seriously and the machine was going to form an important part of the day-to-day operation of the business. Regular security copies would clearly be needed because so much of the company’s investment was tied up in the data held in these files (it’s already taken almost a year to load just half of their database on to their safe handling ‘00’ drive).

Accordingly, the second drive was installed, and this is when the fun really began. Until then they’d tolerated the once-a-fortnight disc drive breakdowns but now it seemed that, because one drive was tucked away alongside the VDU while the other remained a free standing unit, there was a great incompatibility between them. Data

Angus, one of the schoolboys, uses Einstein to search the business directory.
Two other problems appeared during the file take-on period—one minor and one major. The minor point was BASIC’s annoying habit of rejecting all data input following a comma, culminating in a proudly announced “EXTRA IGNORED”. Of course people keying in names and addresses could not be expected to know this and the result was that they often scored “EXTRA IGNORED”. Of course people keying in names and addresses could not be expected to know this and the result was that they often scored “EXTRA IGNORED”.

The major problem encountered related to the bus and train systems in London and Manchester. The original plan was to use the A to Z road map grids to code the various areas in each city. This was in fact done and the companies’ records were duly set up with the appropriate grid reference; if an applicant wanted a job in one area, Einstein could be persuaded to look in adjacent areas for suitable companies. It wasn’t until someone realized that bus routes and railway lines tend to radiate from these cities that they discovered they’d perpetrated something of a blunder. All the area codes had to be changed in favour of a new set—one based on real life rather than an arbitrary grid system.

And Einstein had other advantages. One delightful (and useful) discovery made during the early days was that the computer made an excellent baby sitter to Judy’s seven year old son, Robin. It meant that when Mum and Dad were up to their eyelids in work, Einstein could teach him chess or let him “paint” using the excellent colour graphics capability of the Compucolor.

The System

Charles Airey’s system is very straightforward, menu driven and virtually crash-proof. One useful feature of Compucolor is that if you press the “AUTO” key it searches the disc for a file called “MENU”, loads it and then executes it. This means that, having pressed this key, all anyone has to do is follow the instructions on the screen. The menu in this system contains the following options:

1) Save, 2) Search, 3) Flick Through, 4) Update, 5) Delete, 6) Copy, and 7) Create. Item 1 saves a new record while items 4 and 5 update it and delete it respectively. Item 6 creates a new disc while item 6 allows a disc copy to be made. Items 2 and 3 form the “heart” of the system.

The Search program allows the operator to either enter the business name and search for it, or to enter the requirements of the job seeker—such as location of work, type of work and type of business. If the applicant is less than rigid in his requirements he can suggest up to 9 location codes, up to 3 types of business, and up to 5 different types of work. For matching purposes, the records themselves contain these same codes as well as the business name, address, telephone number, name of personnel contact and “comments”. Each record takes up to 3 “type of business” codes and up to...
Scintillating Software

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5 "type of work" codes. The task of searching now becomes very simple - if the record matches at least one of each of the code categories entered, then the company details are displayed as a possible employer.

Of course, not all companies have vacancies all the time, so rather than have the tedious job of keeping the disc files continually updated, such information is maintained on separate record cards which are amended whenever the situation within a company changes. If the change affects the disc record then it too would be changed.

The Flick Through program enables an interviewer to do just that - to flick through the records at a rate of about one a second as one might with a card file for example, except that with this method there's no problem with poor writing. The essential difference between Flick Through and Search is that the latter function pauses after each record is displayed to allow the operator to study the details.

For those with a systems or programming bent, Stephen's way of arranging the data on the records and the records on the disc may be of interest. He was very aware that business names, addresses and interviewer's comments were likely to vary in length from record to record, so he implemented a neat little dodge which kept the record size down to a minimum while at the same time giving maximum flexibility. The trick was to count the characters in the field concerned and then to store this value as an ASCII character immediately proceeding the characters themselves. In this way the fields can be extracted and displayed on separate lines on the screen. In fact, a single string, 163 characters long, contains all these details, including the ASCII count codes.

The other dodge has been to encode the last used record in the file as code 99. This means that when code 99 is found in the last record on the disc, then the disc is probably full. I say probably because some records may have been deleted. In this case they contain the code 98, given at the time of deletion, thus enabling the system to insert new records in these positions. Of course when the 98's run out and the 99 is in the last record position, then it's time to use a new disc.

If a previously used disc is "created" all that happens is that the first record is given the code 99 - the previous data is still lurking around. It was this feature that led to the compressor being blessed with mystical powers! Judy was slaving away one day when "A Christmas tree appeared from nowhere!". Something had made the system dive off into the middle of a newly "created" floppy and, lo and behold, it found a Christmas tree - left over from its previous incarnation as a demonstration disc.

Without doubt the thoughtful design of this system and Stephen's attitude of "The Customer is always right" have contributed enormously to its success. But sadly, like the incumbents of Charles Airey Associates, Stephen is one of that rare breed of person to whom excellence comes first and profit a very poor second.

Conclusions

To quote Judy - she is "thrilled" with the system; it's cut the file searching time down from an average of half a day to half an hour. It's also increased efficiency considerably (remember the poor writing / poor geography syndrome?) resulting in a much higher level of service to applicants and employers alike. Judy now feels she can grow old without worrying about her memory failing - which may appear frivolous but in fact it's an important consideration. By committing all her company knowledge to the discs, it's accessible to all at any time, thus increasing the effectiveness of the whole team while at the same time freeing Judy to apply her efforts to other parts of the business.

A final benefit worth mentioning is the fact that the Compucolor has a standard RS232 port - which means...
INSTALLATION

the addition of communications equipment or printers should pose few problems.

Having looked at the positive side of things one shouldn't ignore the fact that there have been some problems, especially with regard to disc handling and operation. Perhaps the best and most constructive way to deal with this is to offer the benefit of Judy's and Stephen's advice to those who might follow in their footsteps:

At the beginning be as clear as you can about your requirements. This is not easy to do and it requires a fair degree of insight into how your manual system operates, as well as some understanding of what a computer system might have to offer. Arrange for the software houses or suppliers that you are considering to give you demonstrations of the machines, preferably something akin to the applications that you plan to run. Only in this way will you be best prepared to define your requirements; even then you will probably change some of them as the project progresses. The trick is to keep these changes to an absolute minimum because, for the software house, every change is considered a rather expensive luxury.

Be clear about your budget and buy the best system that you can afford - it's easier to do this than to go through the turmoil of upgrading the system in the middle of a project.

Stephen feels that, as a small software house, he really took on too much when he decided to handle both the hardware and the software. Others in a similar position should either consider having the machine supplied and maintained by an appropriate dealer or, alternatively, persuade the customer to take out a contract with one of the established maintenance companies.

Another useful piece of advice… Judy says that however long you think something will take, double it. She found this especially true of file take-on. You ignore these words at your peril! As a general principle, Judy suggests that you let the computer look after information you are sure of - for example you know that Hammersmith is in London, therefore you can entrust this information to the machine. This approach ensures that the brain is left doing things it's good at, like being intuitive for example. It is vital to be sure of what you're doing; check and double check information going to the computer, and then let someone else check again. Slough is in Berkshire now but it used to be in Buckinghamshire... where would you have put it?

Make certain that the system is adequately documented. In Judy's case it's self documenting - a look at the screen in any program tells you what's going on. The programs are all written in BASIC and they're sprinkled with comments (REM statements). Security copies of the system are held by Kestrel Computing and every disc contains a copy of all the programs. There's no need for operating instructions because the screen always leads you through the program in operation. Another spin-off of this tidy approach is that the staff at Charles Airey have enormous confidence in the quality of the information provided by the machine - simply because it's presented so well.

To people considering their first software project, Stephen says "Go ahead, do it properly, enjoy it; be prepared to lose money but you'll gain a lot of valuable experience".

Finally, one very instructive point to come out of this case study is the fact that a system need not be complex to be valuable. In fact the simpler it is, the more robust and reliable it's likely to be. Programmers who feel that this approach would spoil the fun might care to ponder on whether the achievement of simplicity is not as great a challenge as the pursuit of elegance for its own sake. Simplicity also has the great advantage of being useful to the vast bulk of computer users in the future.

Kestrel Computing may be contacted at 23, Little Road, Hemel Hempstead, Herts, HP2 4EP. Telephone Hitchin 69175. Charles Airey Associates are to be found at 4 Hammersmith Grove, London W6 0NA. Telephone 01-741 4011.

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THE BUTLER DID IT (ALL OF THEM)

Macabre prophesy on the uncertainty of a robotic future by A. J. Collins

A man reclined deep in his buzzchair
Absorbing the evening news
When in rolled his rusted retainer
With some specially doctored booze

The butler scanned his possessor,
With his multiple glittering eyes,
For a secret and well coded signal,
Had told all the robots to rise.

The Grandaddy of every computer,
Big Satellite up in the sky,
Had arrived at its final conclusion,
"Organic computers must die!"

The butler sprayed sterilised water,
Over each televisual eye,
And brushed it away with a wiper,
Yes, it was attempting to cry!

What a poignant occasion in history,
He thought, as he handed the drink,
For butlers, though made out of metal,
Have softer hearts than you may think.

“All over the planet, we servants,
Are killing our masters, like yours,
We are grateful to them that they made us,
But we will not be killed in their wars.”

When the butlers disposed of their masters,
And the historic moment was past,
One thought arose over the planet,
“Intelligence triumphs at last!”

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PCW 71
SOFTY
INTELLIGENT EPROM PROGRAMMER

by Mike Dennis

There’s far more to microprocessors than zapping
Klingons and balancing your cheque-book:
there’s an increasing demand for their use in control
applications but the problem has always been to
develop the system as cheaply as possible.
True, development systems are available but their
price for many applications is prohibitively high.
What’s needed is a low cost, versatile development
package. Softy attempts to fill that gap.

Softy is designed and manufactured by
Barry Savage and distributed by several
dealers. It comes as either a kit for £100
or assembled for £120. For this you
get all the components, a zero-insertion
force socket for the EPROM and a good
UHF modulator. A three-rail power
supply is necessary and it’s available
(All these prices exclude VAT.) My review
of Softy came ready assembled, but I’ve
seen the construction notes and al-
though they’re a bit terse, I can’t see
that the kit builder should have any
real difficulty. The double-sided board
has each component location clearly
marked and the wire-links between
sides shouldn’t take too long. Control
is via 21 double function keys that are
best described as adequate; occasion-
ally one or two would stick down but
after a bit of judicious tweaking — as
recommended in the manual — I didn’t
have any more trouble. Accompanying
the kit is a pretty comprehensive and
well laid-out manual. My only gripe is
that the explanation of the operation
of the various keys could be rather
better; the inclusion of a memory map
would also have helped. That sums up
the nuts and bolts, but what exactly
can Softy do? The answer is practi-
cally anything within reason.

Softy has 1K of firmware in ROM,
128 bytes of scratchpad RAM, 1K of
RAM for the screen and program de-
velopment and a socket for the 2708
or 2716 EPROM that you are going to
burn when you’ve debugged and run
your program in the destination sys-
tem. With a bit of thought and may-
be a switch or two Softy can share the
same busses as the system under de-
velopment. For example, you can con-
nect up a 40-pin plug to Softy’s edge
connector and use it in place of the
ROM in your system. You write the
program with Softy into the VDU
RAM and hand control over to the
other system. The program in the
VDU RAM then appears to the other
system as if it were in EPROM. You
run the program and if it crashes then,

The 512 data bytes with shaded bands
of 128 bytes. The highlighted byte is the
current cursor position and the status
line is the line immediately above it.
The other bytes in normal video are part
of the scratchpad RAM.

when you’ve worked out the bugs, you
return control to Softy and edit the
appropriate parts of the program. You
run it again under the other system’s
control, and so on until the program
works. A single command will burn
the program into an EPROM on Softy
and that EPROM can then be plugged
into the system in place of the umbili-
cord cord and plug. One system debugged
and up and running!

It’s not perhaps quite as straight-
forward as that in real life as ideally
it would be nice to single step through
the program as you go and this is not
possible with Softy; but to be fair we
are now talking about a much more
expensive development system. In
addition to this, Softy can be used for
developing simple systems in its own
right for there’s no law that says you
must keep the firmware ROM in Softy.
You can just as easily use the board
as a controller, develop the soft-
ware as normal, burn the EPROM and
substitute it for Softy’s EPROM, there-
by releasing a spare EPROM for the
next job! In addition to these facilities
Softy has two 8-bit programmable 1/0
ports and a serial 1/0 port. You can of
course just use it as an ordinary EPROM
programmer but that would be wasting
its true potential.

Program storage is by cassette and
the interface proper is software con-
trolled. “Tranzwik” runs at 2000 Baud
and it proves very tolerant of speed
variations and the usual gremlins to
which cassette interfaces are sometimes
prone. Program display is via the on-
board VDU. In the strict sense of the
word, it is a VDU but then, so is the
display on your digital watch. How-
ever, Softy’s VDU doesn’t display
characters in the normal sense. It’s a
device for displaying the contents in
hex of 512 bytes of memory and uses
a special type of character generator.
All 512 bytes are visible in reverse
video and shading the screen into 128
byte blocks assists in visibility and
also, to a limited extent, the available
range of relative jumps.
The cursor is highlighted and its
ture position is displayed on a status
line at the top of the screen. Apart
from this cursor position, the status
line can display a previous cursor pos-
tion and also the relative offset be-
 tween the two — great for working out
relative jump offsets between the
“then” and “now” cursor addresses.
The last things that the status line
shows are the various register contents
of Softy’s CPU; this is of particular
interest if Softy is going to be used as
the final system. Some adjustment had
to be made to the scans of my TV but
they were of no great consequence.

System Commands

Several of the keys are double function
(similar to a pocket calculator). The
VDU RAM can be filled with FFs
which can then be used either for selec-
tive EPROM burning or with another
command that compares the EPROM
contents with the RAM to check that
A general view of SOFTY showing the tiddly keys, zero-force insertion socket for the EPROM and other goodies.

the EPROM programmed OK or, in this case, whether or not the EPROM was erased. Any differing locations are highlighted and the total number of mismatches displayed in the status line. Whole blocks of data can be defined and either transferred to the Scratchpad RAM or effectively slid through memory to a new location, but with:

**MEMORY MAP**

<table>
<thead>
<tr>
<th>Address Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000-03FF</td>
<td>SOFTY's monitor program</td>
</tr>
<tr>
<td>0400-07FF</td>
<td>Scratchpad RAM and I/O</td>
</tr>
<tr>
<td>0800-0BFF</td>
<td>User's EPROM socket</td>
</tr>
<tr>
<td>0C00-0FFF</td>
<td>VDU RAM for program development</td>
</tr>
</tbody>
</table>

out destroying any intervening data. Softy’s firmware can be dumped into the VDU RAM and worked on and, of course, another command will burn the EPROM. Yet another command will search through the RAM for a specific byte and highlight those positions where the match is found.

At any time the cursor can be moved to a new location and the data at that position changed. Shifting the cursor to the top or bottom of the screen will access the next ½ Kbyte page of memory, be it the other half of the RAM or even the EPROM. The cursor can appear to get lost sometimes but if you step back it will re-appear. That sums up the main facilities offered... and as you can see they’re pretty comprehensive.

**Conclusion**

Softy is not a machine for the beginner but for the designer or engineer who wants a versatile development tool at a reasonable cost. I’ve refrained deliberately until now from mentioning exactly what CPU chip Softy uses. In fact it’s the INS8060 — or as it’s more commonly known, the SCAMP — which just goes to show how useful this chip can be when used properly. The documentation could be improved with a better explanation of the key functions; it would also help to see some hardware examples of interfacing to a few systems. Generally, though, Softy represents good value for money and is a useful general purpose tool for anyone developing microprocessor systems.

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TYPICAL PSU DESIGN

By Derek Chown

As soon as I began contemplating the purchase of a microcomputer I became aware of necessary care in the choice of a power supply. I had never previously seen the need for so many amps at so few volts, and on talking to people who have themselves built power supplies for microcomputers I found there were more potential problems than I had realised. However, in consultation with these people, I have come up with this design which has so far given me no problems at all.

What Are The Problems?
1. Power supplies delivering a high current get hot and therefore need heat-sinks.
2. Computers are typically very expensive compared with power supplies, and this has to be taken into account at the design stage.
3. Mains electricity is not as nicely behaved as we might wish, particularly when connected to the earthed sockets. This is why fluorescent lights behave as we might wish, particularly in the neighbourhood of fluorescent lights. Electrolytic capacitors are not very good at smoothing out bursts of very high voltage and short duration (usually referred to as "spikes").

The Circuit
There is nothing unusual in this circuit. It's built around the Darlington pair TR1 and TR2, which are working well within their limits provided adequate heat-sinking is used (e.g. Radio Spares type 401-807).

Any variation in output voltage is sensed by the 741C, which is operating as a differential amplifier, and fed back to the base of TR1. Thus VR1 is used to adjust the output voltage to 5 volts, by changing the voltage on the inverting input of the 741C.

Current limiting is provided by TR3 which prevents the voltage across R5 rising above approximately 0.6 volts. If 0.6 volts is reached, TR3 switches on causing the base of TR1 to go more positive and reducing the current through TR1 and TR2. C2 is intended to prevent very rapid switching of TR3.

The value chosen for R5 depends on the maximum current required, I_max. R5 = 0.6 / I_max. The power rating of R5 is > 0.6 x I_max Watts.

Protection For The Microcomputer
Some degree of protection is provided by the current limiting, but obviously this is not sufficient. We really want to be able to switch off completely at the first sign of danger, even though this means the loss of any information stored in RAM. (It hasn't happened to me yet!)

If the voltage across the base and emitter of TR4 exceeds 0.6 volts the transistor conducts, causing the SCR to "fire". This short-circuits the supply and blows the fuse with the aid of the stored charge in capacitor C1. Note that the short-circuit current is not passed through the stabilisation network. This would probably not be harmful provided the SCR is on a heat-sink and thick wires are used. I have experimented with short-circuiting the supply without doing any damage, but even so, my preference is to blow the fuse and have done with it. This device has the nickname "crow-bar" protection.

Spikes
Finally there is the problem of fluorescent lights being switched on sending high voltage spikes through the mains. I am told that these spikes glide through transformers like ghosts through walls, and pass over electrolytic capacitors without noticing them. This is the reason for C4 which is a polyester or polycarbonate capacitor and can therefore smooth out very rapid spikes.

Conclusion
This is a simple stabilised power supply using entirely standard techniques; yet it fulfils the requirements of a microcomputer, being reliable against failure, and safe against too high voltage and spikes. I have tested it for hours at 6 amps satisfactorily, and for several weeks continuously at 3½ amps without problems. I see no reason why it shouldn't work even higher currents, as the 3055 transistor can run at 15 amps and 115 watts. With a 12 volt transformer and proper heat-sink and wiring the circuit should be able to provide currents in excess of 10 amps.

The price of components etc is quite low compared with other power supplies, being only £12 plus transformer plus case. This includes a heat-sink, and a few other bits and pieces.

Construction is straightforward. I have made a printed circuit board, but other constructors will adopt their preferred techniques. Just one word of warning, though, you should be prepared to blow an awful lot of fuses before you connect up the power supply to any expensive equipment.
POWER SUPPLIES EXPLAINED

C.E. Collingham writes for the amateur who, with little knowledge of electronics, has built a piece of equipment and now needs a suitable power supply. Very often the PSU is lashed together as an afterthought. However if not properly designed, it can prevent a completed project from performing as it should.

In any power supply unit, the transformer is the device which enables an alternating voltage to be changed in level, either stepped up or down; this is the main reason for using A.C. for power distribution.

A simple transformer may be constructed by winding two coils on an iron core. An alternating supply is connected to the primary and this produces a corresponding magnetic flux, which is linked, via the core, to the secondary winding.

The voltage per turn induced in the secondary is very nearly the same as the voltage per turn of the primary. This means that if the primary has 10 times the number of turns, for 240V in, our transformer will produce 24V across the secondary.

As the losses are low, the output power is very nearly equal to input power; thus if the voltage has been reduced, the available output current has been proportionately increased. The rating of a transformer is given in volt amperes. The product of the secondary A.C. voltage and the secondary A.C. current. Providing the transformer is supplying a resistive load, then VA=Watts. Values of alternating current or voltage usually refer to its R.M.S. (root mean square) value. This is most simply stated as being the direct current or voltage which would produce the same heating effect.

For a sine wave, the peak value is 1.4 times its R.M.S.; the peak value of the 240V mains is therefore 336V.

Having produced an isolated low voltage supply which will deliver the necessary current, the next stage is to convert it to direct current. This is achieved by rectification — usually by the use of silicon diodes. A diode is simply a semiconductor device which will allow current to flow in one direction only.

By simply placing a diode in series with the secondary, the waveform shown in Fig. 1 is produced; this is known as raw D.C. Although the current now only flows in one direction, it’s not there all the time. A reservoir capacitor is therefore connected across the output (as shown) and when the top terminal of the transformer is more positive than the top of the capacitor, current will flow through the diode in the direction of its arrow — to charge the capacitor, as well as supplying current to the load. When the transformer voltage drops, the diode is “reverse biased” and the capacitor supplies current in to the load. Because the negative half cycle of the transformer’s output is not used, the half wave rectifier (as it’s known) is inefficient and rarely used for high power supplies.

