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SINCLAIR

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QL WORLD

DO-IT-YOURSELF ARCHIVING

FILE TRANSFERS

THE NEW FLASHBACK

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1731
PRINTED IN ENGLAND U.S.A. Order No. 102-60-CN

SCHÖN

PERSONAL COMPUTER PRODUCTS

NORTHCOTE CRESCENT (04865)
WEST HORSLEY 3836
SURREY KT24 6LX, U.K.

WARNING — GUARANTEE

Now that Sinclair QL World has left the newstands we would like to suggest that you should contact us so that we can add your details to our database. We will then send you details of new products as and when they become available.

We will soon be sending out specification sheets for TRANSFORMER as well as priority order forms. To ensure that you are informed of the latest developments, contact us today!!

SCHÖN STANDARD KEYBOARD

The most popular add-on keyboard for the QL. Same key layout as original but incorporates full travel, two-shot moulded keys. Expansion, ROM ports and microdrives unaffected. Comes complete with anti-bounce device and QL top cover including LED's. Simple installation. No soldering, 5 mins. Please call for free spec sheet. Both keyboards have 1 yr+ guarantee. **Fantastic value at only £35.00 inc VAT.**

SCHÖN PS/2 STYLE KEYBOARD

The absolute ultimate add-on keyboard is now available for the QL. The Schön PS/2 style keyboard. It is the perfect tool for the discerning QL enthusiast and has many extra keys. In total the Schön PS/2 style keyboard has 102 keys and includes separate numeric and cursor pads, Home, End, Page Up & Dn, Del & , SKIP & SOLN, EOLN, RECALL, Caps, Scroll & Num Lock (illuminated), SYS REQ, BREAK, Del Line, diagonal cursor keys AND yes . . . SINGLE KEY UNDERSCORE!! **R.R.P. £114.95 includes I/F and QL top cover with LED's. CALL NOW FOR FREE SPEC SHEET.**

SCHÖN KBL 128 QL CASING

This is a special product intended for the enthusiastic QL owner with electronic knowledge. The KBL 128 comprises of an inner metal chassis and a strong outer ABS casing. Complete with 64 way 'flip-back' connector to allow expansion devices to sit on top of the QL PCB. Casing is suitable for QL PCB, drives, PSU, and all expansion devices. A highly rewarding DIY challenge for the QL owner with the '4ft long' problem. Works superbly in conjunction with the new Schön PS/2 style keyboard. Call for spec sheet and chat about converting your QL. **R.R.P. £65.00 including VAT.**

SOFTWARE

DISKTOOL

Features include:

- max. formatting capacity 1512 sectors
- Hyperfast disk copying
- Single and dual drives supported
- Disk password protection
- Uses QJump Pointer Environment
- QuickDisk speeds up every access on a once converted disk by 30%

Disktool & QuickDisk £14.95
Disktool (alone) £9.95
QuickDisc alone (alone) £7.95

NEW SOFTWARE NEW

CARD
By ULTRASOFT

Card is a small user-friendly database utility to handle simple database applications. Features include:—

- ★ Compatible with QJump Pointer Environment
- ★ Dynamic memory allocation
- ★ Fast SEARCH and SHORT algorithms
- ★ Fully multi-tasking
- ★ 100% machine code
- ★ HOTKEY accessible
- ★ On-screen HELP facility

Card comes complete with Pointer Environment and CONFIG program and is available on 3.5" disk for £14.95. Please call for details.

SOFTWARE

TOOLKIT III
By ULTRASOFT

Toolkit III is the ultimate enhancement for Supertoolkit II. Features include:—

- ★ Fully operational sub-directory structures
- ★ New files attributes: READ ONLY, USER AREAS, etc
- ★ Unique MEM device to access memory as a file
- ★ Fast and flexible database commands
- ★ Extensions to old Superbasic and TK2 commands
- ★ Commands for advanced memory access
- ★ 100% compatible to QJump Pointer Environment

Available on 3.5" for £19.95 or EPROM for £24.95

S-EDIT

S-EDIT is the fastest screen editor available for the QL, giving you maximum value for money. A flexible tool to be used by the novice or experienced programmer, whenever ASCII editing is necesssary.

Features include:

- — Hyperfast search and replace options
- — Flexible block handling
- — Resizeable and moveable window
- — On-screen HELP facility
- — TK3 sub-directories accessible
- — Allows binary file editing

S-EDIT comes with Q-JUMP Pointer Interface and CONFIG program.

NEW SOFTWARE NEW

THE PAINTER

The latest piece of professional software from the Continent to become available in the U.K. The Painter is a totally new, totally complete user-friendly graphics/CAD package for the QL. All menus are full screen and icon controlled. The Painter allows up to 12 full screens to be designed at once in 4 or 8 colours. ★ User variable zoom command ★ Spectacular screen edit facility for close up full cover pixel work (displays mina-

EXTRAS

EXTRAS FOR SCHÖN PRODUCTS

Anti-bounce Device (for Schön Standard Keyboard) £6.00
Black PVC Dustcover for PS/2 Style Keyboard £4.95
12 V Slimline cooling fan for use with Schön KBL 128 Casing £24.95

All 'extras' prices include VAT and P&P

TRANSFORMER

To be released soon, **TRANSFORMER** is to be the fastest PC/MS DOS emulator for the QL. Prototype, consisting purely of hardware to slot in expansion port, is already operating twice as fast as competing products. All software is supplied on ROM on circuit board as well as hardware based CGA. **TRANSFORMER** is supplied with through connector. Developed overseas and constructed in the UK. We strongly suggest that you should consider waiting for a more reliable solution for PC/MS DOS emulation.

Price: TO BE ANNOUNCED

THE PAINTER

ture full screen simultaneously) ★ Work screen/menu screen (wrapping is instantaneous) ★ Normal drawing commands (line, square, circle, etc; as well as more unusual requirements) ★ Requires at least 256K and comes on 3.5" disk complete with manual. All drawings produced on The Painter can be incorporated in other graphics/DTP programs. The Painter retails at **£29.95** including VAT. Please call for more details.

PRODUCT & CARRIAGE COSTS

Schön Standard Keyboard .....£35.00 P&P @ £2.00
Schön PS/2 Keyboard .....£114.95 P&P @ £3.00
Schön KBL 128 Casing .....£65.00 P&P @ £3.00

All software advertised is priced as stated above. Postage is included on all software. Overseas customers please call for export prices. European customers contact **Ultrasoft, Vennhauser Allee 218, 4000 Dusseldorf 12, W. Germany**. All software is supplied on 3.5" unless otherwise stated.

MS DOS is a trademark of Microsoft Corp.
PS/2 is a trademark of IBM.

ORDER FORM/DATABASE FORM

Please send me the following product(s) to the address below.

Product(s) .....
Mr/Mrs .....
Address .....
.....
..... P/Code .....
Tel ..... Amount Enclosed £.....

Please tick box for database inclusion ☐

PLEASE REMEMBER POSTAGE!! and don't forget to get on our product database. Pleaase allow up to 28 days for delivery.

SINCLAIR QL WORLD

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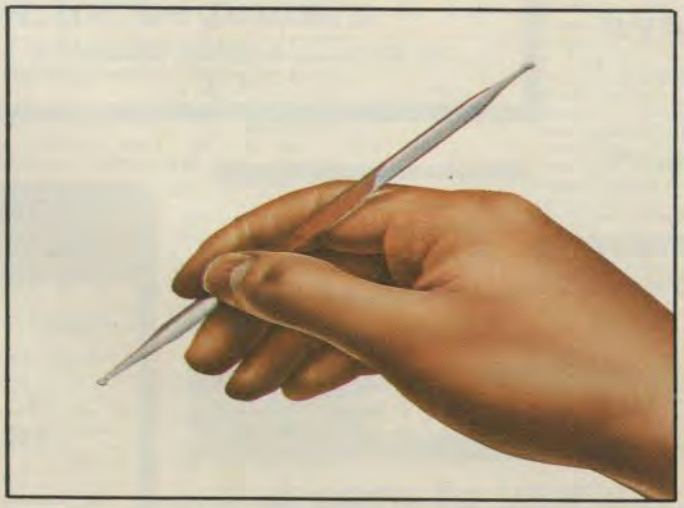

NEXT MONTH

FLASHBACK — THE MODULES

Bryan Davies looks at the modules which accompany the recent Flashback update.

OF MICE AND ART

Old masters and young Painters seen through Ron Massey's critical eye.

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THE SOLUTION

In the past four issues of QL WORLD, our advertisements have fully described the SOLUTION PC Emulator, the magic program that turns your expanded disk-equipped QL into a PC, automatically.

In the last issue of QL WORLD, SOLUTION received a rave review, fully supporting all our claims. SOLUTION was strongly recommended, being described as being "remarkably competent", "effortless" to use, accompanied by "comprehensive documentation". SOLUTION after-sales support was praised, and the "thoroughness" of SOLUTION's coding was complimented. Even more importantly, the extremely high PC compatibility of SOLUTION was confirmed - "SOLUTION ran industry standard programs without hesitation. Given the acid test of running Flight Simulator SOLUTION was again successful...". New Computer Express too has recently highly praised SOLUTION, as have several other leading journals.

SOLUTION users among the general public have been very enthusiastic too. Here is the unsolicited feedback:
"Congratulations - SOLUTION is brilliant." F.Wiseman, Newport; "Congratulations on SOLUTION - great!" R.A.Crawford, Ayr; "The SOLUTION is an excellent start into the IBM system without spending the earth. It is capable of all the claims." L.Chandler, Peterborough; "SOLUTION is very good - I am having a lot of success with it. Well done!" J.Muldoon, London; "SOLUTION is a real boon ... LIGHTNING is excellent, and EDITOR is now indispensable." J.Osmond, Leicester; "SOLUTION is the first Digital Precision program I have tried and I am impressed." E.Pendleton, Culceth; "I'm really happy with SOLUTION - no problems at all." T.Batchelor, Portslade; "I bought the Chocolate SOLUTION, I want to thank you for doing a great job. SOLUTION works perfectly well. It even works in conjunction with the Pointer environment. SOLUTION is one of the best programs ever released for the QL." O.Fink, Oberursel; "Let me tell you my astonishment about SOLUTION: I am not very good in programming, my little knowledge makes me able to appreciate the enormous work inside SOLUTION." A.Pellis, Udine; "There is no software that I've tried with SOLUTION that hasn't worked. I'm very pleased with it." A.Cherry, Kettering; "Everything works fine - SOLUTION works. I think you did a very good job with it." J.van Hulten, Roermond; "SOLUTION is a first class product ... fantastic. I only wish it had been available years ago. I will certainly recommend it to anyone who has a QL." R.Burns, Kilbirnie; "I must say how impressed I am with SOLUTION ... thank you, I would like to record my appreciation. I'm most impressed with the performance." J.Vennard, Stockport; "I'm happy with the emulation." J.Acielo, Yanbu; "SOLUTION is a major software product. Congratulations! SOLUTION has a VERY good compatibility degree with MS-DOS. Advanced PC-Tools 5.0 gave a 15% speed measurement relative to an XT." E.Forenzi, Berbenno; "Congratulations for SOLUTION are due, of course (in abundance!)" P.Coughlin, Exeter; "Many thanks (for SOLUTION) - programs running satisfactorily." Prof D.Sansome, Brierley Hill; "The SOLUTION is GOOD!" J.Pollitt, Stoke Nelson; "Congratulations on SOLUTION." S.Marwah, Bombay; "SOLUTION works very well and I am pleased with it." J.Danjou, Pordic; "I purchased the SOLUTION - thank you for publishing it!" M.Binstock, Pgh PA; "SOLUTION runs OK. I'm pleased that SOLUTION does as advertised - but why else do I shop with you guys and from no one else?" M.Smith, Strommen; "The graphics are really wonderful, stunning - more realistic than a Compaq. I tried FIVE different versions of DOS and all ran." B.Papegay, Harderswyk.