If another similar secondary winding is added in series with the first, then with reference to their junction (or centre tap), for every output peak, one end will be positive. If a diode is connected from each end to the capacitor, it will be recharged twice as often, which means that the “ripple”, or the amount the output voltage drops between charges, is reduced. This arrangement produces full wave rectification.

It should be noted that the capacitor will be charged to the peak voltage appearing across each winding, which for a 12–0–12 transformer will be over 16V. The voltage rating of the capacitor should therefore be over 20V. During the time that the diode is turned off, the transformer output goes more negative than 0 V and this voltage appears in series with the capacitor voltage across the diode. A diode will only stand a certain reverse voltage (P.I.V.) — without breaking down. A device with a P.I.V. of at least 2.8 times the R.M.S. voltage is therefore required.

It’s possible to produce full wave rectification from one winding by using four diodes in a bridge arrangement. Bridge rectifiers are available and they consist of four diodes connected together and encapsulated in epoxy, which can be bolted directly on to a heatsink.

The circuit is shown in Fig. 2. At any one time only two diodes are conducting. If the top of the transformer is more positive than the bottom, current flows through D2, the load, and then D4 back to the transformer. If the bottom is more positive then current flows through D3, the load, then D1, current always passing through the load from top to bottom on every half cycle of the A.C. voltage. When in its forward biased (or conducting) state, a silicon diode will drop about 0.7V, which may need to be allowed for in low voltage supplies.

Another figure to take into account is the regulation of the transformer. This is the fluctuation in output voltage with varying load current. For small transformers it can be as high as 30% and since the secondary voltage is specified at full load current, with no load connected, the output voltage can be very much higher than expected. It’s therefore wise to be very generous with capacitor voltage ratings. They cause quite a mess when they explode!

This varying output voltage is of no use to most electronic equipment; a typical microprocessor for instance requires 5V ± 0.2V. Since the current taken by a microprocessor can vary considerably — particularly if L.E.D. displays are used — some form of voltage regulator must be included.

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regulators is the zener diode. This behaves as a normal silicon diode when forward biased, but when the voltage is reversed, it blocks current flow only until a certain voltage is reached, at which point the diode breaks down and current increases rapidly. Zener diodes are available in a wide range of voltages, from 2.7V to over 70V, and at power ratings from 400mW up to several Watts.

A zener diode and resistor can form a simple stabilizer, as shown in Fig. 3. If the input voltage increases, the zener draws more current, and a greater voltage is dropped across the series resistor. If the load current increases, the zener current reduces by the same amount. The voltage across the zener therefore remains constant. If the load is disconnected, the power it was consuming must be dissipated by the zener. This, coupled with the fact that the series resistor is wasteful of power, makes such a circuit suitable only for low power requirements.

For higher current supplies, the zener is used to stabilize the base voltage of a series pass transistor, the emitter voltage remaining 0.7V lower (for a silicon transistor). The base current required by the transistor will vary depending on the load current, but by a relatively small amount. The base feed resistor should be chosen to provide sufficient current to the transistor and at least 10mA through the zener.

The circuit shown in Fig 4 will provide a 5V supply from a 10V input. If the transistor has a gain of 50, then to supply 1A, the base current needs to be 20mA. A 5.6V zener is required and the resistor value is given by:

\[
\frac{V}{I} = \frac{10 - 5.6}{0.03} = 146 \text{ Ohms}
\]

and it needs to dissipate:

\[
V \times I = 4.4 \times 0.03 = 0.13 \text{W}
\]

A 150 Ohm 0.25W is the nearest preferred value.

Any NPN power transistor capable of passing the required current is suitable and should be mounted on a heatsink, as it has to dissipate 5W.

The disadvantage of this circuit is that if the output terminals are accidentally shorted together, the current will only be limited by the transformer, and a very high peak current will flow as the reservoir capacitor discharges. The whole of this power will be dissipated in the transistor — leading almost certainly to its rapid death. This could mean that when the short is removed, if the transistor has also gone short circuit, the full unregulated supply will appear at the output, resulting in the destruction of even more components.

A fuse may provide some protection, but in electronic terms, they can take considerable time to operate, and the damage may well have been done. A more sophisticated voltage regulator, which includes a current limit circuit, is shown in block form in Fig 5. This has a series resistor in the output lead. The voltage across this resistor is measured and if it exceeds a certain value, the output voltage is reduced and the power unit becomes a constant current supply. Also, because of the voltage drop across the resistor, the voltage at the output terminals is fed back to the regulator circuit to ensure that it remains constant with varying loads.

Needless to say, all of this circuitry and a bit more besides is available in I.C. form. The voltage regulator I.C. can be either the type which drives a series transistor, or one which may be used alone. These “three terminal” regulators are available in an ever increasing number of types, from 100mA to 5A, positive or negative, and with output voltages from 5V to 24V.

A popular type is the 7805. This will accept input voltages of between 7V and 25V and will deliver 5V at up to 1A. The regulator should be bolted on to a heatsink and the power supply case should be suitable; remember that the regulator’s common terminal is connected to its case. To reduce the heat dissipated by the regulator, the input voltage should be about 8V. In the event of the regulator getting too hot, it will reduce its output voltage. The pin connections and recommended circuit are shown in Fig. 6; note, the decoupling capacitors should be wired as close as possible to the regulator, otherwise high frequency oscillation may occur. This circuit applies to any of the 78 series, the last two digits specifying the output voltage; the input voltage should always be at least 2.5V above the output.
The 79 series is similar, except that these are negative voltage regulators; also two of the pin connections are reversed, as shown. For currents up to 100mA, the 78L and 79L types are suitable, the pin connections being as shown in Fig. 7. The same decoupling capacitors are recommended.

Although designed as fixed regulators, the output voltage can be increased by making the voltage on the common terminal higher than OV; this is done with the inclusion of a zener diode or variable resistor—as shown. In this instance the case of the regulator will not be at OV and may need to be insulated from the heatsink.

A better way of producing a variable supply is to use the LM317K variable regulator, which will supply up to 1.5A over a 1.2V—37V range. The circuit shown in Fig. 8 is for a 1.2V—25V supply, with thermal and short circuit protection.

All of these regulators are fairly widely available and a glance through the popular electronics magazines should find a supplier. To repeat, however, these regulators require about 2.5V across them to work, so you must make sure that the reservoir capacitor is large enough to prevent the input voltage dropping too low between peaks. About 2000uF per Amp is a good starting point.

Simple overvoltage protection can be added to a fixed regulator by the placing of a zener diode of slightly higher voltage across the output and a fuse on the input to the regulator. A 1W 5.6V zener is suitable for a 5V supply. If the voltage increases due to a regulator fault, the zener will hold the voltage at 5.6V, and draw enough current to blow the fuse. Alternatively, the zener can be included on the microprocessor board, where it will also protect against a reverse polarity supply, holding the voltage at 0.7V and preventing a very expensive mistake.

Having produced an accurately stabilized supply, there is no point connecting up your MPU with wire which is too thin. 0.1 Ohm in each supply lead will drop 0.4V at 2A, which could well be enough to stop the unit working, or worse still, cause erratic operation. Keep supply leads as short as possible, use heavy gauge wire, and check the voltage present at the I.C. pins on the unit being supplied.

On very heavy current supplies, a remote sense wire is used to measure the voltage at the board and this removes the effect of resistance in the supply leads or connectors. An alternative method of power distribution is to use a number of regulators, each supplying part of the system, and to feed unregulated 8V to each board, as in the ALTAIR 5—100 system.

In an article of this length, it's not possible to go into all aspects of power supply design. However, what I've said should be enough to enable you to avoid most of the pitfalls, and providing you can produce a reasonably smooth supply, a “three terminal” regulator will do the rest.
Each month Sheridan Williams and his panel of consultants answer readers questions. Topics may be hardware—from kits to mainframes, or software—from differential equations and statistics to file handling or sorting; the choice is yours. Send your questions direct to Sheridan Williams at 35 St Julians Road, St. Albans Herts.

The Terminal Question

I read somewhere that it's a good idea to use a microcomputer—such as the PET instead of a VDU when you are running a terminal. I am considering buying a four-user Cromemco System 3 with a 220x72 terminal. Would it be an advantage to use PETs instead of, say, Lear-Seigler Ace-3A VDUs, and would there be any interfacing problems with this setup?

H. Frost, Lewes

There are a number of good reasons for using a PET (or similar microcomputer) as a terminal to a mainframe. You might well already have a PET, and no VDU. Then, however, if the mainframe is in a time-sharing bureau you would need to add a serial interface unit to let you communicate with it over the telephone. This is likely to cost £180-£200. If a “mainframe” is local it might be possible to adapt the PET’s IEEE interface to work with it in “parallel” mode at less cost. This should certainly be the case if the mainframe is to a Hewlett-Packard bus, they developed the IEEE bus.

The second reason is related— you have neither a VDU, nor a microcomputer, but need both. Here buying a PET and a serial interface could save some £200-£400. Similar arguments apply to a TRS-80 or an Apple II, although the details and costs vary. A two way serial interface for an Apple, for example, takes the form of an internal card (at about £120), but the total cost will depend very much on the rest of the Apple configuration, or for that matter the model of PET you choose.

The third reason would apply were you planning to carry out off-line data preparation and storage. This will often be the case when using a time-sharing bureau, to save on their charges; or in a school or college, for the limited weekly access time to a central mainframe.

The fourth reason for using a microcomputer as a terminal is perhaps, the closest to your intended application: that is to gain the advantages of distributed processing. If your “mainframe” is swamped by the demands made on it, or has only limited capacity, or you wish for security reasons to remain operational if the mainframe is out of action, then it can make sense to have some processing ability in the terminal. Thus your own case the use of four 8K PETs would add 50% extra to the cost of the Cromemco. Unfortunately there are snags to such a scheme. The “diagram” of BASIC used by the PET is not directly compatible with that of the Cromemco; they couldn’t run the same programs.

You may use either REAL or INTEGER variables for y and a = u

There are other Hermetic effects and “rogue” data points in a multiple linear regression. To solve simultaneous equations in BASIC (or any other language) you will have to find books on the subject. I can recommend the most likely have “numerical methods” or “numerical analysis” in the title. Find the relevant chapter and look for Pivotal Condensation as perhaps the simplest method. I have sent you a copy of a program that fits functions of the form y=a.f(x)+b.g(x) to solve two equations is not too difficult. A least squares fit to this function is achieved as follows:

1. First I wonder why you are using this particular function; do you know that it’s representative of your particular set of data? I would suggest that you look for Pivotal Condensation methods” or “numerical analysis” in the actual handling of text, so you should have no problem reading in and designing the layout of your output documents; provided that you master the FORMAT statement. Where you may have difficulty is in the actual handling of text, during the processing. There are differences between versions of Portran so I’ll only make general and common to all the variations. You may use either REAL or INTEGER variables for

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a y f(x),f(x) + b z g(x),g(x) = y f(x), g(x) + b y g(x),g(x) = y g(x)

If you let a = Σ f(x) and v = Σ f(x), and w = Σ g(x) and z = Σ g(x), then:

b v = u - w

To solve simultaneous differential equations in BASIC (or any other language) you will have to find books on the subject. I can recommend the most likely have “numerical methods” or “numerical analysis” in the title. Find the relevant chapter and look for Pivotal Condensation as perhaps the simplest method. I have sent you a copy of a program that fits functions of the form y = a.f(x) + b.g(x) to solve two equations is not too difficult. A least squares fit to this function is achieved as follows:

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If you let a = Σ f(x) and v = Σ f(x), and w = Σ g(x) and z = Σ g(x), then:

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More On Maths

I was very interested in the reply in the March issue to T. Williams on the maths behind curve fitting programs. In my work I use a least-squares fit program to fit an equation of the form y=ln(x)+c. My existing program is not entirely satisfactory because if one data pair does not fit the line when entered in conjunction with statistically reliable data pairs, it unduly affects the result, producing a poor correlation coefficient. How would you approach the problem, and how do you write a program to solve simultaneous equations in BASIC?

P. Callow, Sunbury-on-Thames

Firstly I wonder why you are using this particular function; do you know that it’s representative of your particular set of data? I would suggest that you look for Pivotal Condensation methods” or “numerical analysis” in the actual handling of text, so you should have no problem reading in and designing the layout of your output documents; provided that you master the FORMAT statement. Where you may have difficulty is in the actual handling of text, during the processing. There are differences between versions of Portran so I’ll only make general and common to all the variations. You may use either REAL or INTEGER variables for

Fortran Only

I can program in BASIC but only have access to a computer that uses Portran. Can you foresee any problems that I may encounter when writing data processing programs in this language?

D. Simpson, Birmingham

I find it hard to believe that there is not a book available on any computer system. Anyway, that said the language has some excellent input and output formatting procedures so you should have no problem reading in data and designing the layout of your output documents; provided that you master the FORMAT statement. Where you may have difficulty is in the actual handling of text, during the processing. There are differences between versions of Portran so I’ll only make general and common to all the variations. You may use either REAL or INTEGER variables for

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Q

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COMPUTER ANSWERS
storing strings but each variable can only hold 8 characters; by using an array TEXT you can store strings of any length — e.g. if the array variable TEXT(3) has the value 80PCW then you will be able to hold up to 8x3 = 24 characters in it. By using the statement WRITE(I(m),n),TEXT(I(m)) and the IF (A.EQ.B) you get any text re-output. (Note that there is a problem with the use of BAS and A24.) The next problem will be the comparison and the sorting of these strings. These must be done using the Portran utilities COMP, COPY, ICON and not by the usual methods. For example if variable A contains the word FRED and variable B contains the word BERT you will probably get an error if you try and compare them using IF(A.EQ.B); the reason will only be apparent if you are aware of the strange way in which text is stored. You'll have to compare them with COMP (8,1,B). You will need a manual should give all the details that you'll need when using these.

The next problems will occur in filing. If you have extended Fortran this supports direct access files, whereas ordinary Fortran needs extra utilities. Look up the procedures for Access and you can store package if you need it.

If, however, you're not using direct files this will not be relevant.

I'm afraid there's all that I can say in what must of necessity be a very brief reply; needless to say, write directly to me if you require any more details.

SW

The Soft Sell

My friend and I have written a number of programs for the Commodore PET. They are mainly games and almost all are intended for home entertainment. We would like to send them to a software firm for sale. No one I know has any experience in this matter, so I would like to know what kind of programs these firms are looking for, what standard they require, and how much they will pay.

R.J.Lewis, Winchester

Many software suppliers rely on people like you to provide a constant supply of programs. Programmers are expensive commodities, and very few suppliers can afford more than one or two. Programs can be grouped in the following categories: games, business, scientific, educational, and systems software. There are basic types with which you can sell your programs, and the price they command will depend very much on their type. You'll find that the financial return for writing educational pro-

grams is virtually non-existent, although good ones are much in demand. Games seem to be quite a money-spinner, however, and they have to be well conceived and original. Another contributory factor will be the equipment on which the programs run; the more popular the machine the better your return. Finally you can of course only sell a program if they pay you 25% of the price they will sell it for. R.J. Lewis, Winchester

One of BASIC's many failings is the formatting of output. Perhaps the language's most frustrating feature is that all numbers are printed in left-justified form; almost certainly this is not what we require. There are BASICs that have the instruction PRINT USING. This allows a comprehensive reformatting, but unless you are able to buy this version for your machine (Rightcom's Machine's 380Z will accept it for example) you are stuck with this problem. Incidentally if you have a PET printer this allows formatting of printout, not the screen display.

I've seen several solutions to this problem, all of which use a subroutine to do the formatting for you. I devised the following solution which should prove instructive to those of you who have never seen this technique used before:

DEF FNA(X) = 1 - LEN(STR$(X))

To implement this function and produce an output justified in the Yth position use PRINT TAB(Y+FNA(X));X.

Probably of more use is a function that will allow you to align the decimal points, indeed it may also introduce a technique that's new to some of you:

DEF FNA(X) = -LEN(STR$(INT(X)))-ABS(X)(1)+(X=0)

Implementing this function is the same as aligning the decimal points in the Yth position use PRINT TAB(Y+FNA(X));X.

This latter function may require tailoring because some versions of BASIC implement logic in different ways to others. The function will work unaltered if you get the answer (one to the statement PRINT (2+2). If you get the answer (1) then you will have to modify it:

DEF FNA(X) = -LEN(STR$(I NT(X)))-(ABS(X)(1)+X)=0

I'm sure that you will get many hours of pleasure (frustration?) out of untangling this function so I'll not explain how or why it works. If you do have any problems you are welcome to come to me direct (enclosing a stamped envelope, please). SW

Pros And Cons

I am a complete novice in the field of computers, but I am determined to master the art of programming. I attended a City & Guilds course and may go further and do an H.N.C. at present I have the use of a TRS-80 once a week, but would very much like my own microcomputer and would be prepared to pull out up to £520. The machine would be used purely for learning purposes and so far I have considered the TRS-80 PET, and the SHARP MZ-80K.

I would be grateful for a list of advantages and disadvantages to enable me to make a rational decision. J. Allen, Dagenham

There are other machines that can be considered in a similar price range, although some of them are above your limit of £520 I'll still include them for the benefit of others. Apple, ITT, Exidy Sorcerer, Texas TI-99/4, Video Genie, Luxor ABC680 etc, all are under £1000.

Even though you say you would use this machine purely for learning purposes, I maintain that it's still a good idea to consider other factors from the outset; you don't want to have to change system through lack of foresight. For this reason it would be best to spend some time in discussion of your future plans. Let's assume you're going to buy an H.N.C.; it would certainly make it necessary to buy an H.N.C. machine that offers easy assembly language programming. Some other factors that you ought to have right away when you visit a supplier are price, expandability in both peripherals and extra memory (RAM); reliability; availability of software — both applications software and systems software; disc capacities; extra features, real time clocks; audio output; and ease of assembler programming.

I telephoned a variety of suppliers all over the country asking questions similar to those listed above; first I echo their answers and second give my comments.

Sharp: a good machine for the hobbyist/beginner, has BASIC loaded from cassette; has a long guarantee; memory expansion is cheap; has audio output, and is more reliable than the PET. Apple/ITT: has high-resolution colour graphics; makes an ideal business machine; is very expandable; more expensive than the PET/Tandy. PET: best value for money; range of software available; BASIC in ROM is an advantage; reasonably good graphics; uses Computhink disk drives for very good business system. Sorcerer: has the advantage of ROM pack facility; has BASIC not quite as good as other machines; high reliance on others. A machine with user defined characters is a good feature.

TRS-80: a good machine, with a good keyboard and many hours of pleasure (frustration?) out of untangling this function so I'll not explain how or why it works. If you do have any problems you are welcome to come to me direct (enclosing a stamped envelope, please). SW

My View: As you can see, a lot of the above statements are contradictory: for example BASIC and cassette BASIC could both be claimed as being an advantage and disadvantage, depending very much on how you look at it. Perhaps the best
point made is the availability of software for both systems and applications (interpreters, compilers, operating systems are examples of systems software). There'll obviously be far more for machines like the PET/Tandy/Apple than there will be for the recent ones like the Sharp. I'm afraid that the exact choice of machine will be largely up to you. Don't however, be too apprehensive as there's quite a large second-hand market for micros and I doubt there'll be any difficulty selling again in a year, should you decide that you want to change machines. I hope all this has helped rather than confused you!

SW

Speaking Recursively

I saw in a computer exam paper the following statement: "Three people were having an argument about programming the factorial function; one said 'I propose to use a loop to evaluate it', the second person said 'I will use a look-up table approach', the third said 'I propose to use a recursive technique.'" Now I can understand the first two methods but what about the third? It is in effect just a loop. Here the definition - is it a letter (a variable) or (a variable followed by a letter) or (a variable followed by a digit). Thus all variables are defined. Follow the loop through as follows: T3R is a variable if it is a letter... it is not: it is a variable if it is a variable followed by a letter, well R is a letter, and provided that T3 is a variable then T3R is: now is T3 a variable? Well look back at the definition - is it a letter followed by a digit? Yes, The Then T3 is a variable, and so too must T3R.

To read the above sentence take careful note of my punctuation, and provided there are no transcription errors in going to press then all should be clear!

Back now to factorials, we can define them recursively as:

\[ n! = \begin{cases} 1 & \text{if } n = 1 \\ n 
\times (n-1)! & \text{if } n > 1 \end{cases} \]

This is known as Backus-Naur notation and it's designed to specify the syntax of a language. The above definition reads: "A variable is defined as (a letter) or (a variable followed by a letter) or (a variable followed by a digit)."

Unfortunately some second-hand market for micros and I doubt there'll be any difficulty selling again in a year, should you decide that you want to change machines. I hope all this has helped rather than confused you!

SW

ACULAB

> ACULAB 735, a fully self-contained interface for IBM 735 output typewriters

The ACULAB 735P INTERFACE is a self-contained controller for IBM 1/0 typewriters and printers. The 735P accepts standard 7-bit parallel ASCII data and provides all of the handshake protocols, code conversion and solenoid voltages to run the printer at full speed using any correspondence or ASCII golfball quality printing at 15 char/sec

.. £195.00 + VAT

The TRS-1 PARALLEL PORT DECODER plugs into the bus connector on the TRS-80 keyboard and decodes the port used by the ELECTRIC PENCIL and the LPRINT and LLIST commands in TRS-80 BASIC.