We do not enjoy writing knocking copy - however, it is our public duty to warn members of the public about garbage they might waste their money on. We published an expose about the awful program marketed, advertised and hyped by Schon, billed in their recent QL WORLD advertising as "The only alternative IBM PC Emulator ... Now distributed solely by Schon, this long awaited program, that the experts said WAS possible, include all the expected features of a PC Emulator .... All our products have been of superb quality in the past - TAKE A LOOK AT THIS ONE!!". We are happy to note that our public-interest warnings were more than fully backed up by QL WORLD's editorial and independent review (QL WORLD May 1989 issue), which described the so-called alternative as "unwelcome", "clearly unfinished" and "not capable of running any of the popular MS-DOS programs mentioned". QL WORLD went on to report that most software did not even load, and the few programs that succeeded to load failed - with only ONE exception - to run at all - "attempts to load programs under CGA proved fruitless", ALL other programs - even simple, mickey-mouse MDA ones - "exhibited such unusual behaviour that they were impossible to use". ALL the leading brand software "crashed very quickly" - even GW-BASIC "loaded with a corrupted display and failed to acknowledge anything typed on the screen", other software loaded with "garbled" screen output and lock-ups, even various important (key!) PC keys were apparently inaccessible... QL WORLD went on to report that the so-called alternative "wreaks havoc" with QDOS, and even "SuperBASIC inevitably crashes". The program Schon claims (March 1989 QL WORLD, inside front cover) to be fully multi-tasking, comprehensively documented and having CGA and MDA emulation was found by QL WORLD's technical reviewer to be "rushed, unfinished, bug-ridden, incomplete and poorly-documented", "unusable in any meaningful way" and "does not begin to match" the programmer's advertised specifications "which more properly describe the programmer's intentions rather than his achievements." All that we would add to QL WORLD's timely warning is a caution about further so-called PC Emulators - perhaps bearing different names - from the same sources, accompanied by all sorts of tempting, ambitious and inventive advertising claims. For those of you to whom these warnings - and the ones given by QL WORLD's Troubleshooter - come too late - well, we told you so. Go to a Trading Standards office, a Citizens' Advice Bureau or a solicitor. And next time, be a little more street-wise, and listen to Digital Precision.

SOLUTION is a superbly crafted utility, representing many man-years of work by the best QL programmers. With it your QL becomes a PC (more PC compatible than quite a few clones!) - that really does say it all. SOLUTION is supplied with many extras, including full bi-directional file transfer between QDOS and MS-DOS (which allows you to move your existing QL data to a PC or to be manipulated by PC software under SOLUTION). No incompatibility-introducing hardware is involved with SOLUTION - our solution is clean and hassle-free. SOLUTION will work on hard disk too, sharing disk space with QDOS!

SOLUTION is available NOW, for IMMEDIATE DESPATCH - it was released on 20th February 1989. The program costs either £79.95 or £129.95, depending on whether or not you order MS-DOS v4.0 with it (specify VANILLA SOLUTION or CHOCOLATE SOLUTION respectively).

As an extra special summer deal for purchasers of SOLUTION before 15th June 1989, we make you the following offer:

PURCHASE SOLUTION (either VANILLA or CHOCOLATE) AND CLAIM, against Digital Precision software bought at the same time:
* 40% OFF EDITOR (STANDARD EDITION)
* 30% OFF TURBO SUPERBASIC COMPILER and/or SUCCESS CP/M EMULATOR
* 20% OFF SPECIAL EDITION EDITOR and/or SUPERCHARGE
* 10% OFF ALL OTHER DIGITAL PRECISION SOFTWARE, INCLUDING SPECIAL DEALS, EXCLUDING ONLY UPGRADES.

Even better news - these offers are not mutually exclusive, so if you order SOLUTION, TURBO, SPECIAL EDITOR and PROFESSIONAL PUBLISHER, you get 30% off TURBO, 20% off SPECIAL EDITOR and 10% off PRO PUBLISHER, a saving of £49 (plus another £4 for buying 4 programs - see Super Special Deals).

Alternatively, you could compute the order as being SOLUTION, TURBO and Special Deal C - in which case you would save £15 on Deal C plus a further 10%, 30% on TURBO and £3 for buying 3 programs (Special Deal combinations count as one program for this purpose - upgrades do not count) - a total saving of £60!

And order LIGHTNING, the QL accelerator program, at the same time and save a further 10% ON THE LOT (excluding the £50 MS-DOS component of Chocolate SOLUTION, which is not a Digital Precision program and is already too heavily discounted to give us any leeway)- bringing, in the last example, the total saving to a massive £85! We ARE being generous this summer!

So don't get problems - get the SOLUTION. NOW. The difference is incredible.

DIGITAL PRECISION

THE EDITOR SPECIAL EDITOR

Text handling par excellence

These are the ultimate file–handling programs for your favourite computer. A new concept in hyperspeed information manipulation, Editor serves as a word processor, printer driver, database and programming environment. You name it, Editor does it. Its logic and consistency of approach put Editor in a class of its own. Special Editor only works on expanded machines – it takes the QL to its very limits, and is ideal for handling documents, manuscripts, books etc.

TURBO

The supreme SuperBASIC compiler

Turbo is compatible with the entire syntax of SuperBASIC. Its friendliness, features, tolerance, flexibility and fast operation are legendary. TURBOcharged programs run upto 100x faster than BASIC ones . TURBO is supplied with a general–purpose, two–hundred command toolkit.

PRICES SLASHED!

LIGHTNING

The complete QL speed enhancement system

Lightning accelerates the QL's text, graphics, screen and mathematical operations by mind–blowing factors of up to 14x. No technical knowledge or programming is required. Simple to use, but with many bells and whistles - 78 fonts, new nul device, user–variable precision, character-drain, modechange suppression...

DESKTOP PUBLISHER DTP SPECIAL EDITION

These programs provide wysiwyg document design, with a huge. number of RAM and device resident lo–res and hi–res fonts, continuously variable X & Y magnification, compatibility with Editor, Quill and Eye–Q, a preview function, comprehensive graphics facilities, flexible cut & paste, pixel justification etc. Both versions require expansion RAM, and Special Edition is disk only. The Special Edition is supplied with a free copy of grafiX, the well–known PDQL printer controller. Both versions work best with Eye–Q and Editor.

PRICE SLASHED!

DIGITAL C

A C compiler for beginners

Truly portable, but carefully tailored and optimised to produce fast, concise code on the QL. No cash crop conversion this!

SUCCESS

The supreme CP/M Code Emulation System

Converts the QL into a fully compatible CP/M operating environment. No ifs, buts or almosts. Run thousands of the world's favourite programs on your QL NOW! Emulates Z80 too!

For full program specifications refer to the July 1988 QL World

£10 off The Editor and/or ACT Special Edition if bought with anything else

IDIS

The first intelligent disassembler for the QL

The ideal disassembler for beginners – with IDIS you do not need to be an expert to crack other people's programs

3D PRECISION

A dream to use

Provides every facility for swiftly designing and manipulating three dimensional objects in real time. You have complete control over perspective, magnification and position, and you can create lines, surfaces, objects and worlds (groups of objects). Needs extra RAM..

MEDIA MANAGER SPECIAL EDITION

NEW

Media Manager is a very early DP release with oodles of functions. However, the design and user-friendliness of the system was not quite up to the standard of Digital Precision's other programs.
Consequently, we have spent a great deal of time rationalising and improving Media Manager, making it much easier to use, much faster, more powerful and more flexible. The result – Media Manager Special Edition. A classic release, a must for everyone who uses the QL to store things of value. Not that MMSE is just for when things go wrong – it is a manager too, with a host of medium control functions. And if you can program, we've supplied SuperBASIC extensions for every conceivable device control.
Additional features include the facility to read from, write to (and even format) IBM MSDOS/PCDOS disks and Atari TOS disks - two-way access both at sector-level and at file-level.

MORE SUPER SPECIAL DEALS

We want to encourage more and more users to experience for themselves the stunning acceleration imparted to the operation of all Digital Precision programs (and everyone else's programs) by LIGHTNING.
Programs that particularly benefit are editing/word processing programs, databases, graphics/CAD programs, desktop publishers, compilers, games and programs with a high computational overhead (like astrological systems).
We will give a 10% discount, additional and supplementary to all other discounts, for any purchase of two or more programs, if one of them is LIGHTNING. This discount applies to the total price – it is not just 10% off LIGHTNING but 10% off the lot!

DIGITAL C SPECIAL EDITION

NEW

Digital C Special Edition has all the features of the much-acclaimed Digital C System, plus:
★ **Direct access** to all QL traps and vectored utilities is provided.
★ **Machine code** has now been used for writing all the standard library functions – this maximises execution speed and minimizes code size.
★ **Huge programs** can be compiled – no 64K or other code size limit.
★ **Many new fast** library functions including SCANF are supplied.
★ **User selectable size** optimisation gives the choice of efficient 16 bit and flexible 32 bit addressing.
★ **Long integers** are now supported.
★ **Long pointers** are now supported.
★ **Long constants** in octal, decimal and hex are now available.
★ **User friendliness** is improved.

PROFESSIONAL PUBLISHER

NEW

Digital Precision is proud to announce an all-new, top-of-the-range desktop publishing system.

Professional Publisher has all the features and controls you require to produce output of the very highest quality.

Professional Publisher has ALL the features of Desktop Publisher Special Edition, plus the following:

★ **Linked windows...** Any number of windows can be 'invisibly' connected in a sequence determined by you so that text flows from one automatically into the next. Windows can be of any shape.

★ **Wraparound graphics...** Any graphic can be placed on a page and text can be made to automatically flow around the graphic. Pixel-proportional spacing and the integrity of columns will be maintained – the graphic can be of any shape and can wholly or partly overlap any number of windows. The user may define any polygon (up to 64 sides) to demarcate the desired border of the graphic, which need not coincide with its actual outline.

★ **Full mouse compatibility...** Smiling mouse owners can start smiling! The incredibly silky smooth feel of this system, when either used from keyboard or mouse, has to be experienced to be be believed. It comes from our special scrolling and cursor-handling routines, handwritten in machine code. We suggest you use the system from the keyboard first, and then go in for a mouse if you feel the need to.

★ **Style and layout designer** allows you to create any number of layout templates, which contain details of columns, margins, gutters, breaks, guides etc. This permits the easy creation of multiple pages.

★ **No more fiddling** around with cursor keys for exact positioning – text can be snapped into guides.

★ **Full compatibility** (and now absolutely hassle free!) with ASCII files (say from Editor Special Edition), Quill_doc files and Quill_lis files – now with complete preservation of paragraphing, indentation, tabulation, superscripting, subscripting, italicising etc. Any size files can be handled – Pro Publisher has an on-screen skip/preview/chunk routine!

★ **Huge range of fonts supplied** (hundreds) – memory resident and disk resident – with sizes ranging from 8x8 to a gigantic 48x48! User-adjustable (pixel accuracy) descender position, character spacing, X and Y axis widths etc. In addition there are 26 graphic fonts!

★ **Page dimensions specifiable** either in pixels or millimetres – up to an enormous 960x1600 pixels and down to a tiny 48x48 pixels. Inch and mm rules provided.

★ **The whole of the ASCII set** is now supported – this is very useful if you want lots of special symbols or if you want to support non-English characters.

★ **Fingerprinting** is supported.

★ **A virtually infinite** selection of fill textures, with font patterns, graphics, or whatever you choose.

★ **There are 256 paint brushes**, with a unique programmable overlap (1/3/9 pixels) function.

★ **Automatic shading** and grey scale conversion of colour screens.

★ **Automatic interpolation** of graphics and fonts.

★ **Automatic bending/stretching/resizing** of graphics.

★ **All Boolean functions** supplied for brushes, fonts, graphics and freehand drawing – AND/OR/XOR

★ **Cut & paste** is supported both TO AND FROM the page itself, saved screens and compressed screens – this incredible support of all permutations gives unheard of flexibility!

★ **Full support for kerning** and pixel justification, including user-definable % line usage, user-definable maximum and minimum inter-character spacing and inter-word spacing (preventing the ugly spread of characters or words on a line when the first word on the next line is a very long one), preselectable/defeatable auto-hyphenation, auto-indent control, dropcaps, left/right/centre/off justification etc. etc.

★ **Walkdown menus** (selections either by a single keypress or by a moveable bar, you decide), context-sensitive help, very greatly enhanced user-friendliness.

★ **8/9/24 pin printers**, laser printer support, output any part of the page, individually vary X and Y axis magnification, user-selectable print density and number of passes.

★ **Professional Publisher** is supplied on disk for expanded QLs.

Digital Precision want to particularly acknowledge the skills of the ace programmer Andrew Astrand and his dedicated team.

REMINDER: Taken out a QL WORLD subscription yet? Yes, our non-UK friends, we mean you as well. Do it NOW!

IDIS SPECIAL EDITION

All the features of the much-acclaimed IDIS intelligent disassembler – but even more intelligence!
This remarkable Special Edition, Only available to users of expanded QLs, has the amazing ability to recall earlier decisions while in a 'trial' disassembly mode. This greatly reduces the amount of help the system requires from you – usually to zero! Also, no longer will you need to answer the same (or similar) question more than once. Also added are facilities for dumping in hex/ASCII, default responses to startup interrogation, automatic resequencing of absolute addresses, non-destructive windowing etc.

UPGRADES

To upgrade from one version of a program to a later version of the same program, send us the cartridge/disk and £10. Except in the case of Special Edition Editor owners upgrading to the latest Special Edition Editor, do not return your manual to us.
To upgrade from a program to the Special Edition of the program (say from the standard Editor to Special Editor), send us the cartridge/disk, manual and the difference in current advertised price between the two programs, plus £10. For this purpose we will consider Professional Publisher to be an upgrade from the Desktop Publishers and Professional Astrologer to be an upgrade from Super Astrologer.

For example:

★ To upgrade from Special Edition Desktop to PROFESSIONAL PUBLISHER, send us £40 (£89.95–£59.95+£10).
★ To upgrade an early Pro Astrologer to a recent one, send us £10. To upgrade from Super Astro to Pro Astrologer, send us £45 (£59.95–£24.95+£10)

PRODUCT AVAILABILITY ROSTER

All our products, with the exception of MEDIA MANAGER SPECIAL EDITION, are available NOW — for IMMEDIATE DESPATCH. MEDIA MANAGER SPECIAL EDITION, on which there has been a delay in order to maximise program quality, is expected to be ready for despatch on 15th June. We apologise for the delay if you have had to wait.

DIGITAL PRECISION

MEDIA MANAGER

PRICE SLASHED!

Manages and controls disks and cartridges, transfers from/to alien formats, recovers corrupt/lost data.

PROFESSIONAL ASTROLOGER

The best, most comprehensive astrology system in the world: suitable for beginners and experts alike. **Professional Astronomer** is a companion program of equal quality. **Super Astrologer** is a much simpler program and a lot of fun.

ACT SPECIAL EDITION

The Adventure Creation Tool enables the user – who need not know how to program – to create the most amazing adventures, with text, pictures and animation. A disk drive is needed.

TRANSFER UTILITY

Moves stuff from cartridge to disk, performs any translate.

BETTER BASIC

An expert system to help you improve your BASIC programming.

SUPERFORTH

Quite simply, one of the fastest FORTH–83 compilers ever written.

SPRITE GENERATOR

Moves things about, smoothly, quickly, flexibly, 256 planes.

ULTRAPRINT

Outputs screens (from Eye–Q etc.) to printers (Epson or Oki) beautifully, with lots of options.

VIDEO GIVEAWAY

Digital Precision will be giving away lots of VHS movie cassettes with randomly selected orders until stocks run out...

MICROBRIDGE

A generously specified contract bridge tutor and player. Of phenomenal educational and entertainment value!

THE GAME COLLECTION

Backgammon, Droidzone, Arcadia, Reversi/Othello, Blocklands...Super Fun!

EYE–Q

The classic QL graphic system

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QL SCENE

Microcassette manufacturers may quit QL

Signs have appeared that the much-maligned Sinclair microcassette may at last be an endangered species.

Ablex, the company which has made the tape cartridges since the start, reports that supplies of suitable magnetic tape from German comms giant BASF may dry up.

Even if stocks are found, says production manager David MacSorley, Ablex will not make microcassettes after 1989.

Says MacSorley, "We are waiting for alternative samples from BASF, which we will have to test." If an alternative is located, Ablex "would be interested in carrying it for the rest of the year." He gave the declining market as the reason.

MacSorley was pessimistic about another company taking over production. *QL World* has not yet had a response from Sinclair Research but hopes to report further next month.

QL BB breaks away

The QL bulletin board planned by David Park has now parted company with Quanta and will be setting up at a new site and number soon. "We have moved and we will have to wait for a new line to be installed," says the sysop. "We had more than 400 enquiries when the board was announced. Please ask your readers not to ring the original number and we will release the new number as soon as we have it."

Please will reader/ contributor John Banks contact us? Letters to his college address have been returned marked 'gone away'.

Check the cheque

American software publisher Sharps has released a *Checkbook Manager* program — named in the U.S. style. The program costs £13.95 which includes airmail postage to the U.K. and Europe. *QL World* expects to review the program soon.

Sharps, Box 326, Mechanicsville, VA 32111, U.S.A.

Subscription breather

QL World publisher Focus Magazines has modified its plan to convert to a subscription-only base to give readers, the news trade and the company more time to acclimatise.

The large number of new subscriptions arriving coincided with postal distribution problems, while many "occasional" readers remain unaware of the planned changes.

The number of magazines available from newagents will be rolled off gradually up to the end of 1989, allowing the news to circulate, and the subscription base to build up in stages.

Banker upgrade

DJW Software, publisher of *Home Banker Plus*, is issuing an upgrade version of the program, Home Banker Plus V3.1. Features added since the program was reviewed in the March issue of *QL World* include single-key selection on the main and standing order menus, up to 14 accounts on each file, improved account balancing and standing order transactions, and a new owners' manual.

Home Banker Plus V3. 1 is supplied on a 3.5in. disc for QLs with a minimum of 256K memory expansion. DJW Software will be contacting existing customers with information on how to upgrade copies of Home Banker to the current version. The new package costs £19.95 and is available from Sector Software.

DJW Software, 11 Pound Close, Bramley, Basingstoke, Hampshire RG26 5BL.

Sector Software, 39 Wray Crescent, Unles Walton, Leyland, Lancashire PR5 3NA. Tel: 0772 454328.

Show scene thrives for QL

Taurus Computer Systems, promoter of the Alternative Micro Shows, reported an attendance of more than 2,000 at its spring show at London's New Horticultural Halls.

Our observer reports that the overall scope of the show was "much smaller than a Microfair." QL dealers quoted as attending include Quanta, Digital Precision, Sector Software, Care Electronics, QS Sub, PDQL, Schön PC and Miracle Systems, and there seems to have been a good trade in boxed QLs.

Taurus was formerly Emsoft Ltd, which started life as a support group for the Tatung Einstein and has branched out into promoting shows for specialist computers.

Taurus address is 6 St. Ives Close, Kesgrave, Ipswich, Suffolk IP5 7LT. Tel: 0473 622789. Another Alternative Micro Show is planned for Saturday, November 11 at Bingley Hall, Stafford. A colour brochure is available.

QL World assessment of Alternative Micro Shows is that, once established, they have the potential to attract large attendances to central show sites which might not otherwise be accessible to individual computer shows. At present, they are of moderate interest to QL users. We hope to have advance information of companies attending the November show.

Meanwhile, David Batty of Sector Software reports attendance of more than 1,000 QL users at his Northern Sinclair Show in Manchester, with a great deal of local interest, especially from users who would not normally make the journey south for Microfairs. Another Manchester show is planned in three months. Contact Sector Software, 0772 454328, for information.

OPEN CHANNEL

Open Channel is where you have the opportunity to voice your opinions in *Sinclair QL World*. Whether you want to ask for elp with a technical problem, provide somebody with the answer, or just sound off about something which bothers you, write to: Open Channel, Sinclair QL World, Greencoat House, Francis Street, London SW1 1DG.

Two tips

I have two tips for QLers. By accident I found that a three-quarter-inch board placed under the back of the QL, with the QL rear support legs in place, will tilt the QL forward for a more comfortable keying position and, if the board is secured, will locate the QL firmly. I have a SuperQboard plus 512K RAM extension with twin 3.5in. floppy drives and PAR printer driver, internal SuperQmouse, Qram and CPMulator in the ROM socket. That is almost a full house and I get the occasional crash but not since this new arrangement. Presumably the increased angle helps through ventilation to keep components below crash temperature.

Every day I use Abacus to enter changes in share prices and as a matter of course preload F1 to F2 with Altkey Abacus instruction sequences while booting in SuperBasic. With the multi-tasking facilities of Qram, it is always easy to nip back into SuperBasic to add an Altkey sequence and then return to Psion to use it for repetitive commands. One boot-loaded Altkey is:

```
ALKEY CHR$(240), CHR$
(236), CHR$(240)&'lshrs',
CHR$(216), CHR$(216),
CHR$(240)&'wh',
CHR$(248)
&'A26',"
```

which will remove prompts, load 'shrs', drop the cursor two lines, split the window horizontally, GOTO A26 — bring a section of the spreadsheet with top left corner at A26 on to the screen — with the touch of ALT/F3.

Many QL users may not realise the time-saving possibilities.

W.T.M. Lawrence,
Bexley,
Kent.

All the fax

Thank you for the information about ABC Elektronic. If the Instant Access panel is to be of any help, someone at Focus needs to perform an update on it. You should also include fax numbers for all firms which have one.

Don Atkins,
Sydney.

Editor's reply: The latest update of Instant Access appears in this issue. Instant Access is a quick reference for contacts and is not intended to be a substitute for the monthly advertisers' index or advertisements. It covers established QL supporters and the last known numbers of a few companies no longer supporting the QL. Space is restricted and very few private users have fax. Check the companies advertising for further details.

For example, the ABC Elektronic advertisement on page 13 of the April issue gives the fax number. Incidentally, Instant Access now contains up-to-date information about QL World subscription enquiries but full details appear on the Contents page every month.

Crystal call

I would like to take this opportunity to say what a great magazine *QL World* is. Would you ask any readers who live in the Penge, Crystal Palace or Beckenham areas to write to me so that I can start a local QL club?

Brian Dickson,
67 Queen Adelaide Road,
Penge, London SW20

Detective

I am trying to obtain a copy of *QL SuperBasic, The Definitive Handbook*, written by Jan Jones. The publisher McGraw-Hill advises that the book is out of print and not in stock.

If anyone can advise me where I can get a copy I shall be grateful.

C. J. Garnett,
5 Park Road,
Coombs Park,
Coleford,
Gloucestershire.

ZX to QL

Would any of your readers be interested in translating a suite of programs written in Basic for the ZX Spectrum to run on a QL? I can supply either Microdrives or listings and would agree to a reasonable fee.

Colin Hodson,
Hodson Rivers,
2 Ridgemount Street,
London WC1E 7AA.

Editor's comment: Any interested programmers should contact Hodson directly with their offers.

Editor's notebook

Is the "QL in decline", or is it not? How do you define "decline", anyway?

This speculation has been going on for as long as I can remember. If you define decline as "fewer people, less money", there is less to go round. If you define it as "less up-to-date, less useful", this is not the case at all. QL hardware and software is advancing almost weekly, and the QL's unusual and advanced capabilities remain ahead of the field.

Reconciling the lower 'popular' demand for the QL and the continued serious demand is setting QL traders some riddles.

Our own riddle is how to reduced unproductive distribution costs. The prescription is to rely on subscription; however, we realise that everyone needs more time to adapt to the change. So, although the cover price has to be raised, the price of subscription is to stay down, and the magazine will still be available 'one off' from newsagents till the end of the year.

The second riddle is that of the microcassettes. When Ablex ceases to produce them, will anyone else be able, willing and permitted to carry on making them. Some users talk of disc drives, but this sounds like "let them eat cake" to me. Microcassettes are maligned, but still popular. We will keep you posted.