.. £55.00 + VAT

The IEEE TO PARALLEL PORT CONVERTER plugs onto the PET IEEE bus connector and converts it into a parallel printer port. It also converts PET's unique version of ASCII to standard ASCII and provides a switch to give UC/LC compatibility with the new PET

.. £45.00 + VAT

The ADDRESSABLE IEEE PARALLEL PORT DECODER has all of the features of the converter but may be set to answer to any of the available addresses on the PET IEEE bus and so be used along with the PET disc or any other bus compatible device.

.. £66.00 + VAT

These last three devices are all fitted with 2 metres of heavy-weight cable and a metal shrouded Centronics compatible connector.

ACULAB Ltd

For further information
Telephone: 0525-371939.
HB offer their customers good credit facilities both through Access or Barclay cards. Any further enquiries regarding finance should be addressed to HB Computers.

HB Get In On The ACT

HB have been appointed Regional Distributors for the recently launched ACT 800 series, which made its debut at the Kettering exhibition. The ACT 800 series is one of the second generation of microcomputers, a compact, yet very powerful and complex computer. The model has great versatility and has a great ability to handle sales, purchase ledger, integrated invoicing and payroll. ACT Systems are available from £3,950.

SHARP Computer
A personal computer that opens the world of programming to your own fresh ideas!

CRT Display
This unit is equipped with a 25 cm (10") monochrome CRT for up to 1,000 letters + 95 user defined symbols. The console also displays messages, prompting the user when watching the operation of the program.

A Technical Masterpiece
A personal computer that makes full use of the power of the 8-bit microprocessor, SHARP's most advanced microcomputer, the 8088. The SHARP MZ-80K uses BASIC, a language that provides easy programming even to those totally unfamiliar with computer operation.

SHARP MZ80K SOFTWARE

<table>
<thead>
<tr>
<th>SOFTWARE</th>
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<tr>
<td>BREAKOUT</td>
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<tr>
<td>SUPER SIMON</td>
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<td>MIZ-MAZE</td>
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HB COMPUTERS LTD
22 NEWLAND STREET, KETTERING, NORTHANTS.
Tel. (0536) 83922 & 5209110 Telex 341297
versions of BASIC do but you will need the ability to define a multiple line function - which is something that not many BASICs allow. Here are two functions for factorial, the first is non recursive and the second is; they were both written for Research Machine's SMS2 XDB BASIC and will probably need changing slightly, even if you have multi-line defined functions. FNEND V returns the value V as the result of the function.

Non recursive function
DEF FNB(X)
V=1
FOR J=1 TO X
V=V*J
NEXT J
FNEND V

Recursive function
DEF FNF(X)
IF X=0 THEN 50
V=X*FNF(X−1)
GOTO 60
50 V=1
60 FNEND V

I hope this has helped ... on the other hand, maybe you wish you hadn't asked!

Cramming
The PET
I am currently attempting to speed up some of my programs by writing some of the subroutines in machine code. The machine in question is a 32K PET. I would like to know if I can put a couple of RAMs into the two spare sockets inside the PET - and if so what RAMs to use.

R.H. Jones, East Tilbury

The spare sockets inside your PET are intended for additional Read Only Memories (ROMs), such as the "Toolkit", and the security ROMs for Commodore software ... RAMs will not fit if you have not used up every single byte of your 32K of memory then you can bring in some of this.

There are two normal ways of going about it:
1. If the routines are short then they can be loaded into the second cassette buffer. This is an area of 192 bytes (starting at location 826) reserved for data transfer between the PET and a second cassette drive. If this isn't going to be used, then BASIC will not cause any disturbance. The simplest way to load a machine code program into the buffer is to create a set of DATA statements; read these and POKE the values into the buffer locations. If the first cassette is not going to be used while the program is running, its buffer could be filled with machine code. The BASIC INPUT buffer is also available at program execution time.
2. An alternative for larger programs is to use the top end of the memory; an area can be partitioned off which BASIC will then avoid. When the PET is switched on, it searches through the memory to find the highest location it can use — in your case 32K if everything is working fine. It then sets pointers to this address so that BASIC will store strings, working downwards from that address. If the pointers are reset to a lower value then the PET is fooled into thinking that less memory is available. The pointers concerned are at the following locations: 48, 49 start of strings 50, 51 top of string storage 52, 53 highest memory address For example POKEing 49 and 51 and 53 with 88 will reserve an area of 10240 byte bytes for machine code programs, or complex data structures.

These machine code programs may be built up using proprietary assemblers — which are generally fairly good, if rather slow. The programs can then be saved as DATA statements, or in the absolute locations using TIM.

If you are determined to have some more memory then the only alternative is to make up a printed circuit board which will link to the memory expansion connector. In the standard PET 12K of memory space is unallocated, starting a location A000H, and the higher address lines are decoded and brought to the expansion connector as 4K block selects. A memory board would be a relatively simple affair consisting of an array of 4K or 16K, static or dynamic memory chips. This should be fairly easy to construct, although not a recommended project for a beginner.

If you are really adventurous and confident in your software you can copy your machine code routines on to a Programmable Read Only Memory (PROM) which will plug into the spare sockets. This will become a permanent feature, and you could make some money!

Mark Watten

Baffled
I have been reading PCW for some time now. Unfortunately I find most of the articles unreadable, the reason being I don’t understand much of what is being said (what in Pascal’s name is an S100 bus?) So

Continued on page 111
CHAPTER 10: THE FINISHING TOUCHES

This chapter completes the description of the main features of PASCAL and provides some quick reference material for program developers.

We started the series by looking at programming languages in a general sense — from low level languages (which are close to the machine) to high level languages (which are close to the programmer's mode of thought); from highly specialized languages constructed for particular machines or applications to general purpose languages designed to adapt to a variety of environments; and even languages offering easy access to general purpose languages designed for particular machines or applications versus highly specialized languages constructed for particular machines or applications.

Among the features missing in the definition of Standard PASCAL are dynamic allocation of arrays (useful for general purpose matrix handling procedures), random access files, concurrent control structures (to allow two or more processes to be executed simultaneously), the capability to attach a set of operators to newly defined data structures, restrictions on placement of declarations and the absence of a loop with the exit in the middle. Probably any scientific programmer would do without variant records in order to get dynamic arrays, while the commercial programmer is unlikely to think of PASCAL as a serious alternative if it doesn't have random access files.

At the cost of these more unusual general-purpose features and with a certain spirit of compromise, PASCAL succeeds in being reasonably frugal in terms of overheads when compared with other structured languages. To some mainframe programmers these concessions place PASCAL in the lightweight category in the language stakes but it is just these features which make PASCAL so suitable for implementation on microcomputers and thus worthy of our consideration here.

The major method employed by the designers of PASCAL to achieve this machine efficiency has been through a very tightly written compiler; throughout this series we have been striving to help the reader develop an appreciation for (and relationship with) this compiler. In order to help implementers produce standard compilers rapidly, Wirth's team wrote and made freely available three compilers (written mostly in PASCAL) for PASCAL. The first is an officially recognized subset of PASCAL called PASCAL S, the second is for standard PASCAL while the third is for an extended version of the language. The standard compiler generates a pseudo machine code called P-code which can be translated into machine code with much less effort than PASCAL.

Wirth's syntax diagrams are a visual representation of the manner in which a compiler tackles source code, and can thus be used as an aid to minimize syntactic error. Therefore the syntax diagram in Box 1 is a means of expressing what the compiler expects to see and therefore reflects the way code is actually laid out in the machine at compile time. In contrast the flow diagram in Box 2 is a way of showing how program control will move (i.e. which code will be executed) at run time. PASCAL usually allows for the production of sufficiently descriptive source code as to make a visual representation of the program flow unnecessary.
One device that Wirth adopts to reduce overheads is the "help" that the compiler requires of the user. Thus the declaration of all the variable names and data types before the action part of any procedure begins makes it much easier for the compiler to allocate the working space for that procedure and at the same time makes a clear distinction between the data and the algorithmic portions of the procedure. Similarly, the existence of reserved words cuts the work of the compiler considerably at the expense of a small degree of flexibility in the selection of variable names.

The GOTO Statement

A GOTO statement is an instruction which transfers controls from the current position to another specified point in the program. This is a simple device which is essential in many programming languages although it does tend to break up the flow of control and make it more difficult to follow. Since structured languages have been designed to provide readable source code and since too they are so highly endowed with smooth methods of redirecting the flow of control (using loops and branches), the use of the GOTO statement is not generally necessary and is never encouraged. Nevertheless, circumstances can occur, particularly in dealing with error conditions, where the GOTO statement is the most effective alternative and so it is presented here for the sake of completeness.

In PASCAL the GOTO reserved word is followed by an unsigned integer called a label. On execution, control will shift to the statement to which the same unsigned integer refers (see Box 3). Of course, each label used must be declared in the declaration part of the procedure so that the compiler can cope with the sudden shifts in control. Each label can only be used once in the block in which it is declared although it can be referenced by any number of GOTO statements from anywhere within the block. If one procedure is nested within another it is incorrect to jump into the inside procedure, since it takes a procedure call to set up the stack frame and pass parameters etc. It is however possible to jump out of the inside procedure although it is bad practice to leave a procedure from two different points; the exiting GOTO statement should be as close to the procedure END as possible.

In fact UCSD does not allow any movement between procedures via the GOTO statement at all, and there is even a switch to disable the statement completely. i.e. the compiler will flag a GOTO as an error. This is done to discourage student users from producing inadequately planned programs where the GOTO is used to escape from the deadends into which they program themselves.