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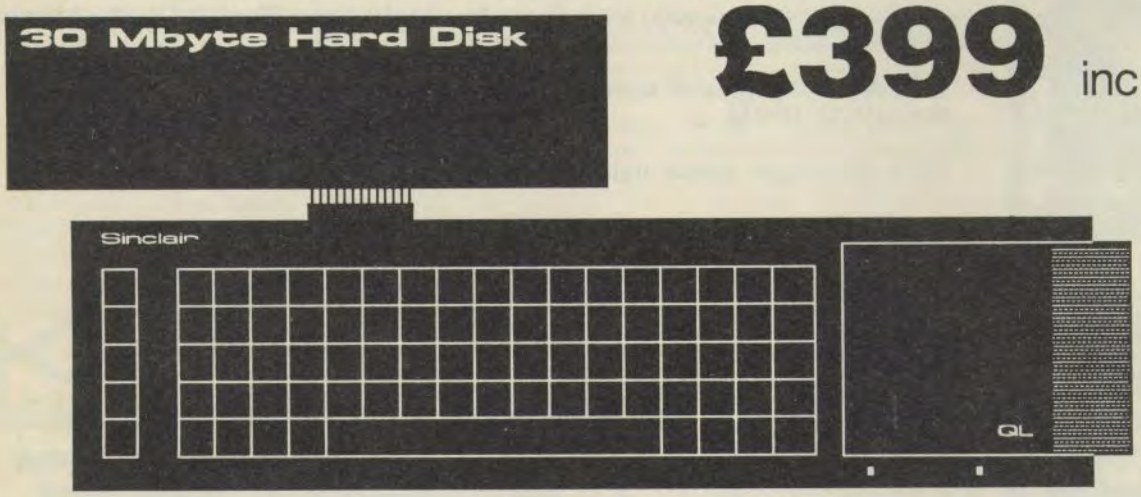

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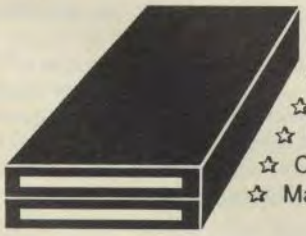

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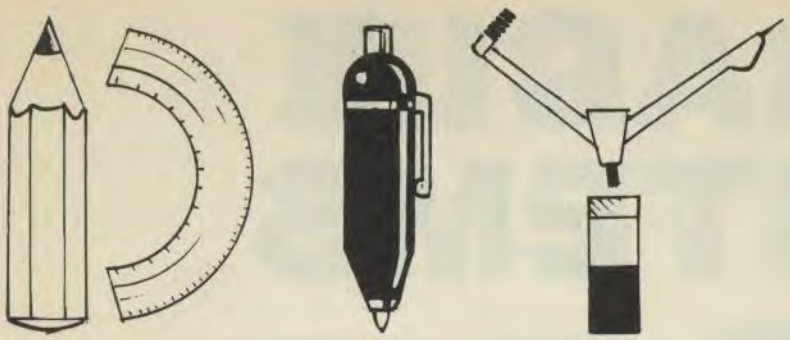

ARC

John Davis presents the first of an occasional series on Archive programming. This month he relates Archive to Basic.

I am a coarse programmer and this article is written for other coarse programmers. Six years ago I knew nothing about programming but I had a time-consuming annual task which seemed to cry for a computer. It involved the preparation of an annual rota for some 50 magistrates. The first home computers appeared but I could get no indication as to whether they had the power for the task I had in mind and they were too costly to buy on spec. Then Clive Sinclair produced the ZX-81 and I was hooked.

I set about learning programming and writing my rota program at the same time. As I saw a possible application for something I had learned, I tried it and kept at it until it worked. I learned rapidly, from hard experience, to save it at least twice and so I am now obsessive about back-up copies.

It is for people who tend to program freehand I am writing. I hope there may be things of some value to people with a formal background in programming. On the other hand I hope that comparative novices may find it possible to work their way into Archive through these articles.

Eventually I was in a position to move to a QL. Before starting the conversion of my program I looked in the Archive section but was deterred by the lack of line numbers and the elegant layout of the procedures. What were procedures anyway?

As a result I set about converting my program from ZX-81 Basic into SuperBasic. I learned a little about procedures and, eventually, when I looked again at Archive I recognised it for what it was, a special dialect of Basic.

If you wish to print a number of values in a column, right-justified in the conventional way for listing figures with the units above the units, the 10s above the 10s and so on, for simplicity they are all whole numbers in the range 1 to 9999. In Basic you could write a sub-routine:

```
1000 LET Y$ = str(Y)
1010 LET Spaces$ = " "
1020 LET Spaces$ = spaces$ (1 to
len(spaces$)-len(Y$))+Y$
1030 PRINT TAB X; Spaces$
1040 RETURN
```

Having written this you could then include in the main program:

```
10 LET X = 10
20 FOR a = 1 to 10
30 LET Y = NUM(a)
40 GOSUB 1000
50 NEXT a
```

The result would be to print the contents of the numeric array NUM in a four-wide character column starting 10 from the margin. Effectively that sub-routine is a PROCEDURE and the values X and Y are its PARAMETERS.

In SuperBasic the subroutine could be re-written as a PROCEDURE in this form:

```
1000 DEFine PROCedure justify (x,y)
1010 spaces$ = fills$(" ",5-(len(str(y))&
str(y)
1020 PRINT TAB x;spaces$
1030 END DEFine
```

In the main program lines 10, 30 and 40 are replaced by:

```
30 justify 10,num(a)
```

Procedures do things and need not always have any parameter passed to them, e.g:

```
1000 DEFine PROCedure home
1010 AT 0,0
1020 END DEFine
```

This has no PARAMETERS but it will, if the word 'home' is typed-in as a command or is included in a program, invariably return the print position to the top left-hand corner of the screen at a saving of two keystrokes every time it is used.

By contrast, FUNCTIONS must always have at least one PARAMETER, based on the value of which it RETURNs another value.

If my 'justify' procedure were to be re-written as a FUNCTION, the parameter, x would probably be omitted and line 1030 would have to be re-written:

```
1030 RETURN spaces$
```

It would be called in the main program by an amended line 30:

```
30 PRINT TAB x;justify(y)
```

The parameter x would now need to be replaced by a program variable or its value could be substituted in line 30.

Once you have used procedures for a time you realise that GOSUB is redundant. For the coarse programmer GOTO still has its attractions but I have been persuaded that there are good reasons, not merely programming fashion, to eschew its use. Even when used completely in a single procedure it sacrifices a major advantage of procedures, namely speed. Use of GOTO involves the machine going right through the program looking for that line number, whereas it has a much shorter index of the start addresses of procedures and functions.

Once so persuaded, I found that it was not so difficult to avoid GOTO as well. Once I had been living without GOTO as well as GOSUB for a time I wondered who needs line numbers? Once you realise that you are ready to approach Archive.

For anyone who started on the ZX-81, moving from SuperBasic to Archive is a little like coming home for the following reasons:

a. To send to the printer you use LPRINT rather than OPEN#4,ser1ehc: PRINT#4:CLOSE#4. You can divert data intended for the printer to a " 000 lis" file by use of the commands SPOOLON and SPOOLOFF. e.g.:

```
SPOOLON "fred"
LPRINT fred$; tab 30;smith$
LPRINT etc. etc
SPOOLOFF
```

will produce a file on your data device — mdv2 00 if you have not re-configured Archive — called "fred00 lis" which will contain the value of fred$ and smith$ on one line followed by the other values LPRINTed.

You can check your layouts without wasting paper by preceding the LPRINTs with SPOOLON SCREEN. This has one important limitation in that, if you have attempted to force a formfeed by a line LPRINT chr(0)+chr(12) it will stop with a report of "i/o error"; the screen will not accept nonprintable characters. You can avoid this problem by writing a Procedure

CHIVING

FF:
proc FF
  lprint chr(0)+chr(12)
  endproc

and including the procedure call "FF" in the document layout. If wishing to test the layout on the screen you can merge in a dummy proc FF for the duration of the test and then merge back the proper one. The dummy procedure would read:
proc FF

  endproc

b. As you will have seen in a, strings are concatenated by "+" and not "&". That will be familiar to those who started on the ZX-81. Other differences are:

"chr(n)" not "chr$(n)" likewise "str(n)". There is no coercion so "LET a = a$(3 to 4)" is unacceptable.

Beginners are reminded that concatenated means chained, e.g., "fat" + "head" = fathead"

c. Use of LET is mandatory, e.g., "x = 10" will return an error.

d. Commands and functions appear in lower-case so, if you wish to check that you have not used one of these as a procedure call in place of a similarly-named procedure, use upper-case for procedure names and check that they are not changed to lower-case when they appear on the screen.

Commands are 'reserved words' and you may not use them either as procedure names or variable names, even with the addition of '$' for strings. The line editor will check that you have not used a reserved word as a procedure name but it will let you use it as a variable name but this will cause the program to halt with an error when it comes to the line. Function names, without the brackets used to contain the parameters, can be used as variable or procedure names. So the line editor will NOT accept:

proc all — (command used as a procedure name).
let a$ =fred — (no closing quote).

but it will accept the following, although they will not run:

let all = 12
(command used as variable name)

let all$ = "fred" (the same)
let a$ = 12 (mixed data types)
let a = "fred" (the same)
The following is acceptable both on input and when run:

let date$ = date(1) (function name used for variable)

e. DEFINE programs in Archive consist entirely of a series of procedures. There are a number of pre-defined functions but there is no provision for user-defined functions. For that reason the keyword DEFINE is not used. An example of pre-defined function which exists in Archive but not in Super-Basic is "dec(n,d,w)". This is a sophisticated version of my example "justify". It takes three parameters:

n. being the value to be printed
d. being the number of decimal places
w. being the width of the field in which it is to be printed

So, if price has been calculated as 2.736, the statement:

print "£";dec(price,2,5)

will produce the output "£2.74"

f. TRACE. Since there are no line numbers, when an Archive program stops on an error it displays the procedure name and the line. So if, in a procedure called "bill" the foregoing print example were used without price having been declared, it would stop with the error number for undefined variable after a line which showed:

bill print "£";dec(price,2,5)

The toggled command "trace" enables the programmer to follow the operation of his program. When trace is on, each line is displayed in the foregoing form and so it is possible, when debugging, to follow the flow of the program.

g. Archive has an ERROR provision which enables a program to deal with error situations without halting. I will show how this can be used to close an indeterminate number of open files and then continue the program, without operator intervention.

h. Loops Basic had just "For/Next" loops; Superbasic added "Repeat/End Repeat" loops with exit. Archive has "While/Endwhile" and "All/Endall" loops. "While" loops are a little like repeat loops with the exit condition contained in the line which marks the beginning of the loop. They may be made to operate as for/next loops by the inclusion of a counter, e.g.:

```
let count = 1
while count<10
  print tab 10; count
  let count = count+1
  endwhile
```

All/Endall provides the fastest way to search through a database file but must not be used where the records are to be updated in the loop.

i. Archive is designed to manipulate database files. For those used to Basic or SuperBasic, a database file can be regarded as an expandable array capable of holding both string and numeric data. Another image would be that of the card index with pre-printed cards requiring specific ordered data. The box of cards is the 'File", each card is a 'Record' and each piece of required data, e.g., 'Name' or 'Date of Birth' is a 'field'. A database can consist of one or more such files.

To start editing, load Archive as you would Quill, i.e., re-set the machine, place the program medium in mdv100 or f1p100 and press F1 or F2. The screen will display the usual prompts at the top and a broad line near the bottom. The cursor will be in the 'command area' below the line.

If you press F3 a list of commands will appear in the centre of the prompts area but, unlike the other three Psion programs, pressing the initial letter of one of these commands has no effect, other than to make that letter appear at the cursor position. As in SuperBasic the whole word has to be typed and then <Enter> pressed. Certain commands will have a familiar look but will operate slightly differently.

Dir — displays the directory of a device
Load — loads a program
Save — saves a program

Unlike Basic or SuperBasic, the device and or file names have to be in double quotes. Nevertheless, if you type the comm and press <ENTER> the interpreter will offer a pair of quotation marks with the cursor between.

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Sload and Ssave which load and save screens respectively work in the same way but somewhat illogically. The following two commands:

Save object and
Load object

which speed loading and saving by condensing the file into machine code, do not have the facility of offering the quotes. If you forget this you have no choice but to type everything again because, unlike SuperBasic, Archive does not return a 'bad line' for correction; you just have to start again.

Type "Edit" and <ENTER>. A thick vertical line will appear about 10 columns in from the left of the screen. In the command area there will have appeared the word Proc with the cursor just to its right. Type "test;t,m" <ENTER>. The word "test" will appear to the left of the vertical line and the following will appear to the right:
As you type and <ENTER> the following lines they will be inserted in sequence between proc and endproc:

```
if m = <ENTER>
mode <ENTER>
endif <ENTER>
if t <ENTER>
trace <ENTER>
endif <ENTER>
rem here insert procedure call to be tested
  <ENTER>
if t <ENTER>
trace <ENTER>
endif <ENTER>
mode 1 <ENTER>
```

On completing this the procedure will read:

```
proc;t,m
  if m = 0
    mode 0
    endif
  if t
  trace
  endif
rem here insert the procedure call to be
tested if t
  trace
  endif
mode 1
endproc
```

If any lines require to be amended, use the up cursor to move up the highlight to the line concerned and press F5. The line concerned will be brought down to the command area where it can be edited. If a line has been omitted, use the cursor keys to highlight the line before it and press F4, type the missing line and <ENTER>. To leave this insertion mode press <ESC>. When you are satisfied with the procedure press <ESC> to leave editing mode. On return from the editing mode type:

save <ENTER> (quotes will appear around cursor)
testrig <ENTER> (this should appear between the quotes)

You will then have saved this one procedure as "testrig prg" on the drive configured as the data device. Test it by typing:

Test;1,1 <ENTER>
Test;1,0 <ENTER> and
Test;0,0 <ENTER>

You have now created and tested a test rig which can be merged into any future program you are debugging. A procedure call with all necessary parameters can be edited into this procedure, which can then be used repeatedly with or without trace to test other procedures in the new program. Use of Mode 0 makes the whole screen area available to display the 'trace'; otherwise only the command area is used, which makes it a little difficult to follow.

The next part will deal with copying and opening files.

SOFTWARE FILE

QD is a text editor, the only one to work under the QJump pointer environment, and it is a smart piece of programming. The review copy was on a 3.5in. disc. The documentation was a prototype, being translated from German to English by the author, and was in the form of a small black hardback ringbinder. Whether this is an example of the proper manual which will be produced for general sale, I cannot say but I hope it will be, as it lends an added quality to the product. Again, though, *QD* has a quality of its own which makes it worth the price anyway.

The documentation gave an introduction to QD and explained the concepts. It dealt with the menus in sections, each being separated with a coloured page card. I found the documentation clearly printed, well laid-out and pleasant to read.

I tested QD for a period of days on my QL, which is expanded with Trump Card to give me 896K of memory and had no problems. I used the Toolkit II command RES_128 to bring the QL back to the state of being unexpanded and tried to load QD but had no luck.

You do not have to use the standard boot to load QD. You could EXEC it in but first you must install two files PTR_GEN, which is 12,500 bytes long, and WMAN, which is 7,800 bytes long, and all explained in the documentation.

German

If you boot QD from the supplied medium you will find that the program will appear in German. Have no fear because, for all who do not know German, there is an English version included on the disc. Load the boot and edit line 30 to read EXEC flp1_QD_ENGLISH. Then type run and press ENTER and the English version will load. The disc is not copy-protected,

Information:

QD
Price £26.45
Jochen Merz Software
Im Stillen Winkel 12
4100 Duisburg 11
West Germany

so you can easily make a back-up of it with a customised boot for your use.

There is a configuration program which is simple to use to configure QD but do your configuring on a back-up copy — never on the original.

Before you run the program read the documentation thoroughly. It is friendly and has much to offer. QD needs experiment, like any other program, to get a feel of the controls and to see how the options work and what they do when executed; as far as I am concerned it is the only way to get the best from software.

QD would be useful for those who program in machine code, Pascal, C, BCPL, Fortran or any of the other languages which require an editor. It can multi-task with other programs, so you can have your assembler-linker and so on laying in memory with QD, if your QL memory permits, and switch between them with CTRL + C. There is no reason why you could not have two or more QDs in memory at the same time.

Basic edit

You can also edit Basic programs with it. I have tried it and found no problems and some of the programs I loaded were very long. When finding and replacing, QD took it all in its stride and, despite the file length, it did it in the blink of an

eye. Apart from using it in a programming environment it could also be used for simple things like keeping notes, records of appointments, recipes or anything involving the manipulation of text.

No Quill

One thing it did not seem to like was Quill documents. No matter how short the file length, it would load about 160 characters of the file and no more. I do not regard this as a bad point of the program, even though there are text editors which will handle documents which have been produced by Quill. QD is neat and efficient to look at. It is made easy to use and friendly, as it is pull-down, menu-driven and I like programs which use those types of menu.

At the top of the screen are small windows with words such as FILES, COMMANDS, BLOCKS, INFO, STATUS in them. They are the categories with which the menus deal. There is also a group of four boxes at the top left of the screen. They relate to a loadable help page, re-sizing the QD window, moving it, and leaving QD temporarily to enable a return to it with CTRL + C.

The text cursor is moved round the editing window with the normal cursor keys, one line up or down, character by character, back or forth along a text line. Pressing ALT, SHIFT, CTRL or a combination of them with the cursor keys allows you to do such things as delete text, character by character or line by line, move to the start or end of text, move along a line word by word, scroll the text page by page, or pan the text left or right leaving the cursor in its current position. There are 22 cursor-orientated commands regarding movement and editing.

By the side of the text window there is a narrow window, the height of the text window, just wide enough to accept the cursor. It is used for fast selection of an area of text for viewing or editing.

Selecting menus is simple. Move the cursor out of the text area to a category and press ENTER and the appropriate menu will be pulled down. Options are chosen from the menu with the arrow or the first letter of the required option.

Once a menu has been pulled down, further menus cannot be pulled down until the menu is pulled up again and this also applies to the execution of an option selected from a menu. Menus can also be selected using the function keys which are displayed by the side of the appropriate windows.

INFO is not really a menu but an information sheet which tells you current line, column and free memory.

STATUS allows you to change parameters, such as tabulation intervals, used by QD and set insert mode, confirmation request and file back-up.

When the insert mode is on text can be inserted and the original text to the right of the cursor is moved to make room for it.

When the insert mode is off the text underneath the cursor is over-written by what you type-in. If you want to insert any text you can make room for it by putting spaces in using SHIFT + SPACE.

BLOCKS allows you to mark blocks of text to copy, delete or move them. Marked blocks can have strings replaced in them and be written to a device such as disc or Microdrive, or to a printer by specifying ser1 or ser2 instead of a device and filename.

COMMANDS will allow you to find/replace strings upwards or downwards throughout a current text file, move to specific lines, delete or insert control codes or quit QD. If you use the quit option all the text is lost and you cannot re-enter QD until it has been loaded again.

> One thing it does not seem to like is Quill documents . . . I do not regard this as a bad point. QD is neat, efficient and easy to use.

FILES, as the name suggests, is all to do with file handling. Files can be loaded, saved and sent to a printer. If you wish, new fonts can be loaded so long as their file names are appended with _FNT. Special fonts, too, can be loaded which use CHR$(0)-(31). High-res fonts such as those of *Page Designer*, or those supplied with *Qwriter II* are not suitable for use with QD.

SOFTWARE FILE

> Shirley Jane Peters tries out a new text editor, QD, to date the only one on the market to run under the QJump pointer environment.

Files which have been made by another editor can be loaded into QD. If they contain control codes such as CHR$ (8) or CHR$ (13) those codes can be removed. Also it is possible to insert control codes into your text with the option Put Character.

The insert text mode in this menu I found really useful because it means that I can merge a file from disc or cartridge with the current file in QD and put it anywhere I want to do within the text at the current cursor position. When I program in machine code I usually write in modules and often I would like to put them all together to make one big file.

QD allows me to do this, whereas the Metacomco editor I have used previously does not. Since the files produced by QD are compatible for use by the Metacomco assembler package. I shall be using it to produce all my machine code listings.

QD allows you to enter text up to 160 characters per line and scrolls the text off to the left if you type-in a line with more characters than it can display in its text window, which is standard practice with text editors.

It is a fast program because it does no garbage collection and memory is allocated only as it is needed. In this respect it is ideal for the programmer who needs to use an editor. Speed was one of the considerations of the author, and as he said in the manual, "Programmers want fast things; they have no minutes to wait," and he has certainly achieved it.

No bugs

I understand that there are many text editors on the market but which one you use depends on if it does what you want. I found QD to be more than adequate and, with the amount of memory I have on my QL, there were no problems. No bugs reared their heads. The program offered me options you find on many text editors, plus a few more.

It is easy to use, pleasing to the eye, well error-trapped and fast in the way it carries-out its tasks. What I have seen from this company makes me think I would like to see more of its products, I like its software. If you need a text editor and can make room in your disc box for this one. I do not think you would be sorry.

INFORMATION:
Product: FlashBack Special Edition.
Price: £40 (£15 upgrade charge for users of FlashBack 1).
Supplier: Sector Software, 39 Wray Crescent, Ulnes Walton, Leyland, Lancs PR5 3NA.
Tel: 0772 454328.

FLASHBACK S.E.

Bryan Davies with a user report on the new V2 update of this popular database manager from Sector Software.

A reviewer may see a program in a different light from some users, partly because the reviewer tends to change to the latest program versions as soon as they are available — often before they are released to the public — and partly because the period during which a program is tested can be short. In the case of *FlashBack*. I have been using it since it was introduced and have had the version reviewed for several months; any bad features are likely to have shown up by now. As the new features of the current version have by now been accepted by me as normal it also means that it is not difficult to overlook the fact that readers will be unaware of them.

While FlashBack has been enhanced, many existing users will be more concerned with what is in the Special Edition package. There are three modules supplied with FlashBack but usable independently of it. One is a Report Generator, another a Forms Designer and the third a Printer-Driver Customiser. The modules will be dealt with in the concluding part of this review in a later issue.

Original

The original FlashBack is still available at £25 and may be more suitable for users with QLs which do not have memory expansion units, because it uses significantly less memory then the new version. Existing users can upgrade to the full new package by sending £15 and proof of original purchase to Sector Software.

FlashBack never set out to replace Archive but one of the intentions was to provide a database program which was easier to use than Archive for typical applications. The program is very successful in that; my test was to transfer a name and address file — 300 records — and a small German dictionary — 1,900 records — from run-time Archive to FlashBack and the results were so good that I no longer use Archive on a regular basis.

Apart from greater ease of use the big advantages are speed of operation and flexibility of data manipulation. The ability to make notes, or even sizeable documents, and deposit them later into a word processing program gives FlashBack another distinct edge on Archive. Perhaps the most impressive feature, especially for someone who habitually loads the QL until there is little memory left, is the consistent high speed of both cursor movement and string searches. The cursor is not only fast but also very easy to follow. Regardless of file size, typical searches each take roughly the same time — a second or so.

The two files mentioned have no data in common; the one is strictly names and addresses in one field with telephone numbers and odd information in another, whereas the second one has German words in one field and the English equivalents in the other. As both are sometimes required concurrently there was a problem when using Archive — any swapping routine took far too long. Not so with FlashBack; the German dictionary was put as Fields 1 and 2, the names file as Fields 3 and 4, and the two files merged into one.

Merging Archive files, or just doing a one-for-one conversion for use in FlashBack, is straightforward. During operation it is simple to Group the records so that the one set can be excluded during searches but the speed is such that this feature is rarely necessary; with the database file size at 140KB, operation is as slick as when the size is only 40KB.

One disadvantage needs to be mentioned. The total space taken by program and database is considerable — in the example quoted, roughly 140KB for the file and 130KB for the program. The combined database file size is about 20KB less than it was in Archive and the 1:1 ratio improves as the database grows but it may be difficult to justify the new version of the program if only very small database files are used.

The program space can be reduced by making the window used smaller, not taking the option to refresh the screens, reducing the number of references permitted per record, and by limiting the number of records which can be added during one session; more than 30KB can be saved in that way. Although it would in a sense be a retrograde step, it might be worth having the facility to keep the data on disc instead of in memory, especially now that it looks as if hard discs will be available to give much faster access than floppies.

New features

The basic commands are unaltered and existing files can be loaded, so there is no difficulty upgrading from version 1. A useful facility if there is a string of records beginning with the same word is the ability to go to the first of them by pressing F2 when the cursor is on that word in another record. If you are on the last of, say, 50 records each beginning with Smith, place the cursor somewhere on the word Smith in the current record, then press F2 to go to the first of the 50. The word does not have to be the first in the current record but the search action always goes to the record with that word as the first one.

An instruction database file is supplied and it can be incorporated into any user database to give on-line help. The FlashBack code is now re-entrant, which allows more than one copy of the program to be run at any time, using the same program code. When the commands are listed, by pressing F3 twice, the first on the list is "Another F1BK — Ctrl A".

Default

Naturally, different keying will be required for the second copy and you are first asked what that new keying is to be. The default database is then loaded or you can specify another. The memory required by this second copy is roughly 50KB — for Index space and so on — plus the database. Further copies can be loaded from either of the two and copies can be called up one on top of the other. Copies can be quit individually.