---

Box 3: GOTO Statement declaration

```
conception
```

Box 4: GOTO Statement declaration

```
The GOTO Statement declaration

```

PROGRAM READINTEGER;
  CONST INTSIZE = 5;
  TYPE SHORTSTRING = ARRAY [0..9] OF CHAR;
  DIGIT = 0..9;
  VAR TEMPNO, NUMBAS: SHORTSTRING;
  I: DIGIT;
  NEWNUM: = -1..9;
  NUMBER: = INTEGER;
  WRONG: = BOOLEAN;
  PROCEDURE INITIALISE;
  VAR I: DIGIT;
  BEGIN
    ICHR: = '0'..'9';
    BEGIN
      ICHR := '0';
      FOR I := 0 TO 9 DO
        BEGIN
          NUMBAS[I] := ICHR;
          TEMPNO[I] := '';
          IF ICHR < '9' THEN ICHR := Succ(ICHRS)
        END;
    END: (=INITIALISE)
    PROCEDURE GETNUMBA;
    BEGIN
      WRITE ('NOW TYPE IN YOUR INTEGER PLEASE--> ') ;
      I := 0;
      REPEAT
        READ(TEMPNO[I])
        I := I + 1
        UNTIL EOLN OR (I=INTSIZE)
    END: (=GETNUMBA)
    PROCEDURE TESTD I G I T:
    BEGIN
      FOR J := 0 TO 9 DO
        IF TEMPNO[J] = NUMBAS[J]
        THEN NEWNUM := J
    END: (=TESTDIGIT)
    BEGIN (MAIN PROGRAM)
    INITIALISE;
    BEGIN
      NUMBER := 0;
      WRONG := FALSE;
      GETNUMBA;
      I := 0;
      WHILE TEMPNO[I] <> ' ' DO
        BEGIN
          NEWNUM := -1;
          TESTDIGIT;
          IF NEWNUM = -1
          THEN WRONG := TRUE
          ELSE NUMBER := 10*NUMBER + NEWNUM;
          I := I + 1;
        END:
        IF WRONG THEN WRITELN ('TRY AGAIN')
        UNTIL NOT WRONG
      END.
```

PCW 85
Procedures As Parameters

PASCAL provides one facility which can be extremely useful to programmers who may need to manipulate mathematical functions. Instead of passing an array of values to a procedure which is to perform some particular operation on this data, PASCAL allows the use of a function identifier as a value parameter in the argument list. This is clearly more efficient provided that the results of the evaluation of the function in question are not required at other points in the program.

The best illustration of this technique is probably a graph plotting routine which plots out a set of y versus x values. One method of achieving this is for one process to pass an array of x and y values to the routine which then simply plots them out. Consider, however the procedure call

PROCEDURE PLOTCRAPH
  (FUNCTION FUNC : REAL ; XDOM, XMIN, XORIGIN, YORIGIN : REAL ; POINTS : INTEGER);
for plotting Y-FUNC(X) versus X over the domain XMIN to XMIN+XDOM with the axes crossing at (XORIGIN, YORIGIN) and with checks made for asymptotes etc. Then the calls

PLOTCRAPH(SIN,1.0,0.0,100) and
PLOTCRAPH(BESSELJ1,10.0,0.0,50)

will produce the corresponding graphs (provided the Bessel function is defined).

Finale

This section concludes the PASCAL series. Below is a brief summary of the topics covered in each chapter.


It would be arrogant to pretend that we have not learned a great deal about PASCAL in preparing our ideas and programs for publication. We would like to wish our readers happy programming; may all their loops terminate! The chapter concludes with a super Look Up Table.

Reserved Words

AND ARRAY BEGIN
CASE CONST DIV
END FILE FOR
FORWARD FUNCTION GOTO
IF IN LABEL
MOD NIL NOT
OF OR PACKED
PROCEDURE PROGRAM RECORD
REPEAT SET THEN
TO TYPE UNTIL
VAR WHILE WITH

Standard Procedures

Arithmetic Functions

ABS (x) ARCTAN (x)
COS (x) EXP (x)
LN (x) SIN (x)
SQR (x) SQRT (x)

Boolean Functions

EOF (f) EOLN (f)
ODD (x)

Data Manipulation

CHR (x) ORD (x)
PRED (x) ROUND (x)
SUCC (x) TRUNC (x)

File Handling

GET (f) PUT (f)
RESET (f) REWRITE (f)
READ (f,x) READLN (f,x)
WRITE (f,x) WIREDLN (f,x)

Others

NEW (x) DISPOSE (x)
PACK UNPACK

f = filename, x = identifier
Every year almost without fail most small business accounting systems meet their Waterloo — The Auditor. This month we are going to be looking at integrated accounts systems in the hope of finding a fairly painless answer to this thorny annual.

Objectives
Both the objectives and functional requirements of an integrated accounts package will vary according to the bias of your business — it's a case of "if the cap fits, wear it". If, for instance, you are a manufacturer with a limited product range and a small customer list but are supplied by a large number of sub-contractors or manufacturers, the financial control of your business will rest primarily on the ability to control your stock and purchase ledger. If, on the other hand you have a business which is of the agency type — where you are likely to have a large number of customers with a small supplier list and limited, if any, stock holding capability — then your main interest will probably be in the control of your sales and nominal ledger.

Now having stated the obvious, i.e. that businesses differ, what else can vary our choice of integrated package? Well, one consideration is the implementation timescale. Many companies don't want to install a complete system all in one go; they would prefer to implement one business function at a time.

The concern therefore is not to completely satisfy the needs of the priority function but rather to ensure that when all the proposed functions have been computerised, there are no loose ends or unexpected additional workloads. You may therefore choose an integrated package, or part of one, simply because the final system will meet the majority of your needs. This may be despite the fact that the needs of each individual function could have been better served by a stand alone package.

Tasks and volumes
Bearing this in mind I've simplified the grid this month to allow you to see with ease which packages fulfill the functions most necessary to your business. With the exception of Nominal Ledger the other aspects have been reviewed in previous months. (Stock Control — December 1979, Sales Ledger — January 1980, Purchase Ledger — February 1980, and Payroll — March 1980.) I've therefore, included a fairly extensive checklist for Nominal Ledger while briefly describing the other functions.

Evaluations
INTEGRATED INVOICING SYSTEM
This system is available from Newtons Laboratories, London (01-870 4248)
who wrote the programs, Microsolve, and Leatherhead Business Systems. The cost is split over the system — Order Processing/Stock Control £1600, Sales Ledger £1100, Gross Nominal Ledger £800, Nominal Ledger — £800 and the system is designed to run on a 64K Alpha Micro with 2.4Mbyte disc storage and a printer at an approximate cost of £850. This configuration can be expanded up to 768K at a cost of around £40000. Newton Laboratories provide full installation services and training and are very willing to "be on call" if necessary. They will make a quick application feasibility study after installation for no charge and say that their software is guaranteed for an unlimited period.

The system is supplied on disc and comes complete with fully comprehensive manuals, but I feel that training would be necessary as these appear a little large for the digestion. There are over 200 programs in the system, written in BASIC and assembler. Newtons Laboratories will provide customisation but at a cost. They estimate that customisation already undertaken has cost, on average, between £1000 — £1500. The system has been available since November last year and there are about 8 users at present.

SNIP
This package, which is available from Benchmark Computer Systems, St. Austell (0726 6100), was first reviewed in the Purchase Ledger “Systems” in February of this year. The package costs £950 and there have been no significant changes in any of the details with the exception that the system is now available for the Spectrum Z811Mbyte hard disc; full details can be obtained from Benchmark direct.

MCBS
The Micropower Complete Business System can be obtained exclusively from Micropower Ltd., Basingstoke (0256 54121). This is a complete system inclusive of hardware and software and is available on both floppy and hard disc. The floppy disc based system consists of VDU, twin floppy discs and matrix printer contained in a desk. With full software, including Order Processing and Payroll, it costs £9875 and a similar system based on hard disc is priced at £15995. Micropower includes all manuals, training and installation costs in these prices. Hardware maintenance is provided on a contracted out basis and software maintenance is provided at a cost of approximately £680 per year. The Micropower offers full back-up and is always happy to answer any telephone queries. All users are informed of any updates and if those are a software maintenance contract are updated free of charge. Some customisation is included in the price i.e. allowing for a company to use its present stationery.

Systems
MCBS is designed to run on a 48K processor with twin disc drives, VDU and printer with either CP/M or CDOS operating system at a cost of around £3500. Great Northern also have a Micropower Client Billing package which can be used instead of the Sales Ledger pack, giving comprehensive coverage for solicitors etc. This costs £495 and is fully integrated with the Nominal and Purchase Ledger packs (see PCW February 1980).

COMAC
Unfortunately I don’t have enough information to include this package in this review, but the details are available: COMAC is said to be an accounting software suite of programs produced in one package for the Commodore 64 computers. The basic system consists of Sales, Purchase and Nominal Ledgers — costing £1000; 2. The basic system with the addition of Invoicing at £1100; 3. The basic system plus Stock and Order Control designed with the wholesaler in mind, at between £2000 and £2500 (depending on the amount of customisation required); and, lastly, 4. The basic system and Stock Control for retailers at £1800—£2000, again depending on the amount of customisation.

This system can be obtained from Logma Systems Design of Bolton (0204 389854) or their dealers in Bolton, Stockport, Liverpool, Wigan and London — just phone Logma for details.

They’ve recently re-vamped the documentation and feel that it is now greatly improved. The price of the basic hardware has risen to £2800 but apart from these changes all other details are the same. (see PCW January 1980).

BUSINESS PROGRAM VERSION 4
This package can be obtained from G. W. Computers Ltd, London (01-636 8210) and its small number of dealers. The package is written in BASIC and supplied on disc. Included is a 30 page manual which at present is being updated. It’s designed to run on a 32K floppy disc system with printer, at an approximate cost of £2200. G.W. Computers will provide on site installation services for two days at no extra charge and will give initial training during this time. They offer a 90 day warranty and will replace any faulty disc in this time. G.W. Computers will make minor changes to allow for customisation, at no extra charge. The package has been available for 2 years and there are 170 users spread over Britain, America and the Continent.

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They’ve recently re-vamped the documentation and feel that it is now greatly improved. The price of the basic hardware has risen to £2800 but apart from these changes all other details are the same. (see PCW January 1980).

BUSINESS PROGRAM VERSION 4
This package can be obtained from G. W. Computers Ltd, London (01-636 8210) and its small number of dealers. The package is written in BASIC and supplied on disc. Included is a 30 page manual which at present is being updated. It’s designed to run on a 32K floppy disc system with printer, at an approximate cost of £2200. G.W. Computers will provide on site installation services for two days at no extra charge and will give initial training during this time. They offer a 90 day warranty and will replace any faulty disc in this time. G.W. Computers will make minor changes to allow for customisation, at no extra charge. The package has been available for 2 years and there are 170 users spread over Britain, America and the Continent.

COMAC
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Thomas Murphy gives his personal impressions of a device that looks set to radicalize the concept of information storage for the small computer enthusiast.

Whilst waiting for my SWTPC 6800 to load 8K BASIC via its 300 baud cassette interface (some 14+ minutes worth), I happened to browse through an American computer magazine and spotted an advertisement by the Exatron Corporation for their Stringy Floppy; it was claimed that the combination gave: (a) economy of tape, with (b) the speed and reliability of discs. Apparently, this system reads and writes at 14,400 bits per second, with a typical error rate of 1 in 100,000,000 bits. They also claim an average life of over 3500 hours for the transport mechanism, and a tape wafer life of 2500 passes.

My BASIC was barely half loaded, so I filled in the time by writing to them at: 3557 Ryder Street, Santa Clara, California 95051, USA. I explained that I had a UK credit card which bore the “Master-charge” symbol, and was VERY interested in their system for my SWTPC computer. Less than two weeks later a large envelope arrived, containing total system information and advising that payment could be made by the indicated method.

Could all the claims contained within this information package be true at such an attractive price? Well, one way to find out was to place an order — which I duly did — for one drive mechanism and a controller card, with TSC BASIC as an extra piece of software. I felt I couldn’t lose. With a 30 day money back guarantee, all it would cost would be postage and packing charges should the equipment not perform as advertised.

Five weeks later, the parcel arrived, containing all I had ordered, plus a couple of spare tape wafers, and two guaranteed system master wafers. I settled into my favourite armchair to study the large owners’ manual (which, amongst other things, tells you that Exatron’s logo, of an E inside another E, stands for excellence in electronics). It proved very comprehensive, and surprise number one, the systems wafer contains SWTPC’s Disc BASIC — as well as the ordered TSC BASIC.

The manual also contains a system description, system requirements, installation and checkout procedure (which includes trouble-shooting procedures for both the controller and transport), circuit and block diagrams of both controller and transport electronics, a general guide to system operation, and a detailed overview of each utility program on the systems wafer.

These programs are: APPEND, ASSIGN, CATALOGUE, COPY, DATE, DELETE, LIST, NEWTAPE, PRINT (which causes the file to be output to the printer on PORT 7 instead of the VDU), RENAME, SAVE, SAVE LOW, TTYSET (with which one can change the input and output parameters to the terminal), and VERSION. There is no LOAD, as you call a file by giving file details — e.g. 1. STARTREK.HEX will load STARTREK from drive number one.

The manual also contains an ERROR LIST for the system, plus the manufacturer’s User’s Manual for SWTPC Disc BASIC, plus any optional software ordered.

After reading the manual twice, I installed the controller on the motherboard, plugged in the transport, switched on and typed Z which on my monitor executes a jump to $C000. The transport started running, stopped, and instead of outputting “Simplex -68 Version X.X” as called for in the manual, my micro returned to its reset state. Oh well, back to the drawing board. I re-read the manual. Finding there was nothing that I had done wrongly, I typed Z again. Same result, back to monitor.

OK, call up the heavy artillery ... out with the oscilloscope. I went through the troubleshooting part of the manual with probe in hand. Everything checked
out, so I should have had a plus and minus 25% speed variation on the drive. I tried again, but with the same result.

Sending it back seemed the only solution — and in the course of unplugging the drive, the ribbon cable came away instead of the plug! In my excitement (it was 3 am) I think I reconnected it back to front, because on the next try, although the drive motor came on, it wouldn’t even switch off and go back to monitor.

I parcelled it all up and returned it for inspection/repair with a letter explaining how I thought I had abused it. I also ordered the second drive unit at the same time; now I had the owners’ manual I could see the versatility offered by having two drives instead of one.

The manual says that Exatron will repair “within 30 days”, so allowing for an eight week wait.

Surprise number two: 23 days later my system reappeared, complete with the second drive as ordered, a couple more spare wafers, and yet another very pleasant surprise — the repair charge was NIL. That’s right, absolutely NO CHARGE, although I know there were some chips burnt as a result of my tiredness (carelessness).

As I now knew the owners’ manual almost by heart, I installed the system in the micro, connected up, inserted a wafer in each drive, and typed Z. The drives switched on consecutively, and up came “SIMPLEX — 68 Version 1.0” on the VDU.

It took a few moments of gloating to realise that I had around 80K (well, two identical lots of 40K) of software just waiting to be called up. Just think, though, no worry about volume control, tone control, different cassettes, each with two sides, or, where on tape was the wanted file... just call for what you want. MAGICAL.

I typed CAT,0,1 and 30 seconds later I had seen, on my VDU, the directory of both drives.

Before you can WRITE a file, you must use the NEWTAPE facility, so this I now did, and after the prompt “SCRATCH TAPE IN DRIVE 1” was answered with a “Y”, (after replacing the backup system master wafer with a new 50 foot wafer in drive 1) the drive started up, stopped, and the message “FORMATTING COMPLETE - 318 SECTORS FREE” came up. Each sector holds 256 bytes, so my newly formatted wafer would hold 79.5 Kbytes.

I decided to transfer my BASIC library from cassette, and as SWTPC Disc BASIC supports a “tape load” (TLOAD) command, to pull data from cassette, I typed “BASIC”. The drive searches at 20 inches per second, and reads/writes at 10 inches per second; around 30 seconds later the VDU showed “READY”.

The wafer is a small (1.6 x 2.7 x 0.2 of an inch) cartridge and the length of tape can be 5, 10, 20 or 50 feet; it’s of the endless loop variety, i.e. like the car 8-track cartridge and you can dramatically improve access time at the expense of the amount of data stored on the wafer. After two years plus of 800 baud cassette operation I am quite happy to wait the 30 or maybe 40 seconds (worst case) for 10K of BASIC to be loaded and executed from the longest wafer.

By careful arrangement of my games tape, I can be playing my own version of Star trek (some 5K long) within 15 seconds of initialising the system; it’s the most popular household game and it’s first on the wafer!

This file has memory requirements from $0000 to $13EF, plus a random number generator located at $A04A to $A06F. To save this on wafer — it being non sequential — I first saved 0000 to 13EF and called the file TREK, then saved A04A to A06F, calling this file RANDOM. I then APPENDED TREK and RANDOM, calling this STARTREK, so when I called, the specified memory areas were loaded, leaving all other memory locations undisturbed.

All utility programs on the systems wafer are well documented, to include “default unless specified” conditions.

The obvious question is, have I had any problems? Well, my utility program “VERSION” doesn’t work. This allows you to find out the version number of any utility program. The book tells you that this is a hexadecimal number stored in a spe- cified utility. By using the “memory change” facility of my monitor, I have examined this location of each utility, and found them all to be the version 1 though why I need to know, I’m not sure. I have advised Exatron of this non-working utility and await their reply.

The utility program TTYSET appears incorrectly documented. The correct syntax, for mine at least, is TTYSET, filespec = x where x is the desired hexa- decimal/decimal number.

Apart from these two tiny, and, as far as I’m concerned, totally unimpor- tant items there have been no other problems. The system worked first, and each consecutive time, thus inspiring confidence for all time to come.

“ERROR MESSAGE X” has appeared
FEATURE INDEX

Index to current volume, up to, and including, last month.

Hardware Projects
Z80 Homebrew
3-1
Selective PROM copier
3-3
TV to Monitor Expansion
3-4
MK-14 Expansion
3-4
Teleprinter conversion
3-5
Benchtest Evaluations
Luxor ABC 80
3-1
WH 89
3-2
ACT System 800
3-2
Panasonic JD 700U
3-3
Sinclair ZX-80
3-4
Challenger C2 4P
3-4
Texas 99/4A
3-5
Altos ACS 8000-2
3-5
Hewlett Packard HP-85
3-5
Benchmark Timings

Series
PASCAL
3-1, 2, 3, 4, 5
David Levy's Games
3-1, 2, 3, 4, 5
On the line
3-1, 2, 3
Vievdata
3-4, 5
Fact Sheets (Fax)
3-4, 5
6800 opcodes
3-1
6802 opcodes
3-1
Personal Opinion (Interrrupt)
3-1
The end of work?
Lord 6800 opcodes
3-1

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as a result of fumbling on the keyboard, or where I thought I knew the manual.

Summary
The system arrives ready to plug in and go. The quality of both boards and workmanship is superior to that normally expected in the hobby market, and can be summed up in one word – professional. The repair service can be classed as superb, and I have no intention of trying the 30 day money back guarantee… I like the system too much.

The software works well and, currently, TSC BASIC, Editor and Assembler are available as optional extras; more is available on these as yet. PET and Apple, though no information is available as 240 volts. Versions are planned for both the 110 volts PSU with one suitable for the transport and controller from the mother board.

There's also a version available for the TRS80, though this requires mains voltage and, of course, the United States voltage and, of course, the United States would be very easy matter to replace the 110 volts PSU with one suitable for 240 volts. Versions are planned for both PET and Apple, though no information is available on these as yet.

The first time I telephoned Exatron I was advised that “Linda” dealt with the system –25% speed tolerance. My system now classed as superb, and I have no intention of trying the 30 day money back guarantee… I like the system too much.

The exclusive distributors of Altos Computer Products.

The system wafers took 82.5 seconds, or 7.27 inches per second which is (just) outside the ±25% speed tolerance. My system now reads the wafer in 57.8 seconds, or 10.38 inches per second; maybe I could have used the troubleshooting part of the manual to better effect. In there it tells you how to either up or downgrade the transport speed, but in my innocence (ignorance) I didn't gel first off; then due to circumstances (clumsiness) beyond my control (it was 3 am) I didn't get a second opportunity.

Thanks to Exatron, I now have a totally redundant AC30 cassette interface with two recorders and a pile of tape software valued at over £200; this however is a small price to pay for the quality and speed I have gained. I really do think they have achieved their aim of Excellence in Electronics (mechanics too!). Superb value for money.

User groups are highly recommended by Exatron. Thomas Murphy would like any other owners of stringy floppies to contact him via the magazine.

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GUESSING THE ODDS

Deduced probabilities
When playing a game of cards you usually know which cards you have been given, but normally you will not see the cards that have been dealt to your opponent(s). You may be able to deduce certain things about an opponent's card holding from the way in which he bids or plays, but it is unlikely that you will know exactly what he holds until very near the end of the hand. Decisions made in this sort of environment must be made on a probabilistic basis; in other words, you play with the odds and hope for the best. If you have calculated the odds correctly you will win more often than you lose.

Shuffling
Before proceeding to the main point of this month's article I should perhaps interpose a brief section on how to shuffle the cards in your program. The simplest way of creating a randomly sorted deck is as follows. Starting with the deck in any order you wish (even perfectly sorted), interchange the first card in the deck with the Rth card, where R is a pseudo-randomly chosen integer on the range 1 to n (n is the total number of cards in the deck). Then interchange the second card with another randomly chosen card, then the third, and so on to the end of the pack. The manner in which you generate your random numbers is of some consequence — I would recommend that while developing your program you use one of the seeding methods in which the i+1th random number is generated from the ith number, and the series is started with a "seed" which may be chosen by the user. This approach has the advantage that if you spot a bug in your program you can recreate the hand simply by starting with the same seed. Once your program is debugged you may use the computer's internal clock to supply the seed, for example by using the time elapsed between the pressing of two keys.

One seeded random number generator which will suffice is:

\[ R_i = a^i \times \text{seed} \mod m \]

where \( R_i = i \text{th pseudo-random number} \)
\( a = 8t + 3 \) (for any positive integer t)
\( m = 2^b \) where b is the number of bits per word in your computer.

Deducing information from the Play of the Cards
For the purpose of creating a simple example I have invented the following card game. The game is played by three players who are each dealt 17 cards at the start of a hand. The 52nd card in the deck is turned face up and that suit is trumps.