The illustration shows at the top the Q_Switch status indicators, (background), this article being written in text^{87}, (bottom) the first FlashBack main window, (middle right) the first FlashBack secondary window, and (top right) the second FlashBack main window showing another record from the same file as is being used by the first copy.

Some new keying has been provided. The next record can now be obtained either by Ctrl+N or by Alt+Down and the previous one by Ctrl+B or Alt+Up. Instead of having to re-start a Search operation from scratch after each instance of a string is found, the next instance can be found by using Alt+Shift+Down. A Replace function has been added to the Search; when any search string is specified you are prompted also for the replace string but pressing Enter without inserting a replacement string will initiate the search on its own.

Search/Replace operations can be from either the current record on, or from the start of the file, depending whether initiated by Enter or Shift+Enter. The Index command is comparable with the Archive Order command. The Field on which indexing is to be based can be selected and there are three possible sorting orders; the default order is all alpha upper-case first followed by all

alpha lower-case, with the alternatives being upper- and lower-case for each letter and "as they come."

This is best illustrated by example — i) ABCabc, ii) AaBbCc and iii) aBcDEf. For a dictionary, option iii is appropriate. Numbers can be treated in two ways. The default is to treat them as "text", as in FlashBack 1, so that 99 will be placed later in the order than 100, because the first character, 9, is later in the code table than 1.

When the Index command is selected you can choose to have numbers treated in their normal numeric order — i.e., 99 before 100 — instead. Successive Group actions can be taken, down to the point where only one record is current. In a names file containing both personal and business contracts it is possible to select business names by type, then carry-out further selection among them by specifying a particular product or brand. The following record is a fictitious example:

Field 3: Autoway Motors, 11 Pickington Road, Beltringham.
Field 4: Tel: 01-999 1212 (cars;Audi/VW-Rod Holliday,sales mgr.)

By grouping on "cars;", all such records would be made current, to the exclusion of any not involving car dealers. A further grouping, using "Audi" as the string, would eliminate any records of dealers not handling that brand. If only those dealers based in the London area are required, a further grouping could be made on either "London" or "(01)". To carry this to the limit, grouping on "Rod" would be likely to reduce the number of current records to one. Printing can be based on such groupings, only the currently-selected records going to the printer.

As you left it

A feature which always impresses me, small though it may be, is that each time you re-load FlashBack the cursor is where you left it at the end of the previous session; further, the last strings used with commands are there when those commands are called up again. The size and location of the window are as set the last time the Size command (Shift+F4) was used. A very useful improvement over the original is that the current string does not have to be deleted to enter a new one, as the latter causes the former to be removed automatically.

The status field is different now, having three indicators — C, I and G. The "C" appears in white when a change has been made to the file, the "I" appears likewise if the file is indexed, and the "G" also if the file is grouped. A point which will please Q_Switch users is the change of keying from Shift+Caps Lock to Ctrl+Caps Lock to give case-dependence when using the Group or Search commands.

The contents of database files can be written to disc in sections. If there are several blocks of data in a file which need to be written-out separately, the Group command is used to select the blocks one at a time and the Write command is then followed by Shift+Enter, rather than Enter, as you would write out the whole file.

Two other new commands — Xclude and INclude — allow records to be treated separately from the Group criteria. A record which would meet the grouping criteria can be previously marked by Xclude and it will then not appear in the group; on the other hand, a record which does not meet the grouping criteria can be marked by INclude and it will then appear in the group.

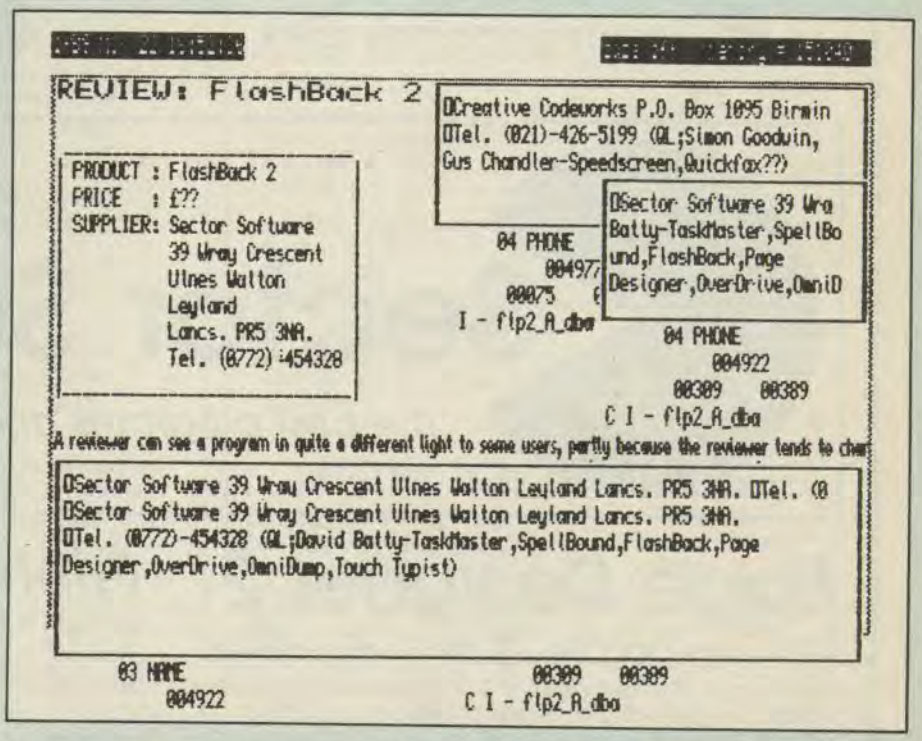
Grouping can be used for deleting large numbers of records; the records not to be deleted can be grouped and written-out to disc/cartridge, then read back in. The unwanted records will effectively have been deleted by the selective writing.

A Quit command has been added. When it is used the program, indices and database file are removed. Although a check of free memory before and after may show no change, the space has been vacated, as can be proved by EXEC-ing the program again. You can, therefore, remove FlashBack temporarily if memory is needed for other jobs, without the need to run the FlashBack boot to load it again later. There may be a fall of about 12KB in free memory when the program is re-run.

The flexible design of FlashBack permits files from Quill, Archive and Abacus to be Imported in _dba file format, after they have been converted by a straightforward Import routine — a separate program. This feature has been available from the start but was previously suggested for use with Archive only. Quill files can be Merged, provided they are in text-only format — usually with the extension _lis — but the file cannot be larger than the memory space allocated in the configuration process for adding records, typically only a few KB. By using the Import process Quill files in a similar format to Abacus files can be handled at any size.

There is considerable choice in the layout of the fields for the _dba file — Archive or Abacus fields can be merged during the conversion or several fields can be put on to the same line. If a one-to-one conversion of fields is sufficient all that is necessary once the program has started is to press the ESC key for conversion to be made automatically.

There is a concept available which is not found in Archive, referred to as "sub-records". The example given is of a gramophone record catalogue, where each album may contain tracks by several artists/groups. In Archive, it is necessary to give each track, title and artist separate fields, to avoid problems when searching for particular titles or artists. FlashBack allows each occurrence of either title or artist on an album to be treated as a sub-record — i.e., track titles may be sub-records 9.1, 9.2 and so on. The Import routine offers the option to amalgamate sub-records after records have been converted. It is then possible to search the one field — number 9 in this example — for any track title, rather than having to search several fields.



Users have asked for additional features, such as a report generator. This, and a form generator and a printer-driver customiser, are supplied as stand-alone modules which can be used with FlashBack. The general layout and specification of the new modules looks good. The command lines are clear and largely self-explanatory to those brought up on Quill and Archive. As with FlashBack, each of use is a prime consideration. These modules will be dealt with in the concluding part of this review.

FlashBack Special Edition

NEW!

– for the expanded QL and CST Thor

After months of blood, sweat and tears, a massive effort by ace machine code programmer Peter Jefferies, technical system support by Dilwyn Jones and Chas Dillon, we are delighted to announce an entirely new version of Flash-Back, FlashBack Special Edition.

- Faster screen handling
- Six file indexing options
- Save subset as stand alone file
- New search & replace option
- Many quick keys - First, Last, Back, etc.
- Extended import program
- Prints invoices, labels, mailmerge
- Additional fonts and ten Translates
- Many more features

Sector price only £40

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NEW!

Ferret file locator will find files based on the contents rather than the file name.

Simply type in 'ENGLAND' and Ferret will tell you the names of all the files containing the word 'ENGLAND'. Ferret will read any kind of file, or, if directed, will search only certain file types e.g. '_DOC' files.

Sector price £12

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A dark screen monitor with composite video, RGB linear and RGB TTL inputs.

A quality monitor which will handle just about any computer output, stereo sound, green screen button. 4096 colours of the Amiga no problem, QL display handled nicely

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Sector Software

The best programs and peripherals for the QL

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– The only COLOUR QL desktop publisher

Page Designer 2 is a fully fledged DTP system for the QL which is capable of producing nine-page publications. (you can produce longer documents in sections). Pages can be any size up to 3840 pixels wide. Over 30 fonts are included as standard and many more are available on the font disks. Clipart (ready made drawings) is available in the form of six cartridges for only £6 each (many more will be made available in the future). Page Designer 2 features an extensive range of graphics commands yet remains extremely easy to use.

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Font Pack 1	£6	Image Processor	£19

Clipart: 1. Animals 2. Animals 3. Animals
4. Maps 5. Sports figures 6. Business
7. Cartoons 8. Christmas etc.
all £6 each

Printers

Star LC10 mono	£229
Star LC10 colour	£274
Star LC2410 (rrp £460)	£374

STD Index

A standalone database of U.K. dialling codes.

Type 'Leyland' and you will get 0772 in about 1 second. Alternatively, type 0772 and you will get the corresponding town and area! Really useful for small ad - Exchange & Mart etc. Just type in the dialling code to see if the number is in your local area.

£12

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Incredibly fast and smooth typing tutor

With 200 lessons, graph options, lesson editor, adjustable speed and accuracy targets and machine code arcade game as a reward for your efforts. This is one typing tutor that works!

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Other Products

MORE BARGAINS!

Overdrive

Printer driver for any program. 255 translate sequences, will print screendumps within standard files e.g. Quill documents
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QZ/QL to Z88 file transfer

Software and cable to connect the Z88 and QL and transfer any files between them. Includes Archive to Pipedream and back conversion routines. *£25*

Spellbound

A spelling checker that checks your spelling AS YOU TYPE. Based on a 30,000 word dictionary, works with Quill or The Editor V1.17 onwards on the expanded QL. *£30*

Image processor

Tidies up images produced by a digitiser. Will produce clip art for PD2 from QL screens and picture enhancement. *£19*

Taskmaster

A brilliant multitasking front end system which lets you use the QL as a serious machine. Multitask many programs at once.
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We now have Clive Sinclair's satellite TV systems in stock. Only *£195* for a full 48 channel, stereo, remote control version. Phone now for details.

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A complete index to the contents of QL World from its start to May 1988. Find articles and reviews in seconds, 160K+ of data compressed to fit into a 128K QL *£6*

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The North's very own Sinclair fair returns by popular demand!

THE 2ND NORTHERN SINCLAIR SHOW

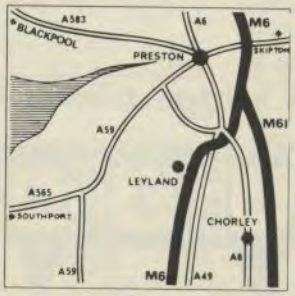
Due to popular demand Sector Software is holding another Northern Sinclair Show at Stokes Hall, Church Road, Leyland, Lancs, on 24th June 1989

Bargains galore for the Sinclair enthusiast will be on sale including Z88 hardware and software and Clive Sinclair's new satellite TV system. Sector Software will have at least three new programs on release at the show. PDQL is promising 'exciting' new software products. Marvel at the speed of Miracle Systems new hard disk and see Digital Precisions new software releases.

A licenced bar will be open throughout the show and meals are available all day from the cafeteria. Bed and breakfast rooms are available at reasonable rates from Stokes Hall (phone for details).

For Quanta members the show will extend to the 25th June in the form of a Quanta workshop. This is for Quanta members only, but any non quanta members turning up on the 25th June can join Quanta and see just what the workshops entail. On the Sunday demonstrations will be available from various QL experts on QL software packages. All this is free to Quanta members.

HOW TO GET THERE



Don't miss the only Sinclair Show in the North

THE 2ND NORTHERN SINCLAIR SHOW

Saturday 24th June 1989

Stokes Hall, Church Road, Leyland, Lancs.

Admission £1.50

Doors open 10am

SUPER BASIC

In the fourth part of our calculator/base conversion project, Mike Lloyd wraps up the main program.

Keen followers of the Super-Basic *QL Calculator* project will by now have the screen format and input routines for the program entered into their computers. By adding this month's listings the project will be almost complete and will certainly be usable, with only the luxury extras offered by the menu options outstanding.

The listings accompanying this article perform all the arithmetic undertaken by the QL Calculator and they also format and print the output. Figure one shows the now familiar hierarchy formed from the relationships between the modules. The definitions on the lowest level support the modules on the next level up, which in turn are called from the root procedure at the top of the hierarchical tree.

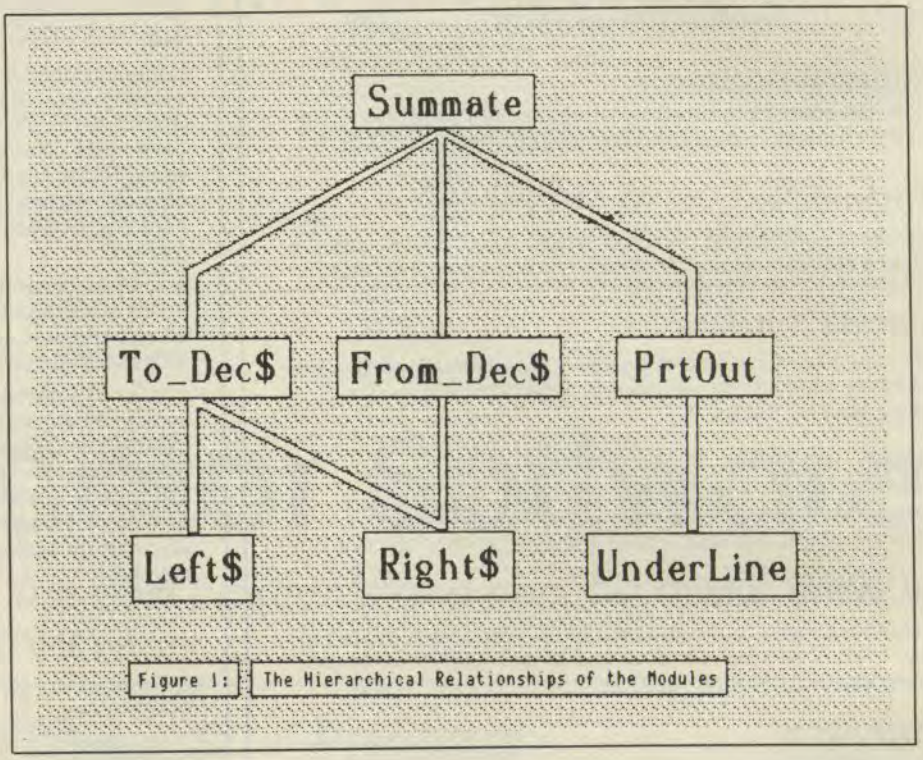


Figure 1: The Hierarchical Relationships of the Modules

Tree analogy

The tree analogy for this type of structure is so widely-accepted that it seems churlish to point out that roots are normally found at the bottom of trees, not at the top. Root has been used to denote the parent of any hierarchical data set

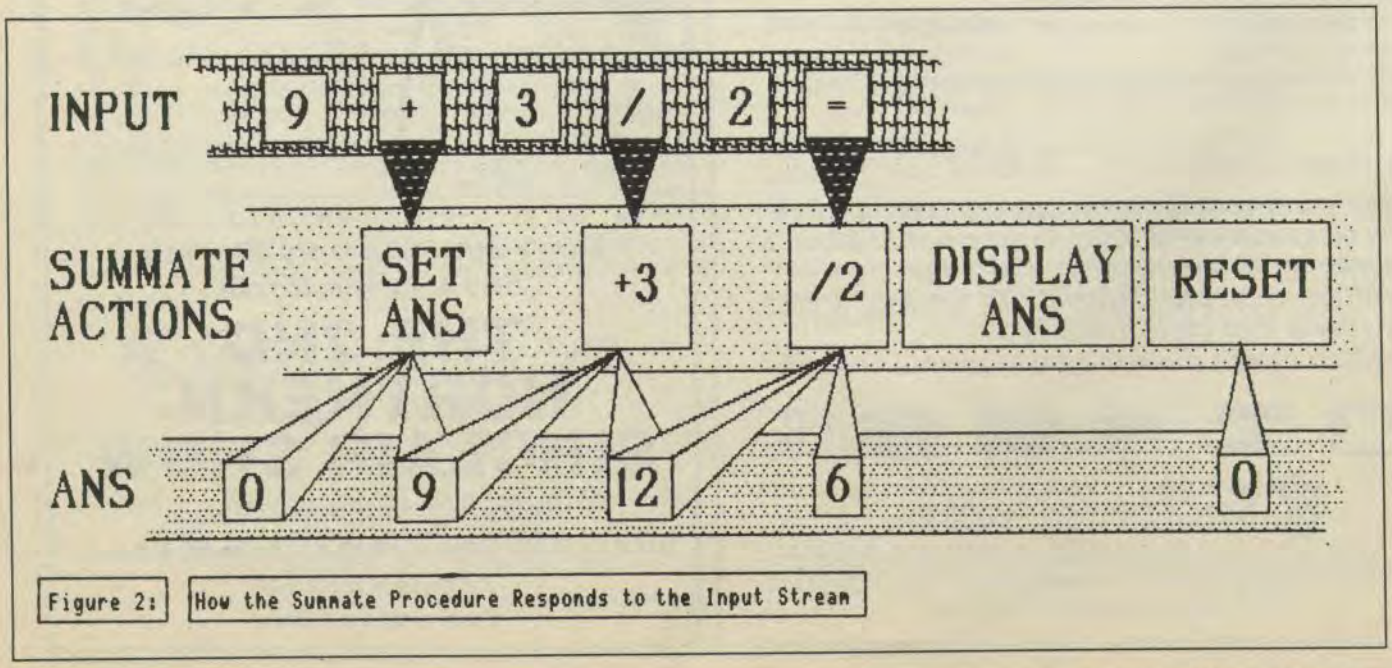


Figure 2: How the Summate Procedure Responds to the Input Stream

almost since the beginnings of computer science. It has established such credence that in the Unix multi-user operating system the person with the most privileges and ownership of the ultimate file directory is universally known as root. It is too late to insist on changing the analogy for one more faithful to nature.

Parented

Even with such a compact hierarchy as that parented by the *Summate* procedure all of the advantages of structured programming are present. Needless repetition of code is avoided by putting frequently-used algorithms into utility procedures called from various other definitions. This concentration of a single task into a single place in the program code also means that any changes to that algorithm can be introduced by amending the internal workings of a single segment of code rather than by making alterations throughout the program.

Program readability is enhanced further by dividing the code into coherent segments and by referring to any complex subordinate process by its user-provided name.

Turning away from the inter-relationships between the definitions and towards their internal workings, the Summate procedure in listing 3.1 is devoted to executing each step, or transaction, in a chain of calculations. Contrast this with the role of the input routine listed in the previous instalment and you will see that the program is switching constantly between receiving information and acting on it.

Such alternating reactive and pro-active phases are very common in real life. Chess players alternate between making a move and waiting for an opponent's response. Tennis players are either receiving the ball or returning it to an opponent. Armies are either attacking or defending. People either influence events or are influenced by them. The distinction between acting and reacting becomes less well-defined with each example but the essential principle remains true.

The key to understanding the workings of the code is in the use to which variables are put. Characters recognised as valid digits are placed in a variable called *Num$* by the input routine listed earlier in the series. Num$ can be in any base from binary to hexidecimal and so its decimal equivalent is calculated and placed in the variable *DecNum* before any arithmetic takes place.

For each transaction two operators normally are involved. The one which triggered the call to Summate is referred to as *Key* while its predecessor is known as *Op*. The numeric variable *Ans* — short for answer — holds the running total for each calculation until eventually it is displayed as the final result when the equals key is pressed. Figure two shows why it is always the previous operator which is used to update the running total.

QL Calculator recognises four classes of arithmetic transaction — the first in a sequence, "running" transactions, subtotals and the full total, which is always the last transaction in a sequence.

For the first transaction, when the value of Op is 18 — i.e., it represents a blank — the running total is made equal to the first value to be entered. Subsequent "running" transactions cause Ans to be modified but it is not displayed until the equals sign is entered, when it is shown in the input area in the input base. If the next keypress is an arithmetic operator the sum continues. Pressing the equals key a second time forces the total to be converted to the output base and the variables zeroised in readiness for the next calculation.

Base conversion algorithms were explained in the introductory article for the project. The functions appear again here in an adulterated form to cope with the special requirements of the program and with an important enhancement — they now handle negative values. The following explanations cover only the modifications to the general-purpose functions.

The code at listing 3.2 turns any number into its decimal equivalent. The standard algorithm is altered only to dispose of floating point decimal numbers and to convert negative integers. It might seem pointless to "convert" a number which is already decimal but the statement at line 3215 is not the simple *IF base = 10 THEN RETURN Number $* which might have been expected.

Adding this month's listings will make the project almost complete and certainly usable, with only the luxurious items outstanding.

Instead, it allows decimal integers to go through the conversion process. This has the satisfactory side-effect of allowing decimal integers with up to eight digits to be displayed without resorting to the annoying "E" notation.

Valid digits

The conversion routine expects a string consisting only of valid digits but the Num$ string might also have leading zeros and a unary minus. The INSTR function on line 3220 is used to detect and locate a unary minus. If one is found the temporary string *Value$* is sliced from *Num$* to the right of the minus. Alternatively, Value$ is defined by the *Left$* function. The conversion algorithm can now set to work; the result is multiplied by minus one if necessary and returned to the calling statement.

Conversion in the other direction is more complex. The decimal number is held in the Number variable and its absolute — positive — value is copied to the temporary variable *n*. A string of blank characters, *X$*, is prepared to receive the final result.

From_Dec$ is designed to receive integer or floating point numbers even though the conversion algorithm copes only with integers. The first special case to be handled is that of tiny fractions which the QL would represent in scientific format; they are all reduced to equal zero.

The second special case handles numbers which are too large to be displayed on the program portion of the screen. Three stages of overflow exist. A number might have too many digits only because it is represented in a small base, such as binary. Alternatively, it might be so large that its scientific notation exceeds 10 digits. In other words it is greater than one followed by 99 zeros. Finally, it might be so huge that the QL crashes.

No billions

In the first circumstance an "overflow" flag is set and a decimal number is returned. If a decimal number exceeds 10 digits it is trimmed to fit the display area by splitting the number at the "E" and removing as many digits as necessary from the left part before joining the number together again.

Accuracy is reduced only slightly because such huge floating point numbers are approximations anyway. Sadly, nothing can be done about super-large numbers and the program will inevitably crash if one occurs. Calculations involving billions of billions will have to be undertaken elsewhere.

By the end of the long IF statement at Line 3344 the routine has disposed of all extreme numbers, leaving the following three categories:

★ Values which can be displayed in eight or fewer digits in a non-decimal output base.

★ Values which would exceed eight digits if they were converted into the output base.

★ Values which are to remain in decimal.

The first category is dealt with by the conversion algorithm detailed in the first instalment of the series. For both of the remaining categories the output is a decimal number, with the overflow flag being set if the output is a failed conversion to a non-decimal base.

The arithmetic is now all over, so non-mathmeticians can address the more practical problems of tailoring the output to suit the program constraints. Listing 3.4 copes with all output to the screen and the printer. The routine begins by establishing a blank string of 14 characters, into which all output values will be concatenated, and by scrolling the screen display area to make room for the new display line. Output can be a number or a message, the

latter being distinguished by an asterisk as the first character.

PrtOut appends to each non-blank output string the base identifier — *h* for hexidecimal, *b* for binary and so on — and the appropriate operator. Overflows are indicated by the presence of a question-mark instead of the base identifier. For printer output, division is represented by a slash because Epson printers do not include the conventional division sign in their character sets.