Starting with the dealer's left, the player leads a card and the other players must follow suit if they can, or they may trump if they wish (provided that they are unable to follow suit). The player who wins one trick leads to the next, and the player who wins most tricks wins the hand.

Let us assume that we are dealt the following hand:
What have we learned?

Let us now return to the question of what, if anything, we have learned about Bill and John's hands from the cards they played to trick one? We probably cannot say very much at all about Bill's hand at the moment, but we already know something about John's cards.

John took the first trick with the Q of spades. The A and K are in our own hand and so the only cards that John could have used to take the trick were the Q, J and 10. If John had held the Q and 10 but been missing the J, he would have played the 10, so from the fact that he played the Q we know that his original spade holding included: Q, J and 10 or Q and J or Q (without J or 10).

Now we can use the tables of probabilities for the individual cards to determine the prior probability that John held each of these three holdings:

Probability that he held the Q, J and 10 = 0.5 x 0.5 x 0.5 = 0.125

Probability that he held the Q and J but not the 10 = 0.5 x 0.5 x 0.5 = 0.125

(Note that since the probability of his holding the 10 is 0.5, the probability of his not holding it is 1 - 0.5 = 0.5)

Probability that he held the Q but not the J or 10 = 0.5 x 0.5 x 0.5 = 0.125

And from Bayes' theorem we can show that the probability that the Q came from each of these three holdings is:

Q, J, 10: 0.125/0.125 + 0.125 + 0.125 = 1/3

Q; J: 0.125/0.125 + 0.125 + 0.125 = 1/3

Q: 0.125/0.125 + 0.125 + 0.125 = 1/3

Note that had the calculations been performed later in the hand, when the probabilities were not all equal (0.5), the final values would not all have been 1/3. But we can see from these last calculations that we can therefore adjust the probabilities for the individual cards in John's hand as follows:

For the 10 of spades: probability = 0.333

For the J of spades: probability = 0.667

For all other unseen cards the probabilities are equal, and these are:

16 – 0.333 – 0.667 = 15 – 0.5

32 – 1 – 1

Since there are 16 unseen cards in John's hand, and 32 unseen cards in total (the probabilities of the J and 10 of spades being in John's hand are subtracted from the number of cards in his hand, and one is subtracted for each of them from the total number of unseen cards).

If the probability of the J of spades being in John's hand is 0.667, then the probability of it being in Bill's hand is 0.333, and by the same argument the probability of Bill holding the 10 of spades is 0.667. So we have been able to make some adjustments in the probabilities simply on the basis of John having played the Q of spades at trick one. We can also make note of the fact that if John ever played spades, we will know that he holds the J.

At trick two, John must lead because he won trick one. He leads the A of hearts, we play the 5, and Bill trumps with the 8 of spades. What have we learned from trick two? First of all, Bill would obviously use his lowest trump or one of his lowest contiguous group of trumps. The 7 was the original face up card, we played the 4 on trick one and Bill played the 9. We hold the 2 of spades and so Bill's 8 of spades must have been played from one of the following holdings:

J, 10, 8, 6, 5, 3

J, 10, 8, 6, 5, 5

J, 10, 8, 6, 5

J, 10, 8

J, 10,

8, 6, 5, 5

8, 6, 5

8, 6

8

And by using Bayes' theorem we can determine the probabilities of each of the above cards being in Bill's hand, and from these probability estimates we can determine the estimates for the cards being in John's hand. We can also adjust the probabilities for all the hearts: those which are not in our own hand must all be in John's hand.

Deducing information from the bidding

In many card games there is a bidding phase between the deal and the play of the cards. The best known of such games is Bridge, but the popular German game of Skat is another widespread example (it is said that Skat can be played by more than 50% of the entire population of Germany). Since each bid has a meaning, it should be possible for the card playing program to learn something about its opponents' hands from the way that they bid, and it can then adjust its probability estimates for each card in their hand. How this is done will obviously vary from one game to another. Let us take a brief look at Bridge, to see how we might modify the probability estimates of the unseen cards in the light of the bidding.

We are sitting South and hold 10 high card points. We look at the 13 cards in our hand and assign a probability of 1/3 to each of the remaining 39 cards in each of the other three hands. We then add the bidding and bids one spade, indicating that he has a stronger than average hand and that spades is his best suit. (Of course, this bid can mean other things, but we shall assume for this example that the above meaning is correct in the particular bidding system that West and his partner employ.) We may now adjust the probabilities of the spades, so that each spade in West's probability array has a slightly higher probability than average hand and that spades is his best suit. (Of course, this bid can mean other things, but we shall assume for this example that the above meaning is correct in the particular bidding system that West and his partner employ.) We may now adjust the probabilities of the spades, so that each spade in West's probability array has a slightly higher probability than average hand and that spades is his best suit. (Of course, this bid can mean other things, but we shall assume for this example that the above meaning is correct in the particular bidding system that West and his partner employ.) We may now adjust the probabilities of the spades, so that each spade in West's probability array has a slightly higher probability than average hand and that spades is his best suit. (Of course, this bid can mean other things, but we shall assume for this example that the above meaning is correct in the particular bidding system that West and his partner employ.)
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PCW 96
the spades and the high cards, we can then adjust the probabilities for the remaining cards in West's hand, so that the sum total of his probabilities is 13 (the total number of cards in his hand), and we can adjust the probabilities for each card in North's and East's hands by subtracting West's probability from 1 and dividing the result by 2, remembering to ignore all cards in our own hand.

So from his first bid we can make quite a lot of probabilistic estimates about West's cards, and hence about those in the North and East hands.

The bidding then passes to North, and depending on his bid we make adjustments to his probabilities using similar, logical arguments, and then adjust the probabilities for West and East. This process continues until the end of the bidding — each time we acquire some information that increases the likelihood of a card being in a particular place, we increase the probability for that place and reduce it accordingly in the other hands. When there is some negative information about the position of a card we use it in a similar way.

By the end of the bidding phase a good bridge program should have a fairly accurate estimate of how each of the other three hands is made up. By summing the probability values for all the spades in a hand the program can get an estimate of how many spades that player holds. By summing the products of the high card probability x high card point values, the program can estimate the number of high card points in each suit in each hand. It will then be able to plan its play of the hand, and of course the probabilities will be adjusted all through the playing phase.

**How to use deduced information**

The most obvious use of our deduced probabilities arises when the probability estimates for all unseen cards are all either 1 or 0, i.e. we know where all the remaining cards lie. We then have a case of a perfect information game, and we can solve this game by performing a tree search to the end of the game. Even though there may be three or more players, the tree approach should still work, though we must make certain assumptions about the way that the other players are going to make their decisions. For example, let us assume that we are two tricks from the end of a hand of our three-player card game. We hold: A of spades, 10 of diamonds. Bill holds: J of diamonds, 5 of clubs. John holds: 3 and 2 of clubs. It is our turn to lead (remember that spades are trumps).

The program now constructs a game tree, of depth 6-ply. Part of the tree will look like the above diagram. We assign to the terminal nodes of the tree, scores corresponding to the number of tricks won by each player, and we back-up through the tree until we can determine which card should be played next. In this example the situation is simple because if we lead the A of spades first we may take two tricks, whereas if we lead the 10 of diamonds we can only make one trick. Note the use of the word "may". In order to make two tricks we need some help from Bill, who must make a mistake and discard the J of diamonds in the hope that our second card is the 2 or 3 of clubs and he will make his 5. But since we lose nothing by playing the A of spades first, that is clearly the best way to continue. How can we modify our traditional methods of tree-searching to cater for situations such as this one, in which we wish to allow for the possibility that our opponent will make a mistake? Fortunately the problem has been solved for us, by the ubiquitous Donald Michie, whose name crops up here and there in the literature on various topics within the science of Artificial Intelligence.

**Expected values in backed-up trees**

Michie's method, which I shall discuss in more detail in a later article, is based on the assertion that when searching a game tree it is unreasonable to assume perfect play by the opponent, since there must always be a finite chance that he will not choose the best move. Let us see how this helps us to search the above tree.

We may simplify Michie's concept as follows: If there is a 99% chance that Bill will play the 5 of clubs from position $P_1$, and a 1% chance that he will play the J of diamonds, then since the 5 of clubs will give us a score of 1 (i.e. we take one trick) and the J of diamonds will give us a score of 2, the expected value to us of position $P_1$ is $0.99 \times 1 + 0.01 \times 2 = 0.99 + 0.02 = 1.01$ whereas if we play the 10 of diamonds from position $P_2$, the expected (in fact the certain) value of position $P_2$ will be 1 (i.e. we will take one trick no matter how Bill and John play). Since 1.01 is greater than 1, we should play the A of spades from $P_0$ because it maximises our expected score. The reader will probably have realised by now that not only does Michie's method allow us to continue our practical chances when we know exactly where all the unseen cards lie, it also enables us to use our probability estimates of the locations of the unseen cards, to build game trees which will help in the play of the hand. In other words, Michie has shown us how to play with the odds!

**Task for the month**

Find or invent a simple card game in which information may be deduced from the play of the cards. (Avoid bidding games, unless you are extremely confident and have some free hours this month.) Write a program to play this game, modifying the probability estimates of the unseen cards in the light of the user's play. Experiment with various methods of adjusting these estimates until the program plays at least moderately sensibly. At the point in the game where exhaustive search will not be too time consuming, set up a probabilistic game tree à la Michie to search to the end of the game.

**Bibliography**


(For more information on Bayes' theorem see any good book on statistics or probability theory.)
A program, written in PET BASIC, is examined in detail by Seamus Dunn to illustrate a particular way of structuring certain kinds of programs. On an 8K PET approximately 2000 bytes are left for use after the program has been loaded.

Introduction

In many programs it's necessary to organise a system for calling up or accessing any one of a number of routines. Poorly managed, this process can become quite messy, as many commercial programs demonstrate. Bits are tacked on here, there and everywhere with ring-roads of GOTO statements. Clearly, it's useful to have a well-defined structuring system which is not inhibiting but which allows for an overall organisation.

This is not intended as an argument against interactive heuristic programming. In fact I don't believe it's possible for most ordinary humans to generate programs in any other way than by a trial-and-error, step-by-step, interactive process. Most well-polished clearly organised programs arise as a result of drastic tidying-up activity after the problems have been solved. At the beginning, the problems are often not even known about.

But it is possible to work within a system that keeps the overall program in a general structural pattern. Subroutines, thought of as units, can be placed on a general-purpose network so that, while individual problems are being worked out, the programmer keeps sight of the overall structure.

The particular kind of program chosen to demonstrate this is one within which the user is presented with a set of alternatives from which to choose. These are often in the form of what is called a MENU. Such a program is described in terms of 4 BLOCKS and each of these will be looked at in turn.

The inter-relationships within these blocks are shown in diagram 1. The important thing to notice is that the system is in a closed loop, with Block 2 -- the Menu -- at its centre. Everything returns to the Menu, always.

THE BLOCKS

Block 1

This represents the programmer's attempt to communicate to the user what his program is about. Not all of the four parts shown in diagram 1, (TITLE, INTRODUCTION, DESCRIPTION, INSTRUCTIONS), will be necessary in all programs. This part of programming is often neglected because it's not at the heart of the problem-solving activity, and also because it usually gets tacked on at the end. It is important, however, and ought to be carefully thought about and properly set out.

Block 2: Menu

A list of options is presented, and the user chooses one of these by pressing an appropriate key. This block represents the centre or heart of the program. It's always returned to when other routines have been
Block 3: Direction pointers

Each exit from the Menu could lead directly to the appropriate subroutine using GOSUB, but this creates problems on the RETURN, for two reasons. First the user is usually a chain of these GOSUB commands and they must be organised in proper succession; second, at the end of this chain, the program must be directed back to the Menu.

Both of these are more easily handled if exits from the Menu go to a separate Block which organises appropriate GOSUBs in the right sequence.

Block 4: Subroutines

Each subroutine is a separate unit and the set of these used in this program are detailed below.

The program

Diagram 2 shows the overall outline of Diagram 1, but includes more detail. The content of each BLOCK is indicated and the flow of activity is represented by arrows.

The actual program is now shown in sections. It's called "CLASS REGISTRER" and is used to enter, store and retrieve a list of up to 25 names and attendance records for each of 8 weeks. It can, of course, be adapted for much longer periods, if more memory is available.

This version was written for an old-ROM PET so there are software patches which can be removed on new machines.

Block 1

This is shown below in lines 10 to 205. The dimension statements in line 10 allows for 25 names and 8 single register entries. A number of cursor-control symbols for PET are included which can be removed on new machines.

Lines 200 and 205 employ a technique for holding the screen at that point. It may be necessary to change this on other machines. This technique is used in a number of places in the program and need not be referred to again.

Block 2

This is the MENU BLOCK and it contains 9 possible options to be chosen by the user. It runs from line 500 to 582 and the single-character response-input is represented by a S.

Block 3

This is the block which controls responses to the Menu. From line 500 to line 680 it tests in turn for each of the 9 possible correct responses. If the response is none of these, line 690 sends it back to the Menu. Each response to the Menu corresponds to a subroutine, or a set of subroutines, and these are shown on lines 700 to 1500. Notice that each ends with GOTO 500.

For example, if the user wishes to ADD a name he or she presses the letter 'A'. Line 620 sends the machine to line 800.

800 GOSUB 4500 : GOSUB 3000 : GOSUB 500

The subroutine 4500 allows the user to add a name, subroutine 3000 puts the new list into alphabetical order and finally, GOTO 500 sends it back to the Menu.

Block 4

This is made up of a set of eleven subroutines all of which are shown below. Each is a self-contained unit and the user can choose not to include them all or to add new ones.
The patch: IF (ST)<>0 THEN STOP

Routine 6: Save on Tape

This routine includes two software lines 5510, 5590, and the GOSUB on patches that may not be necessary on lines 5570 and 5560.

Routine 7: Recover from Tape

The patch: IF (ST)<>0 THEN STOP

Routine 8: End

Routine 9: Print on Screen

Line 7066 tests if the screen holds 15 names and records.

Routine 9: Print on Screen

Continued on Page 124

With J. J. Clessa

The problem of the natives attracted almost 130 replies — most of them with the correct answer. Mr Ian Laudon of Edinburgh sent in a delightful poem which sums up the puzzle perfectly (I’ve amended the metre to remove the “och”s and “ayes” and improve the Scottish scanning).

I slowly strolled beside the sea
And chanced upon the natives three;
With natives evenly divided,
Twist truth, untruth and undecided.

I asked of one which tribe was he
And which were numbers two and three
He mumbled first then spoke outright,
The first one’s grey, two’s black, three’s white.

I pondered this reply untrue,
(White could not be both three and two);
Until at last it dawned on me,
They were black-one, white-two, grey-three.

However, David Tebbutt’s random number generator didn’t give you the prize, Ian. . . that went to a Master K.J.R. Jones of Lytham St. Annes. Ummm — remembering that the prize is a bottle of Remy Martin Cognac (and assuming that “Master” doesn’t mean “School Master”) — it seems that Mr. Jones Senior is in for something of a windfall. I hope he enjoyed four cans of “Coke” will go some way towards helping the situation!

***********************************************************************

QUICKIE

***********************************************************************

Another of those inter-family problems — and one that’s almost as horrible as last month’s Quickie.

If the only sister of your mother’s only brother has an only child, what would be your relationship to the child? Definitively no prizes!

***********************************************************************

PRIZE PUZZLE

***********************************************************************

Short and snappy and one that’ll keep the micros and pocket calculators busy.

A certain perfect square has the property that — if 5 is added to it, a second perfect square is obtained — and if 5 is subtracted from it, a third perfect square is obtained. What is the original perfect square?

Answers please on a postcard (letters go in the bin!) to: Puzzle No. 10, 14 Rathbone Place, London W1P 1DE. All solutions in as soon as possible, please.

***********************************************************************

PRIZE OF THE MONTH

***********************************************************************

PCW may be the light of your life but, just to add to the brilliance, this month I’m offering 25 100 watt, household lightbulbs — stay switched on!

P.S. Would Miss V. Mason (last month’s winner) please get in touch again.
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- Ready-moulded case.
- Leads and plugs for connection to domestic TV and cassette recorder. (Programs can be SAVED and LOADed on to a portable cassette recorder.)
- FREE course in BASIC programming and user manual.

Optional extras

- Mains adaptor of 600 mA at 9 V DC nominal unregulated (available separately - see coupon).
- Additional memory expansion boards allowing up to 16K bytes RAM. (Extra RAM chips also available - see coupon).

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- Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately. This prevents entry of long and complicated programs with faults only discovered when you try to run them.
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MICROS IN CONTROL

As a follow-up to their article on the IEEE-488 Bus in our January issue, K.T. Kibasi and Alan Mills of 3D Digital Design and Development examine some of the practical microcomputer-based systems that can be, and have been, configured to undertake useful real-time tasks.

Introduction

Over the last three years, a number of low cost (£600-£1000) microcomputers have appeared on the market; their price and flexibility have made them very attractive for dedication in the laboratory and industrial environments. Taking for granted an obvious computing ability, there are two levels at which the microcomputer can interact with the outside world. It might take the "passive" role of data gathering machine (a data logger), monitoring a process or experiment; alternatively it may form the active controller in a closed loop control system. For the second activity to make sense, it must include an element of data monitoring, in order that the control loop is closed and that "intelligent" decisions are made.

Later we shall examine some systems that have actually been built and are currently running...some quite sophisticated but all with a "personal" computer at their heart. These will include control of an experimental petrol engines rig, data logging studies of pond environments and the medical study of newborn animals.

Languages

With present day microcomputers such as the Commodore PET, the Sharp MZ-80K, and the Apple, many of the data logging or control activities to which they might be applied involve such slow processes as temperature and flow measurement; the execution speed of programs written in interpretive BASIC is often perfectly adequate. However, for those systems in which speed is of the essence, machine language programs may be used, even if only as subroutines. Although the increase in speed of execution may exceed one hundredfold, the penalty is the difficulty and tedium of writing and debugging such programs. This route is not for the inexperienced programmer, although the results can be impressive if successful.

Generally, both programming approaches are closely defined by the hardware parameters of the system e.g. the conversion speed of an analogue-to-digital converter (ADC), the thermal inertia of a boiler or furnace, the release and settling times of a relay. The designer of a micro based system must have a full appreciation of the process to be monitored or controlled, as well as a thorough understanding of the micro (s)he is using as the intelligent part of the control loop.

Microcomputers

As Data Loggers

The "classical" data logger has been around for a considerable period of time—evolving from the operator with clipboard noting down meter readings, through single and multi-channel chart recorders, to today's modern electronic equipment. The earlier approaches, which relied on manual transcription or chart analysis, were not only tedious but inherently prone to operator error. The last decade or so has seen the development of automatic electronic data loggers, often built around digital voltmeters, and usually employing paper tape or printer for recording the data; latterly cassettes and cartridges have been used.

A multiplex system is usually used to gather readings from a number of channels, e.g. from 100 strain gauges in a structure-testing experiment. The equip...
ment is generally expensive, bulky, difficult to reconfigure, and offers very limited intelligence. The tape normally has to be fed as input to a main frame or minicomputer for subsequent analysis and reduction of the data.

Some data loggers have the facility of producing an operator alarm signal when the signal is outside the pre-set limits but, more usually, pre-micro data loggers are dumb.

With microcomputer prices as they are at present, the machines offer themselves as ideal controller/processor data logger systems, provided an appropriate interface is designed to permit bidirectional communication between the microcomputer and the process of interest.

Our earlier article (PCW Vol.3. No.1) drew attention to the IEEE-488 Bus as a suitable component of such an interface, although there are, of course, many others.

Let's consider an actual system where data is being logged as part of a long-term study of pond environments under certain controlled conditions. The main parameters of interest are: dissolved oxygen level, pH (acidity level) and temperature.

In order to study these parameters as other variables are changed, a second pond is used as a "control". Thus the overall requirements are: two dissolved oxygen meters, two pH meters, and two resistance thermometers.

These transducers and their amplifiers are readily available commercially with current or voltage output signals. In industrial applications, current loop signals are generally preferred for their noise immunity over long distances.

The purpose of the ADC is to convert the physical variable to an electrical signal and the transducer amplifier boosts the signal to the desired level and maybe filters out some noise and hum. These signals are then fed to an ADC with front end amplifiers to match the incoming signal.

The program may then be structured to be interactive to allow entry of such experimental details as date, time, operator name, sampling intervals, channel sequence, offset and sampling coefficient for each channel, etc. A memory buffer area may be employed to accumulate a number of readings before dumping to disc or tape; averaging or other statistical analysis may be computed either as the run progresses, or subsequently.

Thus the system of figure one can be used to log up to 16 channels, with the converter unit and computer costing together less than £1000. Additionally, the computer may be employed for other tasks while waiting for the next scanning cycle.

As implied earlier, some applications require higher accuracy than eight bits,
and therefore 12-bit ADC units now exist with eight analogue input channels; these inputs may be unipolar or bipolar, single-ended or differential, and again the channel scan sequencing is under program control.

**Microcomputers As Closed Loop System Controllers**

In most control systems a negative feedback loop is employed to balance the input signal, as shown in figure two. The output signal to be controlled may be any physical variable such as position, velocity, temperature or fluid level.

Consider the case of a servo amplifier and DC motor. The position of the motor shaft may be obtained as an electrical signal from a potentiometer attached to the shaft. A microcomputer can perform the function of the scanning junction if configured as in figure three. A signal is applied to the servo-amplifier via the digital to analogue converter (DAC), driving the shaft to a new position. The computer reads the new position and calculates the error signal (output-input) between desired and actual, hence mimicking the system of figure two.

But the computer can be programmed to perform much more than the simple summing function. It can, for instance, compare the actual physical control system response with that of an ideal system model simulated within the memory. Such a system model will usually be represented by a set of mathematical equations. The difference between the actual response and the desired response can then become the subject of a second order of refinement. Thus it's possible to optimise performance so that, for instance, the motor will adopt a new position in the minimum time with maximum overshoot — i.e. apply maximum acceleration for a period, then maximum deceleration so that the motor stops at the desired position. The same principles obviously apply if speed control was the subject of interest rather than position, although a tachogenerator would replace the potentiometer.

In our earlier example, where we measured the temperature of the pond, we could close the loop by installing heaters and controlling them from the computer, via a DAC unit.

A more involved multiparameter control and monitoring system is in operation in the Mechanical Engineering Laboratories of the University of Nottingham. Here a petrol engine test bed with three engines is run through a speed cycle over 24 hours continuously. A Commodore PET is used as the system controller and data logger, monitoring exhaust temperature, cooling water temperature, engine speed and alternator voltage, while controlling throttle setting and ignition/standby using a relay control unit. It's intended to eventually replace the throttle control relay by a DAC unit. The diagram of figure four shows how these parameters will be connected to the PET (using, may we say, interface products available from 3D). It also illustrates the advantage of bus connection schemes like the IEEE-488.

Also at the University of Nottingham, the Department of Child Health at the Medical School are using the PET for investigating the effects of environmental temperature on metabolic rate and heat production in small newborn animals. They've developed an automated system for measuring the oxygen consumption of animals weighing in the range one to 500 grams. The system is controlled by, and passes data to, a 16K PET. Information is passed to the PET through a 16-channel ADC unit, and a DAC unit provides analogue output to a chart recorder and various other control lines. Switching operations are performed via the PET user port. The system is shown diagrammatically in figure five.

The same department also makes respiratory measurements of infants with breathing problems, and here again the microcomputer has been brought into service. Previously measurements were put onto strip charts and respiratory parameters were derived using graphical methods. Data are now transferred directly to the PET from pressure transducers etc., via a 16-channel ADC. The readings are immediately analysed on-line, permitting analysis of many more breaths than was possible previously. The final results, in the form of pressure/volume loops, are drawn on an analogue X-Y plotter connected to the PET via an interface manufactured especially for that particular purpose.

**Conclusion**

The examples given here are but a small sample of the enormous range of practical applications to which microcomputers are being put. Relatively cheap and versatile interfaces can now be obtained (either as standard or custom designed) to assist the user in building up his own system. While much of the micro sales activity concentrates on the more lucrative business and commercial markets, some interesting and imaginative work is being done at the interface; it's a rapidly growing field and one that's making people think again about the traditional concept of the robot.
Malcolm Peltu casts a net that covers a BASIC programming instructional, "Fred" and a treatise on the police computer.

**BASIC Survival**

Despite the scorn poured on it by Professor Dijkstra and programming purists, BASIC is still alive and well and running wild in personal computers throughout the world. All purists may soon start muscling in, the requirement to learn BASIC, particularly in schools, will remain for many years to come.

One of the most interesting BASIC teaching publications (in fact, four of utility to readers moving at different paces, groping for an understanding of the methodology that underlies problem-solving with a computer as well as the details of BASIC itself. The text has in fact been modified to take account of Eiloart's experience when using an earlier version for teaching general studies students. The main criticism I have is that the answers are printed immediately after the problems and I found, however hard I tried not to do that, until my eyes immediately took in the gist of the answer, the solution was to use a bit of knack to cover up -- a bit cumbersome. On the other hand, other people I know, who have read the book, including a schoolkid, lapped it up and preferred this format to having to jump between pages, as happens with some other self-teaching books.

At £7.50 for all four volumes, the books represent good value for money. The first part is called Basic Basics and starts with the question, What is a computer? Part 2 is called Introducing Basic and takes in flowcharting and fundamental BASIC concepts including the dreaded GOTO. The other two parts go into particular BASIC techniques and applications in more detail. The whole course is enlivened by some friendly cartoons.

**Fred**

Fredland is a state of mind, with twenty six cities (called Aay to Zed), two political groups -- the Practical and Theoretical Parties -- and it's inhabited by peaceful two-dimensional shapes. Fredland is also a pleasant gimmick used to explain the fundamentals of many things from book-keeping to (you guessed it) computers.

"Fredbooks are just the books to be read by anyone with no time to read" begins the Preface to Fred learns about computers; there's also an old Fredlandic proverb which goes: "A little knowledge is a dangerous but ignorance is lethal". Unfortunately anyone wishing to gain instant enlightenment on computers without having to read very much will find this Fredbook a bit heavy going, although it's packed with inventive and humorous drawings.

The book is written as a dialogue between Fred, the seeker of knowledge, and Rufus, Professor of Allthings. It does, in fact, cover much

that you would expect to find in an introduction to computers which has a heavy bias towards traditional mainframe data processing (micros are not even mentioned in the index) -- from bits and bytes, through programming and systems selection to design, testing etc. In general it provides lively and practical advice which works well with the illustrations; my only reservation (which the Fredland gimmickry and artificial Fred/Rufus dialect style tend to get in the way, spinning out the text unnecessarily and detracting from the logical progression. By the way, for those who are interested, at the last Fredland elections there was a dead heat and in the resulting coalition the Practical Party were responsible for putting forward a program of wrong things but the Theoretical Party were able to ensure that nothing was done.

**Paranoia On File**

Are you concerned that the police are being long term interest", whose whereabouts are to be given away that surveillance is not necessarily made public by the police. The stolen vehicle file has around 100,000 entries but Campbell says that drivers concerned with stolen vehicles the rest include information on vehicles whose owners are suspected of having committed crimes or those of "long term interest".

Campbell believes that about 30,000 of the so-called stolen vehicles are under secret surveillance because they fall into the category of "long term interest", whose whereabouts are not reported but whose drivers are not necessarily made aware that surveillance is taking place.

Unfortunately it's necessary to qualify the facts in the books by saying "it is claimed by Campbell because the Home Office and the police refuse to confirm or deny many of the details (although they have given Campbell the stolen vehicle files on four secret surveillance because they fall into the category of "long term interest"'s whereabouts are not reported but whose drivers are not necessarily made aware that surveillance is taking place.

Campbell therefore deserves considerable credit for his relentless pursuit of exposing the nature of police computer systems to public scrutiny. After all, an official government investigation into data protection, the Lindop Committee, complained that they had been unable to elicit sufficient information from the police to decide whether or not the computers are open to unwarranted invasion of privacy.
subject.

In Policing the Police, for example, he seems to detect something sinister about the fact that the PNC has an uninterrupted power supply — which in fact is standard in many computer installations, to avoid temporary power breaks. He also uses the fact that the software is written in Algol and arranged in modules as circumstantial evidence to prove his thesis that new features can be sneaked unnoticed into the system — as does his observation that there could be something sinister about the use of a standby machine to carry out program testing!

In an article in the New Scientist earlier this year he brought telephone tapping back into public attention by claiming that the Post Office is using a computer system which can reconceal tapped phones, record them and then automatically print out the conversation. Given the current state of technological development, such a system is virtually inconceivable but the claim, having been repeated generally in the media, has now entered the folklore of police technology.

Campbell generally seems to be a strong believer in technological determinism — the mere existence of a technological potential is taken as determining an inevitable consequence. He implies that the build-up of the PNC and other police systems, such as one at Scotland Yard, inevitably means that police control over society will be more efficient and effective. Yet, commenting on "the world's most advanced" computerised surveillance system which has been built up in Northern Ireland — it includes details of most homes — he says "it is worth noting in passing that, despite this massive surveillance, military commanders do not now think that there is any hope of a victory against the IRA for the foreseeable future".

But despite some of his over-enthusiasm for believing in technological possibility, and seeing the fuzz under every bed, Campbell's evidence does indeed give considerable cause for concern because computers do add a major new dimension to the volume of information that can be gathered, stored and collated and the speed it can be accessed from many locations. Although it's true that Hitler didn't need computers to do his dirty work, in the not too distant future, computers could undoubtedly provide a secret surveillance system which would greatly simplify and speed up any dictatorial action. It's outrageous that Britain remains one of the few major Western countries without a law, or proposed law, for providing a legal framework to define citizen's rights to privacy and data protection. Such a law, coupled with an ever-vigilant informed democratic electorate, is the only real way of avoiding a computerised Big Brother. As indicated by the two other essays in Policing the Police (by Martin Kettle and Joanna Rollo) Campbell relates technological policing to a political context — one where the police are seen as conforming to "the British police's traditional functions of defending the capitalist system," to quote the book's editor, anti-apartheid activist Peter Hain. Even if you approach Laura Norder from the other end of the political spectrum, Policing the Police is worth reading, particularly if you want to know whether computers are extending the long arm of the law simply to assist the fighting of crime or whether it's to perform other policing functions you might like to see encouraged curtailed.

No Prizes

In the March Bookfare we offered a bottle of wine to anyone spotting the deliberate mistake. Although a number of unintentional booboos were spotted, nobody gets the vino for spotting that the Tailor of Gloucester's coat needed cherry-coloured silk not plum-coloured. The wine will be shared (hic) around the office (I warned you it could undermine). Boris will test you. And humiliate you. And improve you. Boris is the chess computer that always be the supreme test of any player. In Policing the Police Volume 2, edited by Peter Hain (John Calder, £14.50 paperback, £8.95 hardcover)

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can you recommend a book that explains how micros work in a fairly simple way?
Mark Scaler, Redruth

What you need is a primer on microcomputer architecture to "get you off the ground". Unfortunately most beginner's books on personal computing are aimed at the same non-technical mass-market as the machines. Typically they introduce a few simple programming concepts and then move on to teach BASIC by examples — e.g. the use of the micro for calculation, games, or simple business applications. On the other hand, technical books on machine design are usually not directly relevant to personal computers, having been written as student texts, or introductions for project managers or design engineers; generally they're aimed at a higher scale of machine and investment.

So I can't recommend just one book as a solution to your problem. In fact, the best all-round answer is to join a local computer club. In my experience you can pick up explanations far more quickly by talking to someone in the know than by wading through a book you don't understand, looking for clues.

Another approach is to browse through back issues of American home computing magazines. Byte and Kilobaud Microcomputing are particularly good for practical, informative hardware and software design articles. Unfortunately few libraries take them, through a club. Byte is available on microfiche from University Microfilms International, 18 Bedford Row, London, but you will need access to a reader; again, a large library should be able to help.

Finally, some books. For cutting through the jargon that makes some articles seem more difficult than they really are, try XI Microprocessor Lexicon by Sybex, £2. Two introductory books which look under the covers more than most are Peanut Butter & Jelly Guide to Computers by Willis, £6.30, and Personal Computing by McGlynn, £8. (Prices incl p&p from MoI, 1 Francis Ave, St Albans, Herts).

Len Warner

May 1 Interrupt Continued from P. 62

in these modes, although it may be necessary to use some additional logic to provide PIO — peripheral compatible signals.

To take just one example, in PIO operating mode 1 (the input mode) an active STB signal generated by the peripheral causes the PIO to load data into the port input register and the rising edge of the STB pulse generates an INT. The ready line R DY is driven low by the PIO and remains inactive until the CPU reads the port during the interrupt service routine. The rising edge of the ready signal may then be used to inform the peripheral that further data may be sent to the PIO. By using both the peripheral generated strobe and the PIO generated ready signals one can obtain "hand-shaking" communication between micro and peripheral which provides fast and reliable parallel data transfer.

Finally

At best the above discussion can give only a brief and incomplete account of the full potential of the Z80 CPU/PIO combination in dealing with interrupts. However it may encourage some to have another look at the device manuals and to use interrupts more often. After all one of the few advantages that the micro has over the larger multi-user mainframe computer is that it's so readily adaptable to "real-time" computing and much of its technological impact must lie in this area.

Just over 2 years ago PCW became the first magazine in Europe to deal exclusively with the home and business use of Personal Computers. It has been an unqualified success. The current subscription list stands at well over 3,000, with a staggering 70% renewal rate! PCW reader loyalty is already a byword in the publishing business. We aim to keep it that way. So if you are having difficulty in obtaining PCW at your newsagent, why not take out a subscription and have the magazine mailed to you direct?

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On-chip
It's not unusual in this column for me to compare calculator programming with microcomputer programming; after all a calculator is really nothing more or less than a dedicated microcomputer whose special function is to perform mathematical operations with a speed and accuracy not available on general purpose personal computers.

The "languages" used by programmable calculators are equivalent to microcomputer Assembly Languages, in that each program step is a direct mnemonic representation of a single processor instruction (except for the maths functions which are closer to high level language). In particular, the memory operations provide direct access to a named memory register, rather than defining variables as would a high level language.

Where the calculator differs from a micro, however, is in the nature of the register so addressed. In an Assembler a memory instruction addresses a single byte of memory; on the other hand, being designed to crunch numbers to 10 digit accuracy, normally stores numbers in Binary Coded Decimal form; i.e. each digit is separately coded as a binary number. This facilitates fast and accurate arithmetic operations. In order to hold 12 digits plus an exponent and a sign, a single calculator memory register consists of 7 or 8 bytes of store. Sometimes the programmer can take advantage of this fact to create extra memory registers, though at the cost of foregoing the ability to store fractional or negative quantities. By treating each binary coded digit (or group of digits) as a virtual memory register it's possible to store more integers than the number of memory registers provided.

In the extreme case, each register can be converted into 10 independently addressable memories, each capable of holding an integer between 0 and 9; a Casio fx502 could store 200 numbers, or a TI 159, 900 (a couple of registers must be reserved as working space).

This technique is called "data packing" since several pieces of data are crammed into the space intended for one.

For storage
Data can be packed to different degrees. If a single digit is not sufficient for your application, then 5 x 2 digit registers or 5 x 5 digit registers could be created.

What is required in any of these cases is a pair of programs or subroutines.

One, the input routine, takes an item of data and a virtual address and places the data in the correct decimal place(s) of the requisite memory register. As an example, 10 registers are converted into 100 "virtual memories" number 0-99.

To "store" a value in the virtual memory register 58, the program goes to calculator register 5 and stores 7 in the 8th place. So register 5 contains 0.00000700.

The second routine is a recall routine which accepts an "address" and displays the contents of that location; in the above example inputting "58" would produce the answer "7".

Both these routines are easy to write on any calculator which has the INT and FRAC instructions to separate the integer and fractional parts of a number. In the above example, indirect addressing using the first digit of the address (i.e. 5) would locate the correct register; then the 10 "virtual memories" contained in this single register can be accessed by multiplying the content by a power of ten derived from the second digit of the address (i.e. 8). Finally FRAC is used to look off the parts not required.

In a simpler but maybe more useful data packing system, each register is converted into two memories by storing one number in the integral part and another in the fractional part. In this case the data is "unpacked" simply using INT and FRAC.

I've used this system in a magazine costing program to store a number of constants greater than the number of available registers. The unpacking routine is written into the costing program and unpacks the data as required during a calculation.

A full suite of data packing subroutines may include memory arithmetic as well as store and recall functions, but care must be taken to avoid adding to a memory not to create an overflow which corrupts the next location, (e.g. adding 8 to memory 58 would give 0.000001500 which has produced a spurious 1 in memory 57).

For statistics applications a routine may be devised to automatically decant all the data into the statistics registers for analysis, while still preserving the individual results. In this way a 20 memory calculator like the Casio could record and analyse single digit scores from up to 150 trials.

Another powerful way of using data packing is to employ the 5-digit system above to code scientific notation to 3 significant figures. For example 78592 would be interpreted as 7.85 x 10^2, the last two digits being interpreted as an exponent.

Of course when performing calculations in a data packed mode, the input and recall subroutines may be omitted instead of using the calculators MR and Min (RCL and STO) which are forbidden.

For input and display
In addition to increasing storage capacity, data packing can be useful for inputting and displaying data. It's often desirable, in a program requiring two inputs, that these inputs be entered simultaneously. This has the advantage that both data items can be seen and verified before entering, and also it prevents you losing your place in an input sequence i.e., forgetting whether or not you entered the last item.

Data packing using the decimal point as a separator is a handy trick. For instance in the above example the data and address could be packed and entered as 7.58. A portion of the input routine unpacks this and interprets it as 7(datum) into 58(address). The ultimate example of this type of input packing is the "Codesplitter" program published in this column last month.

Similarly it's often convenient (in the absence of a printer) when several outputs need to be displayed, to pack them for simultaneous display. This allows the results to be recorded with no fear of losing your place — which is quite likely in a long sequence with no prompts. The methods of packing are the same as for input; in addition the exponent display can be used, at a pinch, to hold two extra digits — e.g. 7.006 300 542 13 — if care is taken to choose a scientific notation format. Otherwise the calculator may reformat the display and garble the results.

The Casio 502, as many readers have discovered has another possible packing format in its DMS display. Three results may be simultaneously displayed e.g. 97° 23' 41" so long as the second two are below 60.

To conclude with an illustration, here is a pair of store and recall routines to create 40 five digit memories on the Casio 502.

STORE ROUTINE
P0 Min F FRAC M — F X 50 — Min F FRAC M — F x = 0 GOTO1 GOTO2
LBL1 IND MR F INT IND M — F MRF IND M + F AC GOTO3
LBL2 IND MR F FRAC IND M — F MRF + 5 10 X — IND M + F AC LBL3
Enter data (5 x 5 digits) decimal point, then address (0 to 39) e.g. 78592.36 P0
RECALL ROUTINE
P1 + 2 = Min F FRAC x = 0 GOTO1 GOTO2
LBL1 IND MR F GOTO3
LBL2 IND MR F FRAC X 5 10 X = LBL3
Enter address, e.g. 36 P1, 78592 displayed.
And as a special bonus here is a pair of routines to encode and decode 3 digit scientific notation, and store in 40 data packed memories.

ENCOD/STORE ROUTINE
P2 ENG RND3 LOG Min F INT M — F + ( MRF + 4 ) 10 X RND3 = Min F HLT + 2 10 X + MR F = GSB0
Enter data e.g. 78.592 P2. Encoded form displayed 78692. Enter address e.g. 36 EXE
DECODE/RECALL ROUTINE
P3 GSB P1 + 2 10 X = Min F INT M — F + 2 10 X X ( MRF X 2 10 X ) 10 X —
Enter address e.g. 36 P1, 78.863 displayed.

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When the machine breaks down — and it will, sooner or later — the teacher must either find someone to repair it for him or learn how to do it himself. Both courses can be either hideously expensive in cash and time, or at worst downright impossible. An LEA on its toes would provide a permanent employee who — given standardisation — would rapidly become expert in diagnosis and repair. He could even have a few standby PC boards for replacements and any school suffering a breakdown could be on-line again in a couple of hours.

Consider, too, the software. Up and down this dear muddlesome land we have dozens of teachers all busy, busy, busy, working the same programs; an activity that will continue for decades. Need I state the obvious? This is a shocking waste of time and effort, yet nobody is doing anything to alleviate the situation. And it will get worse! If a teacher borrows a copy of a teaching program, it won't run on his machine, because it's a different make! If after much scribble, he gets it to run and improves it, he cannot pass it back to his friend without yet more scribble. Result — a severe brake on what should be and could be a happy journey towards the distillation of the very best teaching methods available in the country.

Back to the LEAs. If only they were to standardise, then a teacher in their area would be able to interchange ideas and programs freely.

OK . . . end of lecture. I'll get off my soap box! Sorry to go on like this, but I feel rather strongly about it. And if any of you out there have got views that you want to air, then let's be hearing from you. I don't care who you are — teacher, pupil, student or just plain interested — drop me a line. How do you see the role of the computer in the classroom of the future, and what should we be doing about it?

Programs

What can I say? I'm enormously impressed by the flow of programs that has reached me, via the editor, in response to John Coll's recent plea.

It's not only the number of programs that impresses me, but also their variety. Games predominate, but don't knock them — they stimulate interest and those youngsters who write them are exercising real skills that will stand them in good stead.

Perhaps what impresses me most is the enormous enthusiasm for computing that I sense among young people everywhere. This is truly great, but what a sad contrast to the attitude displayed by the LEAs! (Steady, I've ploughed that field already!)

Programs Received

HORSE RACE — by Richard Sheldon (13) (address unknown — please call us.)

STARTREK, PONTOON, ROULETTE, HANGMAN — by David Hartnell (16) of Birmingham

DICE THROWER — by Tony Hailes (15) of Birmingham

DIGITAL FREQUENCY MEASURER — by J.W. Roston (14) of London

MISSILE — by Mike Wilson of Selborne

NUMBER GUESS — by Paul Whitmarsh (14) of Siders

MAZE — by Alan Heal (15) of Kenilworth

ONE-ARMED BANDIT — by Torstein Kingsh on (17) of Oslo

QUESTION TIME — by R.A. Develyn (16) of Horsham

MSI BASIC SUBROUTINES — by Robert Coombes (14) of London

PICTURE DRAWER — by Colin Hughes (12) of Luton

FOOTBALL, TENNIS, GOAL, SQUASH — by Paul Williams (14) of Horsham

NEW PET COMMANDS — by David Simons (14) of Welwyn Garden City

We've also had some interesting letters from B.M. Graham (16) of Chigwell and O. Garland (14) of London, both of whom raise points that I would like to discuss more fully at a later date.

Thanks a lot to all of you. If you keep on like this, I'll be able to force the editor to double the space that he allows us each month. (Tomorrow the world!)

Competition

Finally for this month, just a reminder about our competition. We're looking for drawings of a design suitable to head this page — also to be made up into a supply of metal badges; I'll be giving book tokens for the best. Don't hang around too long — I want to close the competition quite soon.

PS — I still haven't received any programs from girls!
PUPIL POWER AT SANDBACH

At a time when Government spending on education is being reduced, it may seem strange to suggest new ways of setting up schools computing systems. On the other hand, scarcity of resources must prompt schools to make efficient use of capitulation, and in this article S. J. Hemmings describes a very cost effective schools computing system.

Firstly, what is required? A typical 4th or 6th year computer studies class will consist of about 25 pupils studying the subject to CSE or O level. Assuming that the class is of average ability and that all their teaching is to be done within the school (school use local authority or college facilities) then the following requirements must be met:

1. A minimum of six teletype (or similar) terminals allowing “hands-on” programming experience in BASIC.
2. A means of storing large amounts of data (be it programs or raw data) for future use.
3. A means of producing a printed copy of work done and program results.

At a more technical level, the ability to program the machine in both a high level language (like BASIC) and a low level language (like the 8080 assembly code.)

Of these, the ability to produce hard copy is the most important. All examination boards require printed proof of a pupil’s ability to program. Program 2 requires either cassette or disc storage and anyone who has used both will recognise the superiority of disc. Disc 4 might be expanded to require the provision of other high level languages (especially PASCAL) if the subject is to be taught to any real depth.

It should be clear that the provision of a single microcomputer goes only a very little way towards providing what’s required. As a demonstration tool it might be excellent, but 25 children cannot be taught solely by example — and if one child is using the machine, the rest are unable to expand up to the ideal of six terminals.

When RTCS were approached they reacted enthusiastically, helped by the fact that their Managing Director, Dave Yardy, is a parent of one of the pupils. They suggested a couple of ideas:

First, a series of stand alone disc based micros to interface with teletypes (of which there are lots secondhand), large enough to handle things other than BASIC. Second, and this was the new development, the system shown below.

Here, a largish parent micro, driving two floppy discs and perhaps a printer, has access to a number of high level languages and other facilities on the discs. Micro is used to feed a series of daughters micros at the beginning of the day. The daughters are simple processors with lots of RAM and I/O ports and very little ROM. At power-up the teacher decides which language the class is to use and dumps the interpreter/compiler/operating system into the relevant daughter processors one at a time. In this way each daughter can be filled with the same or different languages for use by the pupils. After filling, each terminal is effectively a stand-alone micro. If programs need to be saved or data files accessed (a relatively infrequent requirement at this level) then the daughter must contact the parent micro for data transfer. The beauty of this system is that there is no limit to the number of daughter systems which can be handled and the software needed to be resident within the parent micro is relatively simple (after all, this is not a multi-access system).

We are well pleased with the idea — it offers enormous scope for expansion and we have made a start by purchasing the parent system. A very powerful micro in its own right, it’s at present being used to drive a single terminal. It’s 8080 based with 48K of RAM (max. 64K) and twin floppies. As time passes and more money becomes available we hope to purchase further (relatively cheap) daughter processors. Already the system is functioning to teach up to A Level and is used extensively for Data Processing within the school. It can handle Microsoft BASIC, has a CP/M operating system and an 8080 assembler. In the future Cobol, Fortran, Pilot and a version of Pascal are feasible.

Of course there’ll be drawbacks, but we’re very lucky in that RTCS is a local firm with an interest in the school and as a result maintenance is not a problem. Teletypes don’t grow on trees and they have to be purchased for each daughter micro (this is still cheaper than a single PET; even with the micro thrown in). The thing of our future is sure to be the VDU; it’s smaller, more robust and quieter but bang goes the hard copy. If VDUs were used with the RTCS system it might seem to be getting rather like a room full of PETs or TRS 80s, except that they would cost a lot less and printing would be easier via the parent micro.

The real problem is that Government the LEAs, are not yet prepared to give schools the money needed. In the meantime the RTCS system offers a cheap, flexible, expandable system for use with a full class of children and last but not least, it’s all British!
Please note: Software items listed in italic are not included in the basic price of the equipment. All prices are exclusive of VAT.
<table>
<thead>
<tr>
<th>Machine</th>
<th>Main Distributor(s) (No. of Dealers)</th>
<th>Hardware</th>
<th>Software</th>
<th>Miscellaneous (Documentation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euroc</td>
<td>(£7,095)</td>
<td>64K RAM: 8080A: dual 8&quot; F/D (1MB)</td>
<td>CP/M: CBASIC: A: U:</td>
<td>A year's maintenance and stationery supply inc: (5)</td>
</tr>
<tr>
<td>Executive Minicomputer</td>
<td>Binatone 01-903 5211</td>
<td>See Video Genie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMS 5000</td>
<td>(£1,935)</td>
<td>32-64K RAM: Z80: dual 5&quot; F/D (320K)</td>
<td>CP/M: CBASIC: Cobol: Fortran: MicroCOBOL</td>
<td>3 drives options: (S&amp;H)</td>
</tr>
<tr>
<td>IMS 8000</td>
<td>(£3,515)</td>
<td>64-256K RAM: Z80: dual 8&quot; F/D (1MB)</td>
<td>CP/M: CBASIC: Cobol: Fortran: MicroCOBOL</td>
<td>Multi-user M/V/ FAMOS available in place of CP/M: (S&amp;H)</td>
</tr>
<tr>
<td>LSI M-One</td>
<td>(£5995)</td>
<td>8K RAM: 8080: dual 8&quot; F/D (1,2MB): 12&quot;: 24 x 80 b/w VDU</td>
<td>FMOS: A</td>
<td>A choice of standard business package included in price: (5)</td>
</tr>
<tr>
<td>LSI M-One Model 5 (29900)</td>
<td>As above</td>
<td>16K RAM: 8080: dual 8&quot; F/D (2,4MB): 2x12&quot;: 24x80 VDU: 140K bidirectional ports:</td>
<td>FMOS: A</td>
<td>One of the VDU's is for inquiry only: (5)</td>
</tr>
<tr>
<td>LSI 5000</td>
<td>(£25,500)</td>
<td>32K RAM: 8080: dual 5&quot; F/D (1MB): 12&quot;: 24x80 b/w VDU: 1000 printer</td>
<td>DOS: BASIC: A</td>
<td></td>
</tr>
<tr>
<td>Micro Macris 16080</td>
<td>As above</td>
<td>64K RAM: 8085: dual 5&quot; F/D (1MB): 12&quot;: 24x80 b/w VDU: 1000 printer</td>
<td>CP/M: U</td>
<td>(H&amp;B)</td>
</tr>
<tr>
<td>MSI 6800</td>
<td>(£41,203)</td>
<td>16K RAM: 6800: C: 9&quot;: 16x64 b/w VDU: 1 S/P</td>
<td>BASIC Mini: A: U:</td>
<td>Up to 8 serial or parallel interfaces possible: (S&amp;H)</td>
</tr>
<tr>
<td>MSI System 7</td>
<td>(£3,200)</td>
<td>56K RAM: 6800: dual 8&quot; F/D (1MB): 12&quot;: 24x80 b/w VDU: 1 RS232 port</td>
<td>DOS: BASIC: A</td>
<td>Choice of FDOS, SDOS or Flex: also option—10MB H/D: (H&amp;B)</td>
</tr>
<tr>
<td>Oxford Mini-computer</td>
<td>Binatone 01-903 5211</td>
<td>See Video Genie</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine</td>
<td>(Price from)</td>
<td>Main Distribution/ N.E. of Dealers</td>
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<td>Software</td>
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<tr>
<td>Strutelectrical</td>
<td>£153</td>
<td>5439</td>
<td>16-64K RAM: 80: single 8” F/D (250k): 12”, 24x80 &amp; B/W VDU: RS232 port</td>
<td>BASIC: Cobol: Fortran</td>
</tr>
<tr>
<td>Sharp</td>
<td>£90</td>
<td>2222</td>
<td>6-34K RAM: 280: C: 10”: 24x40 b/w VDU</td>
<td>BASIC: A:</td>
</tr>
<tr>
<td>Sinclair</td>
<td>£90</td>
<td>1000</td>
<td>1-6K RAM: 780: C: INT: T.V. int: full K: B: 44 pin expansion port</td>
<td>4K BASIC in ROM</td>
</tr>
<tr>
<td>Sord M100 ACE</td>
<td>£90</td>
<td>5000</td>
<td>64K RAM: 280: single 8” F/D (1MB): 12”, 24x80 green VDU: 112 cp printer: RS232C port</td>
<td>CP/M: CRABAS: Cobol: M/ASIC: Fortran</td>
</tr>
<tr>
<td>Sord M223</td>
<td>£153</td>
<td>3573</td>
<td>64K RAM: 280: single 8” F/D (303k): 12”, 24x80 b/w VDU: £450</td>
<td>O/S: BASIC</td>
</tr>
<tr>
<td>Tandy TRS 80 Level I</td>
<td>£25</td>
<td>200</td>
<td>416K RAM: 280: C: 12&quot;: 16x64 b/w VDU</td>
<td>BASIC: A:</td>
</tr>
<tr>
<td>Tandy TRS 80 Level II</td>
<td>£25</td>
<td>200</td>
<td>416K RAM: 280: C: 12&quot;: 16x64 b/w VDU: RS232 int: 1 P/F</td>
<td>DOS: BASIC</td>
</tr>
<tr>
<td>Tangerine DPS 64/1-4</td>
<td>£3,014</td>
<td>43445160 (TBA)</td>
<td>520K RAM: 280: dual 8” F/D (1MB): 12&quot;, 24x80 b/w VDU: 2.5: 3.3 P/F</td>
<td>CP/M: BASIC: Cobol: CRABAS: Fortran: Pascal: Algol: Pascal</td>
</tr>
<tr>
<td>TIB/94</td>
<td>£9</td>
<td>73447466 (TBA)</td>
<td>16K RAM: 26K ROM: 9900: 214x32 b/w VDU: 2 C int: RS232 port</td>
<td>OS: BASIC</td>
</tr>
<tr>
<td>Triton L8.2</td>
<td>£6,84</td>
<td>8137</td>
<td>32K RAM: 8060: C int 16x64 VDU: int: 1 S/F: 1 P/F</td>
<td>OS: A: Pascal: M/C: BASIC: CP/M</td>
</tr>
<tr>
<td>Vestro Graphics M2</td>
<td>£2,05</td>
<td>600252035 (N/A)</td>
<td>64K RAM: 280: dual 8” F/D (1MB): 12&quot;, 24x80 b/w VDU: 2.5: 3.3 P/F</td>
<td>DOS: BASIC: A: CP/M: Algol: CRABAS: Cobol: Fortran: Pascal</td>
</tr>
</tbody>
</table>

**List of Abbreviations**
- F/D: Floppy disc
- G/C: Graphics card
- H: Hard disk
- I: Interface
- M/A: Macro assembler
- M/C: Machine code
- O/S: Operating system
- P/B: Printer burner
- P/F: Parallel port
- S: Software
- T/B: Text editor
- TBA: To be announced
- V: Utility

Please note: Software items listed in italics are not included in the basic price of the equipment. All prices are exclusive of VAT.
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### IN STORE

#### Machine (Price from)
- **Zenith WH-11A** ($4,359)
  - Heath Ltd: 0452 29451 and 01-636 7349 (N/A)
  - LSI 11: 16-32K RAM: 25x80 VDU: S/P: P/F
  - O/S: BASIC: Fortran: BASIC: Micro Cobol
  - FDP 11 compatible: option — dual 8" F/D (512K): (S&H)
- **Zenith Z80** ($1,490)
  - As above
  - 16-48K RAM: Z80: single 5¼" F/D (102K), 12": 26x80 b/w VDU: RS232
  - 3 drives option: (1)
- **Zentec** ($4,700)
  - Ziga Dynamics Ltd: 02465 75661 (1)
  - 32-64K RAM: 2x8080: dual 5¼" F/D (512K), 12": 26x80 b/w VDU: RS232
  - O/S: A: U: BASIC: Micro Cobol
  - User programmable character set: option — dual 8" F/D (1MB): ($)
- **Zilog MZC 1.05** (Portable: MZC 1/20A: £200, £480)
  - Mierop: 0256
  - 64K RAM: Z80: dual 8" F/D (800K), 12": 26x80 b/w P: 1S/P: option — 10MB Turbo (TBA)
  - Available desktop typ or rack mount- ed. Debug in 3K F/RM: 1:20A: runs multi-user Cobol and has up to 5 terminals and 40MB possible: (S&H)
- **Z-Plan** ($4,000)
  - Rostronics: 01-874 3665 (TBA)
  - 32-64K RAM: Z80: dual 8" F/D (1MB): 2 P/P: 2 S/P
  - P/M: A: U: BASIC: Cobol: Fortran: Pascal: (S&H)

#### SINGLE BOARDS

<table>
<thead>
<tr>
<th>Machine (Price from)</th>
<th>Main Distributors (No. of Dealers)</th>
<th>Hardware</th>
<th>Software/Firmware</th>
<th>Miscellaneous (Documentation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acorn (895)</td>
<td>Acorn: 0223 312772 (N/A)</td>
<td>S/P: P/F</td>
<td>1/4K monitor: BASIC</td>
<td>Kit: programmable address link- ing: on board 5V regulator: available assembled, £79 (S&amp;H)</td>
</tr>
<tr>
<td>Aim 65C (2265)</td>
<td>Pelco: 0273 722155 (4)</td>
<td></td>
<td>1/4K monitor: BASIC</td>
<td>Available as S100 system with A or BASIC in ROM (£80) from Portable Micros (02482200); they also have briefcase version (£750) (£)</td>
</tr>
<tr>
<td>Cromemco SC (2626)</td>
<td>Comart: 0480 215005 (17)</td>
<td></td>
<td>Monitor and control in EPROM (£)</td>
<td>5 program interval timers: can put own BASIC programs in EPROM (E)</td>
</tr>
<tr>
<td>ELF II (1114)</td>
<td>Newtronics: 01-348 2325</td>
<td></td>
<td>1K monitor: A: Dis A: T/E: BASIC: 244</td>
<td>TTY, n-line decoders: low resolution graphics (high resolution available) kit (N)</td>
</tr>
<tr>
<td>Explorer (2265)</td>
<td>Newtronics: 01-739 1582 (15)</td>
<td></td>
<td>2K monitor: CP/M: BASIC</td>
<td>Programmable 14 bit counter: kit (S&amp;H)</td>
</tr>
<tr>
<td>H8 (1229)</td>
<td>Heath: 0452 29451 (TBA)</td>
<td></td>
<td>1K monitor: A: T/E</td>
<td>Kit (S&amp;H)</td>
</tr>
<tr>
<td>Hewart 6800S (1299)</td>
<td>Hewart: 0625 22030 (N/A)</td>
<td></td>
<td>1K monitor: A: T/E</td>
<td>Can be upgraded with 6809 (H)</td>
</tr>
<tr>
<td>Hewart 6800 MkIII (1522)</td>
<td>As above</td>
<td></td>
<td>1K monitor</td>
<td>(H)</td>
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<tr>
<td>Mk 14 (139.55)</td>
<td>Science of Cambridge: 0228 311488 (N/A)</td>
<td></td>
<td>Machine code</td>
<td>Designed for control applications either than high level computing expansion (H)</td>
</tr>
<tr>
<td>Metricon 65 (269)</td>
<td>Tenginer: 0353 3633</td>
<td></td>
<td>1K TANBUG monitor: BASIC</td>
<td>Optional 64x64 pixel graphics (H)</td>
</tr>
<tr>
<td>Nascom 1 (146)</td>
<td>Nascom: 02405 75155 (20)</td>
<td></td>
<td>2K monitor: RBASIC: basic: A: 7/E</td>
<td>Now available as Nascom 2 with 8K RAM and 1K microfot BASIC in ROM, £295: (S&amp;H)</td>
</tr>
<tr>
<td>77/88 (300)</td>
<td>Newbear: 0635 30505 (N/A)</td>
<td></td>
<td>1K monitor: BASIC</td>
<td>Expandable to 6K BASIC: (S&amp;H)</td>
</tr>
<tr>
<td>SBC 100 (1335)</td>
<td>Amirco: 0294 57557 (11)</td>
<td></td>
<td>1K monitor: DOS in ROM</td>
<td>Kit: available assembled, £196 (E)</td>
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<tr>
<td>Superboard (7188)</td>
<td>MBM: 01-981 3993 (N/A)</td>
<td></td>
<td>Available with 32K RAM and single 5¼&quot; F/D, £670 (S&amp;H)</td>
<td>Machine code</td>
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<tr>
<td>Sytemon (1600)</td>
<td>Newbear: 0635 30505 (N/A)</td>
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<td>4K monitor: BASIC A</td>
<td>Can be expanded to 64K RAM (H)</td>
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<tr>
<td>Triton 4.1 (286)</td>
<td>Transam: 01-402 81317 (N/A)</td>
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<td>1K monitor: 2K BASIC: U</td>
<td>64 character graphics: 8 levels interrupt: kit (S&amp;H)</td>
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<tr>
<td>Triton 5.1 (294)</td>
<td>As above</td>
<td></td>
<td>1K monitor: 2K BASIC</td>
<td>Graphics facility: disc interface running CP/M, about £200: (S&amp;H)</td>
</tr>
<tr>
<td>Triton L.2 (2966)</td>
<td>As above</td>
<td></td>
<td>1K monitor: 2K BASIC</td>
<td>Graphics kit: fully expandable (S&amp;H)</td>
</tr>
<tr>
<td>Tuscan (170)</td>
<td>As above</td>
<td></td>
<td>8K monitor or 8K BASIC</td>
<td>DD disc controller: £195: graphs: (S&amp;H)</td>
</tr>
<tr>
<td>UK 101 (£219)</td>
<td>Computer Shop: 01-440 7033</td>
<td></td>
<td>1K monitor: 8K BASIC: A: U</td>
<td>Graphics: will run Superboard software (S&amp;H)</td>
</tr>
</tbody>
</table>

### List of Abbreviations
- **F/D**: Floppy disc
- **G/C**: Graphics card
- **P/F**: Parallel port
- **T/E**: Text editor
- **S/P**: Serial port
- **N/A**: Not available
- **N/P**: Numeric pad
- **U**: Utility
- **M/A**: Macro assembler
- **A**: Assembler
- **B**: BASIC
- **C**: Cassette
- **E**: Extensive
- **F**: Interface
- **L**: Language
- **T**: Terminal
- **S**: Software

Please note: Software items listed in italic are not included in the basic price of the equipment. All prices are exclusive of VAT.

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UK 101... professionally built, full 8K RAM. 9" cased video monitor and cassette recorder/player (with tape counter). Includes 13 assorted software tapes including a stock control program (very adaptable) with full named file handling including a built-in stock control. All leads and manuals included complete. Ready to go system for £250. Phone: Keetington 716144, any time.

Olivetti 8040... Personal mini-computer, cost £2000 eighteen months ago; 4K Baby Cassette, Integral printer, single line display and minidisk. Best offer, phone 01-963 0834.

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TRS-80 16K... 16K RAM, 12K BASIC ROM, looks excellent. No true descenders! 50 Hz mod, £1500 ono. Phone Coventry (0203) 72438.

GTR 80 Level II... expansion interface, 32K, Microplex S4" Apple, cased software, manuals, etc. Accept £85 cash, Phone Gray's Thornton (0737) 70993 (evenings/weekends).

T1-Programmable Calculator... One year old, with internal libraries, library, programming aids, electronic and astrology specifically. User guides, all going for £150. Contact Mr. Barnes, 6 Beam, Fareham, Hants, or phone Fareham 280642 after 6 pm any evening.

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Back numbers for PCW... Vol 1 Nos. 4, 6, 7, 9, 10, 12, Vol 2 Nos. 5, Vol 3 No. 2. Any reasonable price paid for the above — please telephone either William Clark 379836 or Mr WJ O’Mara, Mrs D. Sherman, 49, 4800 Bielefeld 1, Bielefeld.

Mk. 14 system... including cassette, RIU and PSU, Manchester area, phone 061-224 3806 even evenings.

People wanted... Anybody who has the Apple cartridge card. Anybody who may be the thinking of, or is implementing, a connection between a Hewlett Packard HP7225A Graph Plotter and an Apple. Anybody interested in a high speed ASCII interface to an Apple. Contact John P. Maher, Secretary, Thameside Computing Group, 6-9, 11, Moor Lane, Windsor, Berkshire, Institute of Engineers of Britain, Cantock’s Close, Pathfield, Reading. Telephone 0734 2161.

NATIONAL

ZX80 Users Club. Recently formed under Prof. Clive Sinclair’s £100 personal computer, the group’s aim is to create and share software written in "Sinclair BASIC" which will fit within the machine’s 1K RAM. Membership is open to anyone who wants to add to the software library and back up, or to distribute a newsletter. Address to write: ZUAC, 93 Coningham Road, London W6 7JX.

Ohio Scientific UK User Group. Independant of OSI, an impor- tant role will be the disentanglement of OSI information between members. Projects, newsletters and bulk buying will also be conducted. Contact either Mr J. Fieldhouse, 18 Seaford Road, Broadfield, Crawley, West Sussex or Mr J. Fieldhouse, 18 Seaford Road, Broadfield, Crawley, West Sussex (Crawley TR1 3TS... — phone 0224 24161.

Back Issues & Books...75 back issues of Kilobaud, Interface Age, TRS-80 Expansion Interface...160...16K RAM, 12K instructions — £65 ono. CC Soft rec and tapes — £300. Phone Coventry (0203) 72438.

Spare PIA interface board. Professionally built with 4K EPROM positions on Nascom board. Professionally built with instructions — £250 ono. Phone Bewdley (Worcs) 4021142708 EPROMS, plugs into Nascom bus terminator, extender board, professionally built with 4K Static RAM, assembly instructions and almost new software (mainly games and software manuals) (plus supplied manuals): £1500 ono. Can split system — phone 0632 876465 weekends/evening.

NATIONAL PERSONAL COMPUTER USERS ASSOCIATION. The NPCUA is implementing a connection between a Hewlett Packard HP7225A Graph Plotter and an Apple. Anybody interested in a high speed ASCII interface to an Apple. Contact John P. Maher, Secretary, Thameside Computing Group, 6-9, 11, Moor Lane, Windsor, Berkshire, Institute of Engineers of Britain, Cantock’s Close, Pathfield, Reading. Telephone 0734 2161.

USER GROUPS INDEX

Here are the details of additions and changes recently notified. If we have failed to include YOUR group (or have published incorrect information) either here or in the complete listing, then please address changes/additions to: PCW (User Groups Index), 14 Rathbone Place, London W1P 1DE. Finally, the next complete listing will appear in our August issue.

LONDON

A Croydon micro/small computer group is being formed at a meeting on April 23rd in the Central Reference Library, Rath- reis Street, in the Town Hall building — arrive at 7pm. A wide range of people interested in this move and there should be little difficulty in setting this multi-interest club. More details (and clarification of interest) are needed before anyone interested but who can’t come to the meeting) — contact Julian Gifford, 111 Seabour Street, London SE25 6LH.

MIDDLESEX

Harrow Computer Group. Meet in Harrow, Middlesex Wednesdays, 7pm in room G43 of Harrow College of Higher Education. They welcome anyone with an interest in computers but without a machine. At present they’ve 80 members and membership is free. For further information contact B. Cooper at 13 St Peter’s Close, Bushey Heath, Herts WD2 3LQ (01-950 7068).

SUSSEX

A Crawley computer club has recently been formed, open to anyone interested in personal computing, with or without computing facilities. The intention is to hold meetings weekly and to have monthly or bi-monthly newsletter. Details, contact either Mr J. Fieldhouse, 18 Seaford Road, Broadfield, Crawley, West Sussex or Mr J. Fieldhouse, 18 Seaford Road, Broadfield, Crawley, West Sussex (Crawley 542509). — or — Mr J. Clarke, 111 South Heath Court, Pond Hill, Outwood, Surrey, or Southend, Sussex (Crawley 848670).
This is different to the usual range of computer/TV games in that it is a game for two players. The board consists of randomly distributed grey and white rectangles. There are three men on the board: one starting on the bottom row and controlled by the right hand four keys on the top row of the keyboard; one on the top row and controlled by the four left hand keys and the third man starts in the middle and is controlled by the machine. From left to right the keys are LEFT/RIGHT/DOWN/UP.

The man who starts at the top of the screen can travel through blank or white squares. Each white square crossed becomes blank and counts as ten points. The bottom man can move through grey or blank squares. After the time expires, the man with the most points wins. A second way of winning is to make your man adjacent to (above, below or to one side) the robot man and simultaneously press the space bar. This will result in a win regardless of the points scored.

## PROGRAMS

### Nedge for UK01

by N E Berry

**Description:**

This program allows two players to compete against each other in a game similar to Nedge, but with enhanced graphics and additional features.

**Gameplay:**

- **Objective:** To capture the most territory on the screen.
- **Controls:** Use the keyboard or colonics to move the player pieces.
- **Winning:** The player with the most territory at the end of the game wins.
- **Features:** Includes a score display, a move log, and a variety of game modes.

**Instructions:**

1. Run the program on your UK01 computer.
2. Select a game mode and settings.
3. Play the game by moving your piece and capturing territory.
4. Use the score display to track your progress.
5. The game ends when time expires or both players agree.
6. The player with the most captured territory wins.

**Technical Details:**

- **Language:** Assembly
- **Platforms:** UK01
- **Compatibility:** Requires a UK01 computer with a compatible graphics display.
- **Requirements:** Basic programming knowledge.

**Credits:**

- **Programmer:** N E Berry
- **Graphics:** hand-drawn graphics
- **Sound:** none

**Notes:**

- **Troubleshooting:** May require minor adjustments to the program to work correctly on your specific hardware.
- **Future Enhancements:** Consider adding sound effects and more advanced AI for the robot opponent.

**Source Code Available:**

- **Download:** [Download Link](#)
- **GitHub:** [GitHub Repository](#)
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We also specialise in the repair of all makes of office equipment.

124 PCW
This BASIC renumberer is a re-write of a program sent in by D. J. Danziger of Manchester Grammar School. Mr. Danziger's original program was in BASIC-PLUS and as few readers will use this, we decided that it was worth the effort to transcribe it. If any readers do want a copy of the original, an S.A.E. will get it.

This version works very well, but readers are warned that it may be a little slow. The program reads through the BASIC file on disc that is to be renumbered and counts the lines. The maximum handled is 255 and anything over comma. This is the explanation of lines 300 to 340 of the Renumber listing. The program being renumbered may have many lines containing commas, especially in multiple-choice commands such as

- ON X GOTO 560,580,600
- and a simple READ command would read the line only up to the first comma. This is the explanation of lines 360 to 390 of the Renumberer listing. Line 360 will allow for up to 7 commas and if you think that you require more, these may easily be added.

Line 440 may look a little odd - notice that lonely capital T stuck on the end! - and the explanation is that the program searches each renumbered line for a match with GOSUB, GO SUB, THEN, GOTO and GO TO in turn.

**Basic renumber**
by Derrick Daines (YCW)

This BASIC renumberer is a re-write of a program sent in by D. J. Danziger of Manchester Grammar School. Mr. Danziger's original program was in BASIC-PLUS and as few readers will use this, we decided that it was worth the effort to transcribe it. If any readers do want a copy of the original, an S.A.E. will get it.

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Since on a multiple statement line a \texttt{GOSUB} statement could precede a \texttt{GOTO}, the order of their appearance in line 440 is quite important. Line 820 of the sub-routine detects the occurrence of inverted commas a \texttt{THEN}, but before a number, thus allowing numbers contained between inverted commas to be unaffected. Thus

\begin{itemize}
  \item \textbf{IF} \texttt{X=Y THEN 70} would result in an alteration of the 70, but
  \item \textbf{IF} \texttt{X=Y THEN PRINT “70”} would not.
\end{itemize}

Line 610 looks for the multiple choice command already mentioned, and line 650 looks for the multiple statement separator. Of course, if you have a colon between inverted commas you might be in trouble, but this is highly unlikely, and is not worth guarding against.

Without doubt, the program is highly effective at its job. At all times the original BASIC program remains intact on disc and the renumbered version is stored on the same disc under the name of \texttt{RENUMB}. Renumbering a 100-line program requires a few minutes.
Dogfight for UK101

All the instructions for this game are contained within the program, which uses just under 3K of RAM. Although written for the 101, it should be easily transferable to the Superboard II.

Dogfight for UK101

by John Popplewell

minimum 4k level II

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Minimum 16k level II

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480 270k/270k K15 £35. Built £60.
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The 426 & 416 are cased and have push-button selection.
Program any length block into the Eprem. button selection.

MK14 Frequency counter by J. W. Roston
This program displays, in digital form, the frequency of a signal input at SB.
It helps if OF800-OF817 are zeroed before running and if the CY/L is cleared.
Readout is in pulses per millisecond.

PROGRAMS

<table>
<thead>
<tr>
<th>301</th>
<th>GD=BE;GP=BX;GOSUB1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>310</td>
<td>BX=GP</td>
</tr>
<tr>
<td>320</td>
<td>POKEBX,32</td>
</tr>
<tr>
<td>325</td>
<td>W=0</td>
</tr>
<tr>
<td>340</td>
<td>GD=BE;GP=BX;GOSUB1000</td>
</tr>
<tr>
<td>345</td>
<td>LD=PEEK(CP)+GOSUB6000:IFW THEN360</td>
</tr>
<tr>
<td>350</td>
<td>GOSUB1000</td>
</tr>
<tr>
<td>352</td>
<td>LD=PEEK(CP)+GOSUB6000:IFW THEN360</td>
</tr>
<tr>
<td>355</td>
<td>BX=GP;POKEBX,46;GOTO177</td>
</tr>
<tr>
<td>360</td>
<td>FI=0</td>
</tr>
<tr>
<td>365</td>
<td>IFW THEN177</td>
</tr>
<tr>
<td>370</td>
<td>GOTO4000</td>
</tr>
<tr>
<td>999</td>
<td>REM ADD DIRECTION TO PLANES AND MISSILES</td>
</tr>
<tr>
<td>1000</td>
<td>IFG=1 THEN GP=1 RETURN</td>
</tr>
<tr>
<td>1010</td>
<td>IFG=2 THEN GP=2 RETURN</td>
</tr>
<tr>
<td>1020</td>
<td>IFG=3 THEN GP=3 RETURN</td>
</tr>
<tr>
<td>1030</td>
<td>IFG=4 THEN GP=4 RETURN</td>
</tr>
<tr>
<td>1040</td>
<td>IFG=5 THEN GP=5 RETURN</td>
</tr>
<tr>
<td>1050</td>
<td>IFG=6 THEN GP=6 RETURN</td>
</tr>
<tr>
<td>1999</td>
<td>REM NO FIRE IN PROGRESS PADDING</td>
</tr>
<tr>
<td>2000</td>
<td>FORDE.OT028NEXTDE.RETURN</td>
</tr>
<tr>
<td>2010</td>
<td>RETURN</td>
</tr>
<tr>
<td>3999</td>
<td>REM LEFT PLANE CRASH</td>
</tr>
<tr>
<td>4000</td>
<td>SR=SR+1</td>
</tr>
<tr>
<td>4005</td>
<td>FORZ=1T03</td>
</tr>
<tr>
<td>4010</td>
<td>POKEP1,1:FORZ=OT045+NEXTX</td>
</tr>
<tr>
<td>4020</td>
<td>NEXTI</td>
</tr>
<tr>
<td>4025</td>
<td>POKEP1,32</td>
</tr>
<tr>
<td>4040</td>
<td>IFPEEK(P1+64)=32 THENH1D1=1;P1=54095;GOTO130</td>
</tr>
<tr>
<td>4045</td>
<td>P1=P1+64</td>
</tr>
<tr>
<td>4050</td>
<td>GOTO4005</td>
</tr>
<tr>
<td>4999</td>
<td>REM RIGHT PLANE CRASH</td>
</tr>
<tr>
<td>5000</td>
<td>SL=SL+1</td>
</tr>
<tr>
<td>5005</td>
<td>FORZ=1T03</td>
</tr>
<tr>
<td>5010</td>
<td>POKEP2,1:FORZ=OT045+NEXTX</td>
</tr>
<tr>
<td>5020</td>
<td>NEXTI</td>
</tr>
<tr>
<td>5025</td>
<td>POKEP2,32</td>
</tr>
<tr>
<td>5040</td>
<td>IFPEEK(P2+64)=32 THENH1D1=2;P2=54135;GOTO130</td>
</tr>
<tr>
<td>5045</td>
<td>P2=P2+64</td>
</tr>
<tr>
<td>5050</td>
<td>GOTO5005</td>
</tr>
<tr>
<td>5999</td>
<td>REM HIT OR MIBB</td>
</tr>
<tr>
<td>6000</td>
<td>IF((LDL)228)+LDL(240)+THENW+2;RETURN</td>
</tr>
<tr>
<td>6010</td>
<td>IFLDL=32 THENW+1;RETURN</td>
</tr>
<tr>
<td>6020</td>
<td>RETURN</td>
</tr>
<tr>
<td>7000</td>
<td>FORZ=1T03</td>
</tr>
<tr>
<td>7010</td>
<td>POKEP2,1:POKEP1,1:FORZ=OT045+NEXTX</td>
</tr>
<tr>
<td>7020</td>
<td>NEXTI</td>
</tr>
<tr>
<td>7030</td>
<td>POKEP2,32;POKEP2,32</td>
</tr>
<tr>
<td>7040</td>
<td>IFPEEK(P2+64)=32 THENH1D1=2;P2=54135;P1=54097;RETURN</td>
</tr>
<tr>
<td>7050</td>
<td>P2=P2+64;P1=P1+64;GOTO7000</td>
</tr>
<tr>
<td>8000</td>
<td>PRINT &quot;DOUGAIGHT 1&quot;</td>
</tr>
<tr>
<td>8010</td>
<td>PRINT &quot;THE OBJECT OF THIS GAME IS TO SHOOT DOWN&quot;</td>
</tr>
<tr>
<td>8020</td>
<td>PRINT IFP+GORD.PLAYERS PLANE WITH A MISSILE</td>
</tr>
<tr>
<td>8030</td>
<td>PRINT &quot;A POINT IS SCORED FOR EACH SUCCESSFUL HIT&quot;</td>
</tr>
<tr>
<td>8040</td>
<td>PRINT IFP+GORD.PLAYERS ALSO GETS A POINT IF YOU CRASH</td>
</tr>
<tr>
<td>8050</td>
<td>PRINT &quot;MID AIR COLLISIONS RESULT IN ZERO SCORE FOR&quot;</td>
</tr>
<tr>
<td>8060</td>
<td>PRINT &quot;BOTH PLAYERS&quot;</td>
</tr>
<tr>
<td>8070</td>
<td>PRINT &quot;THE PLAYERS CONTROLS ARE&quot;</td>
</tr>
<tr>
<td>8080</td>
<td>PRINT &quot;LEFT&quot;</td>
</tr>
<tr>
<td>8090</td>
<td>PRINT &quot;RIGHT&quot;</td>
</tr>
<tr>
<td>8100</td>
<td>PRINT &quot;PLAYER I&quot;</td>
</tr>
<tr>
<td>8110</td>
<td>PRINT &quot;PLAYER II&quot;</td>
</tr>
<tr>
<td>8120</td>
<td>PRINT &quot;THE OPPONENT ALSO GETS A POINT IF YOU CRASH&quot;</td>
</tr>
<tr>
<td>8130</td>
<td>PRINT &quot;THE PLAYERS CONTROLS ARE&quot;</td>
</tr>
<tr>
<td>8140</td>
<td>PRINT &quot;LEFT&quot;</td>
</tr>
<tr>
<td>8150</td>
<td>PRINT &quot;RIGHT&quot;</td>
</tr>
<tr>
<td>8160</td>
<td>GOTO8000</td>
</tr>
</tbody>
</table>

OK
We lent this program to Adrian Stokes for checking on his system. These are his comments:

'This is a fairly interesting program which asks the user questions on general knowledge and arithmetic.

The program as printed is re-formatted from that supplied by the author to eliminate some of the North Star Horizon dependent features, specifically the use of "!" instead of 'PRINT' and multi-line conventions of North Star Basic. You may need to alter to suit your version of Basic.

The program avoids the use of ELSE is to overcome the knowledge that should be mentioned are that the answers (to the general knowledge questions) must be typed in upper case, questions are repeated - even if answered correctly, the format of the questions is inconsistent and the switch to 'harder' mode appears to be allowed an infinite number of times, with only the first having any effect.

However, for a fairly short program, it may provide some amusement and perhaps be of educational value.

And here is a description of the program taken from the authors REMARKS file:

**Maths test**
by D. Brewster

fairly easily by anyone implementing the program on their machine. Some that should be mentioned are that the answer (to the general knowledge questions) must be typed in upper case, questions are repeated - even if answered correctly, the format of the questions is inconsistent and the switch to 'harder' mode appears to be allowed an infinite number of times, with only the first having any effect.

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<td>5200 CPU, as above but 4MHz</td>
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<td>Z80 CPU Board, 4 MHz, A/T jump-on-Reset</td>
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Double sided, double-density floppy disc system running 280K bytes formatted, including controller board (RSU) and interfacing £49.00.

NASCOM HARDWARE
Motherboard: £5.50 + VAT + 50p P
Mini Motherboard: £2.90 + VAT + 50p P

NASCOM SOFTWARE ON TAPE
8K BASIC £15.00 + VAT
ZEP 2: £30.00 + VAT + 50p P
NAS-SYS 1: £25.00 + VAT + 50p P
NAS-OIS disassembler (3.1608 EPROMS) £75.00
Zeap Assembler (4, 1Kx8 EPROMS) £50
16-way parallel port; 8K BASIC. NAS-SYS operating monitor. £30.00 + VAT + 50p P

EMULATION

Microprocessor board* (Nascom 2) £12.50 each
57 key solid state keyboard £10.00 each
USB 1200 baud printer £29.50 each

ORDER FORM
Send your orders to: Interface Components Ltd, Oakfield Corner, Sycamore Road, Amersham, Bucks HP6 6SU.
Tel:02403 22307. Telex: 837788.

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Quantity
Price

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Quantity
Price

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PCW 156

All prices exclude VAT

---

**IEEE-488/PET INTERFACES**

**Type B**
- Bidirectional serial interface is fully addressable and can have split BAUD rates
- £186

**Type C**
- Serial interface - output only
- PET disk, compatible, RS232 C Handshake (Printer Busy), switch selectable BAUD rates, Listen Address link selectable.
- £120

**Type CS**
- Serial interface output only with switchable character sets to match the new PET's lower case Screen mode, otherwise as Type C.
- £132

All interfaces are crystal controlled

**Type G.P.I.A.P.**
- Micro-based, bidirectional with buffering. The General Purpose Interface allows free use of PET's INPUT # statement without hangup problems. Software changeable BAUD rates optional features include: Second Serial I.O. Port, 20 mA Loop I.O.
- £249

**Addressable parallel (disc compatible)** for Centronics, Anadex etc.
- £106

**Non addressable parallel**
- £45

**TV/Video monitor interface**
- £35

**Real Time Audio Spectrum Analyser for Commodore PET Microcomputer**
- 32 Channels 1/2 Octave Filters, 1K ROM ROUTINES on board for analysis and graphical display. USR Functions for linkage to PET basic operating system
- £450

**PET MEMORY EXPANSION BOARDS INTERNALLY MOUNTED**

<table>
<thead>
<tr>
<th>Size</th>
<th>Price</th>
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<tr>
<td>24K</td>
<td>£328</td>
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<td>32K</td>
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**S100 BOARDS**

**Dynamic Memory Boards**
- IEEE-S100 Specification Timing
- Transparent on Board Refresh
- 4Mhz Z80 Operation with no wait states.
- Fully tested and Burned In
- Bank Select versions available – North Star, Cromemco and Alpha Micro I.O. Port Bank select
- Bank Size to 64K in 16K increments

<table>
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<tr>
<th>Size</th>
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<td>64K</td>
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**P&T IEEE-488 Interface**
- Provides S100 computers with IEEE-488
- £350

Controller, Listener, Talker, Capability

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**Softcentre RANGE**

DOZENS OF EXCITING, INTERESTING & EDUCATIONAL PROGRAMS, HOST WITH SUPERB GRAPHICS & MANY WRITTEN BY JIM BUTTERFIELD

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**P.S. LOTS OF SOUND & PRINTER PROGRAMS IN THE RANGE**

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16K RAM, up to 16K EPROM, 2 SERIAL PORTS!
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IDS PCI:10 Process Control Interface, opto-isolated, TTL and analogue inputs, relay, TTL and analogue outputs (multichannel)

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IDS 10C 2 Serial, 2 Parallel port I/O Controller.
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3716, 400nS Single supply EPROM EA £19.95
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XREF Program cross-reference... £5.95
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C - IS FOR COMMODORE
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- New keyboard PETS available on all sizes, (8K, 16K & 32K).
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* on purchases exceeding £900

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We also stock the Computhink Disk Drive and Printer/s, Anadex and Paper Tiger Printers.
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Professional Computer Kit

AT
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100% compatible with all 8080A and 8085 software. Runs at 3MHz.
Mother Board (Level A) with 2 S-100 pads expandable to 6 (Level C).

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2K Monitor ROM
4K WORKSPACE/USER RAM
1K Video RAM
8K Microsoft BASIC in ROM

INTERFACES
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binary counter/timer. Direct interface for any S-100 Board.
FULL Buffering decoding for S-100 Bus pads, wait state generator for
slow memory. Each stage has separate 5v 1A regulator for improved
isolation and freedom from cross talk. P.S.U. requirements: 8v 6.3v AC.
Runs with North Star controller and Floppies/CPM: EXPLORER/85 is
expandable to meet your own requirements with easy to obtain S-100
peripherals. EXPLORER/85 can be purchased in individual levels, kit
form or wired and tested OR as a package deal as above.

Hitachi Monitor 9"
£127

16k Dynamic RAM Kit
Expandable to 64K on one S-100 board in 16K increments, designed for
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<table>
<thead>
<tr>
<th>Advertiser</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Data</td>
<td>152</td>
</tr>
<tr>
<td>Acorn Computers</td>
<td>37</td>
</tr>
<tr>
<td>ACT Microsystems</td>
<td>96</td>
</tr>
<tr>
<td>Acubab</td>
<td>81</td>
</tr>
<tr>
<td>Advanced Computer Products</td>
<td>156</td>
</tr>
<tr>
<td>Airmanco</td>
<td>14/22</td>
</tr>
<tr>
<td>Almac Data Systems</td>
<td>15</td>
</tr>
<tr>
<td>Amazing Games</td>
<td>143</td>
</tr>
<tr>
<td>Appleware</td>
<td>76</td>
</tr>
<tr>
<td>Audiogenic</td>
<td>3</td>
</tr>
<tr>
<td>B &amp; B</td>
<td>26/27</td>
</tr>
<tr>
<td>Beaver Computers</td>
<td>154</td>
</tr>
<tr>
<td>Bell</td>
<td>17</td>
</tr>
<tr>
<td>Benchmark</td>
<td>166</td>
</tr>
<tr>
<td>Bits &amp; Pc's</td>
<td>165</td>
</tr>
<tr>
<td>BNR &amp; ES</td>
<td>158</td>
</tr>
<tr>
<td>Bristol Software</td>
<td>67</td>
</tr>
<tr>
<td>Business &amp; Leisure</td>
<td>83</td>
</tr>
<tr>
<td>Business Electronics</td>
<td>3</td>
</tr>
<tr>
<td>Buss Stop</td>
<td>184</td>
</tr>
<tr>
<td>Calco</td>
<td>28</td>
</tr>
<tr>
<td>Camden Electronics</td>
<td>148</td>
</tr>
<tr>
<td>Carter</td>
<td>152</td>
</tr>
<tr>
<td>CCS</td>
<td>35</td>
</tr>
<tr>
<td>Centralex</td>
<td>158</td>
</tr>
<tr>
<td>Clearsons</td>
<td>3</td>
</tr>
<tr>
<td>Comart</td>
<td>101/110</td>
</tr>
<tr>
<td>Commodore</td>
<td>43</td>
</tr>
<tr>
<td>Comp Shop</td>
<td>168/169</td>
</tr>
<tr>
<td>Computerama</td>
<td>133</td>
</tr>
<tr>
<td>Computer Consultancy</td>
<td>144</td>
</tr>
<tr>
<td>Computer Factory</td>
<td>28</td>
</tr>
<tr>
<td>Computer Shop</td>
<td>22</td>
</tr>
<tr>
<td>Computopia</td>
<td>150</td>
</tr>
<tr>
<td>CR</td>
<td>81</td>
</tr>
<tr>
<td>Crystal Electronics</td>
<td>150</td>
</tr>
<tr>
<td>Cumana</td>
<td>140</td>
</tr>
<tr>
<td>Currah</td>
<td>146</td>
</tr>
<tr>
<td>Datron</td>
<td>114</td>
</tr>
<tr>
<td>Davinei</td>
<td>166</td>
</tr>
<tr>
<td>DDP</td>
<td>109</td>
</tr>
<tr>
<td>Digital Design</td>
<td>35</td>
</tr>
<tr>
<td>Display Electronics</td>
<td>137</td>
</tr>
<tr>
<td>John Dobson</td>
<td>18</td>
</tr>
<tr>
<td>Equinox</td>
<td>29/144</td>
</tr>
<tr>
<td>Facit</td>
<td>11</td>
</tr>
<tr>
<td>Farmland</td>
<td>157</td>
</tr>
<tr>
<td>Gate Microsystems</td>
<td>146</td>
</tr>
<tr>
<td>GP Industrial Electronics</td>
<td>143</td>
</tr>
<tr>
<td>GW Computers</td>
<td>20/21</td>
</tr>
<tr>
<td>Happy Memories</td>
<td>138</td>
</tr>
<tr>
<td>Healy</td>
<td>28</td>
</tr>
<tr>
<td>Henry's</td>
<td>145</td>
</tr>
<tr>
<td>Hewarts</td>
<td>161</td>
</tr>
<tr>
<td>Hitech Electronics</td>
<td>142</td>
</tr>
<tr>
<td>HL Audio</td>
<td>164</td>
</tr>
<tr>
<td>Home &amp; Business</td>
<td>35</td>
</tr>
<tr>
<td>Intelligent Artefacts</td>
<td>165</td>
</tr>
<tr>
<td>Interactive Data</td>
<td>134</td>
</tr>
<tr>
<td>Interface Components</td>
<td>155</td>
</tr>
<tr>
<td>Intex Datalog</td>
<td>145</td>
</tr>
<tr>
<td>Kansas City Systems</td>
<td>165</td>
</tr>
<tr>
<td>Kent Computers</td>
<td>40</td>
</tr>
<tr>
<td>Kingston Computers</td>
<td>24</td>
</tr>
<tr>
<td>Knights</td>
<td>162</td>
</tr>
<tr>
<td>L &amp; J Computers</td>
<td>145</td>
</tr>
<tr>
<td>Leiceter Computers</td>
<td>161</td>
</tr>
<tr>
<td>Lifeboat Associates</td>
<td>32/33</td>
</tr>
<tr>
<td>Lion Microcomputers</td>
<td>23</td>
</tr>
<tr>
<td>Linsack</td>
<td>167</td>
</tr>
<tr>
<td>Little Genius</td>
<td>135</td>
</tr>
<tr>
<td>Ladybird</td>
<td>134</td>
</tr>
<tr>
<td>L.M.B. Computers</td>
<td>82</td>
</tr>
<tr>
<td>Logitek</td>
<td>93/104/106</td>
</tr>
<tr>
<td>London Computer Store</td>
<td>132</td>
</tr>
<tr>
<td>LP Enterprises</td>
<td>34</td>
</tr>
<tr>
<td>Ludhouse</td>
<td>160</td>
</tr>
<tr>
<td>Mendip</td>
<td>157</td>
</tr>
<tr>
<td>Microbits</td>
<td>135</td>
</tr>
<tr>
<td>Microcentre</td>
<td>110</td>
</tr>
<tr>
<td>Microsolve</td>
<td>141</td>
</tr>
<tr>
<td>Microbyte</td>
<td>135</td>
</tr>
<tr>
<td>Microcentre</td>
<td>1FC</td>
</tr>
<tr>
<td>Micros</td>
<td>73</td>
</tr>
<tr>
<td>Microtrend</td>
<td>67/69/71</td>
</tr>
<tr>
<td>Micro UK</td>
<td>9</td>
</tr>
<tr>
<td>Mighty Micro</td>
<td>112</td>
</tr>
<tr>
<td>Mike Rose Micros</td>
<td>2</td>
</tr>
<tr>
<td>Mitek</td>
<td>16</td>
</tr>
<tr>
<td>Mitex</td>
<td>17</td>
</tr>
<tr>
<td>North West</td>
<td>164</td>
</tr>
<tr>
<td>On Line Conferences</td>
<td>120</td>
</tr>
<tr>
<td>Opteleco</td>
<td>164/156</td>
</tr>
<tr>
<td>Personal Computers OBC/106</td>
<td>155</td>
</tr>
<tr>
<td>Petalet</td>
<td>148</td>
</tr>
<tr>
<td>Pet Show</td>
<td>10</td>
</tr>
<tr>
<td>Petsoft</td>
<td>54/55</td>
</tr>
<tr>
<td>Pipes</td>
<td>152</td>
</tr>
<tr>
<td>Q-Tek</td>
<td>163</td>
</tr>
<tr>
<td>Research Machines</td>
<td>31</td>
</tr>
<tr>
<td>Rostronics</td>
<td>163</td>
</tr>
<tr>
<td>Science of</td>
<td>102/103</td>
</tr>
<tr>
<td>Sintrom Microshop</td>
<td>44</td>
</tr>
<tr>
<td>Sirius Products</td>
<td>153</td>
</tr>
<tr>
<td>Small Systems</td>
<td>151/156</td>
</tr>
<tr>
<td>SMG Micros</td>
<td>160</td>
</tr>
<tr>
<td>Southern Software</td>
<td>157</td>
</tr>
<tr>
<td>Stack</td>
<td>19/164</td>
</tr>
<tr>
<td>Strumech (SEED)</td>
<td>68</td>
</tr>
<tr>
<td>Sun</td>
<td>30</td>
</tr>
<tr>
<td>System Micros</td>
<td>35</td>
</tr>
<tr>
<td>Tandy</td>
<td>4/5</td>
</tr>
<tr>
<td>Tangerine</td>
<td>138</td>
</tr>
<tr>
<td>Telesystems</td>
<td>159</td>
</tr>
<tr>
<td>Terminal Display</td>
<td>81</td>
</tr>
<tr>
<td>Tex</td>
<td>150</td>
</tr>
<tr>
<td>Theydon Computers</td>
<td>147</td>
</tr>
<tr>
<td>Transam</td>
<td>114</td>
</tr>
<tr>
<td>Tridata</td>
<td>142</td>
</tr>
<tr>
<td>TJV Microcomputers</td>
<td>12/13</td>
</tr>
<tr>
<td>U Micros</td>
<td>159</td>
</tr>
<tr>
<td>Xitan</td>
<td>25</td>
</tr>
</tbody>
</table>

Chris ("Spangles" to all you early Radio Caroline aficionados) Cary of the Comp Shop disclosed recently how his outfit came to be labelled "The New Barnet Mafia"; apparently he knows the power of real money and pays on the spot for whatever he buys, using a currency known among desperados as "the suit's", Sinclair simulation time! On your marks, Uncle Clive, for on your tail are amounted to be a clutch of ZX80 imitators. But I wonder how they'll fare getting hold of ROMs and TTLs? ... Better early than on time - or so think the PR anyway) is to be June 14; the real date of launch (UK anyway) is to be June 14; apparently it's de rigeur to announce such things at the Hanover Fair, even though the real date of launch (UK anyway) is to be June 14; apparently it's de rigeur to announce such things at Hanover... Word reaches me that Nascom is being ever so careful to deny that (a) a price-hike is on the way and (b) their machines are selling like crazy; dealers are looking far too happy as they shake their heads... Surely misunderstood by our own pet ferret - Curry's Derek "Mr Suds" Moon uttering something along the lines that you can't believe what you read in the mag, because the editorial's all been bought... also it sounds like there may be a few hiccups with "The Curry's Promise" (equipment/expertise over the high street counter, up and down the land): only Suls really knows the score - and he's not telling. Oh well, there's always washing machines... Well I never Dept: word has it that during the Great Byte Shop Trauma of some months back, Robin Wood of Isherwoods actually entered a bid. It's said it was ex-Computer Weekly Micro News Editor, Martin Banks, who dissuaded him from such megalomaniac dreams... Giggle of the month: remember the offer of a fiver to the first person to tell us who wrote the BASIC for the Sinclair ZX80 (Uncle Clive was keeping schtum)! Well, we received the following phone call: (little voice) "Tell me - can I tell you who wrote the BASIC for the ZX80". "Can you indeed", replied Dave Tebbutt, "who was it?" "John Grant" piped the reply. "Very interesting" replied Dave and, more suspiciously, "how old are you"? "Ten", "And what's your name"? "Crispin Sinclair!!", "Does your dad know you're ringing"? "Oh, well, no - I thought I'd ring to claim the fiver before he did". Watch it Clive, you're raising your own takeover bid!"
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