Listings 3.5 and 3.6 are general-purpose string functions which remove and replace leading blanks. *Right$* adds blanks to the beginning of any text to pad the string length to exactly 10 characters. *Left$* removes leading spaces for the benefit of the *To_Dec$* function but it could be used whenever left justification was required.

The final procedure copes with underlining for output to screen and printer. The underlining algorithm states that a subtotal is preceded by an underline and a final total is also underlined. Underlining therefore takes place whenever the equals sign is pressed except when the Op variable is set to 18, indicating that the equals sign is not being used to complete a sum.

Once the accompanying listings have been added to the program, the QL Calculator will work in floating point mode. By changing some of the values in the *Init_Var* procedure there can be experiments with different input and output bases. The values chosen must accord with the advice given in figure three.

Menu options to automate this process and to accomplish much more besides will be published next month to bring the project to its conclusion.

INPUT			OUTPUT	
IN_BASE	IN_VAL		OUT_BASE	OUT_VAL
10	1	DECIMAL	10	1
16	2	HEXIDECIMAL	16	2
2	3	BINARY	2	3
8	4	OCTAL	8	4

IMPORTANT: THE VARIABLE IntOnly MUST BE SET EQUAL TO ZERO ONLY IF BOTH THE INPUT AND THE OUTPUT IS DECIMAL. SET IntOnly TO 1 IF A BASE OTHER THAN DECIMAL IS BEING USED.

FIGURE 3

Listing 3.2

```
3200 DEFine FuNction  To_Dec$       (Base, Number$)
3205 LOCal y, z, Value$(10), digit$(16), Break
3210 digit$ = "0123456789ABCDEF"
3215 IF NOT IntOnly: RETurn Number$
3220 Break = "-" INSTR Number$
3225 IF Break
3230   Value$ = Number$(Break +1 TO)
3235 ELSE
3240   Value$ = Left$ (Number$)
3245 END IF
3250 z = 0
3255 FOR y = 0 TO LEN (Value$) -1
3260   z = z +(Base ^y) *(Value$ (LEN (Value$) -y)
       INSTR digit$ -1)
3265 END FOR y
3270 IF Break: z = z * -1
3275 RETurn Right$ (z)
3280 END DEFine To_Dec$
```

Listing 3.1

```
3100 DEFine PROCedure Summate
3102 LOCal DecNum
3104 DecNum = To_Dec$(In_Base, Num$)
3106 SELect ON op
3108    = 18: Ans = DecNum
3110    = 20: Ans = Ans - DecNum
3112    = 21: Ans = Ans + DecNum
3114    = 23: Ans = Ans * DecNum
3116    = 25
3118      IF DecNum <> 0
3120        Ans = Ans / DecNum
3122      ELSE
3124        Warning: PrtOut "* Div by 0"
3126      END IF
3128 END SELect
3130 PrtOut From_Dec$ (Out_Base, DecNum)
3132 Num$ = B$
3134 SELect ON Key = 19 TO 24: op = Key + 1
3136 IF Key = 26
3138   SELect ON op
3140     = 20 TO 25: op = 26
3142       Num$ = From_Dec$ (In_Base, Ans)
3144       IF Overflow
3146         PrtOut Num$: op = 18: Num$ = B$
3148       END IF
3150     = 26: op = 18: Ans = 0
3152   END SELect
3154 END IF
3156 END DEFine Summate
```

Listing 3.3

```
3300 DEFine FuNction  From_Dec$     (Base, Number)
3304 LOCal ex, n, x$(10), digit$(16), Temp$(16)
3308 digit$ = "0123456789ABCDEF"
3312 n = ABS(Number): x$ = B$
3316 IF n < 1E-6: RETurn Right$ ("0")
3320 IF LEN(Number) > 10
3324   Overflow = (Base <> 10)
3328   Temp$ = Number: Break = "E" INSTR Temp$
3332   x$ = Temp$: Temp$ = Temp$ (Break TO)
3336   x$ (12 - " " INSTR Temp$ TO) = Temp$
3340   RETurn x$
3344 END IF
3348 IF Base <> 10 AND n < Base^8
3352   IF Number<0: x$(9-INT(LN(n)/LN(Base))) ="-"
3356   FOR ex = INT (LN(n)/LN(Base)) TO 0 STEP -1
3360     x$(10 -ex) = digit$(1 +INT(n /Base ^ex))
3364     n = (n -(Base ^ex) *INT(n /Base ^ex))
3368   END FOR ex
3372   RETurn x$
3376 END IF
3380 Overflow = (Base <> 10)
3384 RETurn Right$ (Number)
3388 END DEFine From_Dec$
```

Listing 3.4

```
3400 DEFine PROCedure PrtOut          (Text$)
3404 LOCal Temp$(14)
3408 Temp$ = FILL$(" ", 14)
3412 AT 8, 0: SCROLL -10, 1: AT 7, 0
3416 IF Text$(1) = "*"
3420   Hue 2: Temp$ = Text$
3424 ELSE
3428   Hue 4:  UnderLine
3432   IF Overflow
3436     Temp$(11) = "?"
3440   ELSE
3444     IF Text$ <> B$
3448       Temp$ (11) = BaseTag$ (Out_Val)
3452     END IF
3456   END IF
3460   Temp$ (13) = Valid$ (op)
3464   Temp$ (1 TO LEN (Text$)) = Text$
3468 END IF
3472 CLS 3: PRINT Temp$(1 TO 13): AT 8, 0: UNDER 0
3476 IF PrtOn
3480   IF Temp$(13) = CHR$(187): Temp$(13) = "/"
3484   PRINT#5; Temp$ (1 TO 13)
3488 END IF
3492 END DEFine
```

Listing 3.5

```
3500 DEFine FuNction  Right$          (Text$)
3505 IF LEN (Text$) > 9: RETurn Text$
3510 RETurn FILL$(" ", 10 -LEN (Text$)) & Text$
3515 END DEFine Right$
```

Listing 3.6

```
3600 DEFine FuNction  Left$           (Text$)
3605 LOCal x, Temp$(10)
3610 Temp$ = Text$
3615 FOR x = 1 TO 10
3620   IF Temp$(x) <> " ": EXIT x
3625 END FOR x
3630 RETurn Temp$ (x TO 10)
3635 END DEFine Left$
```

Listing 3.7

```
3700 DEFine PROCedure UnderLine
3705 LOCal x$
3710 UNDER (Key = 26 AND op <> 18)
3715 IF PrtOn
3720   x$ = CHR$(27) &"-" &(Key = 26 AND op <> 18)
3725 PRINT#5; x$;
3730 END IF
3735 END DEFine
```

TRANSFERS without tears

There are many ways to move files between a QL and a PC. You pay your money and you take your choice. Bryan Davies reassesses the file transfer programs available to date.

There were several developments in the area of file transfer during 1988 and 1989 started with some more. You can now move a wide range of file types between a home-based QL and an office PC — and in the reverse direction. With certain file types you can avoid the chore of having to re-insert printing codes. The ultimate in theory at least is to be able to use the same files, on the same discs, on both types of computer, and that also is now possible.

What is not possible at the moment is to transfer spreadsheet files complete with formulae; the data can be transferred but the formulae are lost. Neither can programs be taken from one computer type and run on the other but, if you can write in SuperBasic and have compilers for the C language, you can do the writing on the QL and the running on both QL and PC.

All the programs mentioned run on the QL — you do not have to buy anything extra for the PC nor do you have to do anything special on it; the PC and the programs you run on it are used in the normal way to load and save files. There is no need for inter-connecting cables; you take discs from PC or QL and insert them in the other system.

In the case of the emulator, you do not even need a PC. There have to be reservations, of course, but they are not due primarily to the transfer programs. The disc modes and formats used on PCs are somewhat different from those used on the QL and, although allowances are made for this in the programs, they can do nothing about the fact that QL drives are not equipped to handle high-density discs.

Much as you might fancy the idea, you cannot increase your QL disc capacity to 1.2MB or 1.44MB; a suitable interface could be designed but existing drives are almost certainly unsuitable for working at the higher densities and new drives would not be cheap — typically £150-£200 for a single 3.5in. drive, without interface or power supply, on a PC.

The basic difference between the PC 40-track and QL 80-track 5.25in. drives is dealt with by the software, but you may have to provide some information to enable the programs to make the necessary changes.

The two dominant operating systems on micros are CP/M, as used on the Amstrad PCW series and Commodore 64, and PC-DOS/MS-DOS for IBM PC/XT/AT models and their clones. In terms of numbers of users, there may be more call for CP/M-related programs than for MS-DOS ones and CP/M is catered for by the programs mentioned. MS-DOS is much more the current interest than CP/M except where games are concerned and it is assumed that readers are concerned primarily with transfers to and from a PC in the IBM or compatible sense.

Inevitably, the emphasis is on the transfer of text files. You can transfer spreadsheet or database files but the programs available do not offer facilities for making them easily usable afterwards. With the formulae or the layout lost you might well think the effort of re-creating them is not worthwhile; it is better to start from scratch and create new files in the other machine.

That does not apply to an emulation program. As the files are unchanged in the transfer process you can continue working on them as normal, whether they be word processing, spreadsheet or database files. Although not considered in the context of this article, the Import program supplied with *Flashback* provides a means of taking Quill, Abacus and Archive files and putting them in a format suitable for use in FlashBack, without further attention; no provision is made for transfer in the reverse direction.

What are the reasons for buying an emulator? Emulation programs cost about the same as other major programs and, no doubt, many copies will be sold to users who buy out of interest rather than to meet a specific need. Perhaps the user is interested in seeing what programs for other machines are like, or how the machines operate. Buying an emulator is cheaper than buying the other machine and gives the user a chance in part to evaluate something he may be considering buying.

It is certain that some QL users will have had a CP/M machine and will have programs used on that; some of the programs may still have no direct counterpart on the QL and a CP/M emulator provides the facility to run them.

There are also PC users among the QL fraternity and they will already have a version of MS-DOS, plus programs such as *WordStar* and *SuperCalc*. Some of those users will work on a PC in their offices and may want to continue some jobs when they get home. Others may feel that learning to use a PC will be an inevitable part of business life in future, so why not look at it now, in the relative peace and quiet of the home QL atmosphere?

Swapping files by means of a conversion utility enables work to be taken to and from the office but the time taken by the conversion process may be unacceptable if extensive editing is required to get the transferred file to print-out with the same typestyle enhancements.

Success

This CP/M emulator is now the only one freely available, the Sandy version having disappeared from advertisements when that company left the QL market. *Success* is, anyway, a rather better emulator. Two versions of the program are supplied on the same disc — one for QL and the other for Thor 20/21. The format of the program is different from that of the IBM emulators, in that you do not run a copy of the CP/M operating system after it, because version 2.2 of that OS is emulated in Success.

All the features of CP/M are there. All you need is Success plus CP/M versions of your favourite programs. You can also write and run Z-80 assembler programs. It is simple to get started if your CP/M discs are in a format Success accepts immediately. Microdrives and RAM discs are still usable devices

but CP/M programs must be on disc.

If the disc format is not accepted initially you have to go through a conversion process, which may be fairly straightforward for a hacker but may not be so with some disc formats for a non-technical user. At least one disc drive and 640KB of memory are required to run Success. Speed of operation is quoted as equivalent to a 2MHz Z-80 processor; that is similar to that of many CP/M machines, so is fast compared to the MS/DOS emulators. Qdos and CP/M jobs can be multi-tasked. Apart from the large commercial library of CP/M programs there is a vast range of public domain software available.

The Solution

The attractions of an MS/DOS emulator are similar to that for CP/M emulation — a large range of commercial and public domain software is available and the user may have several programs as a result of previous involvement with those machines. PC-DOS can be taken as being the same as MS-DOS so far as the programs which run with them are concerned; PC-DOS is used only on IBM machines.

MS-DOS offers little joy as an operating system. It rarely rates favourable comment from journalists; compared to Qdos it is a pain. The only thing which really counts for it is that it is firmly associated with IBM and the PC and there are an estimated 15-20 million computers round the world using it.

The Solution can be expected to work with most versions of MS-DOS and has been tested with various stages of versions 2, 3 and 4. The emulation approach is, as with Success, to use software to simulate the PC hardware but the difference is that the operating system is not emulated but is run separately in the same form as it is on a PC — the emulation program is set running and it then runs MS-DOS from a separate disc.

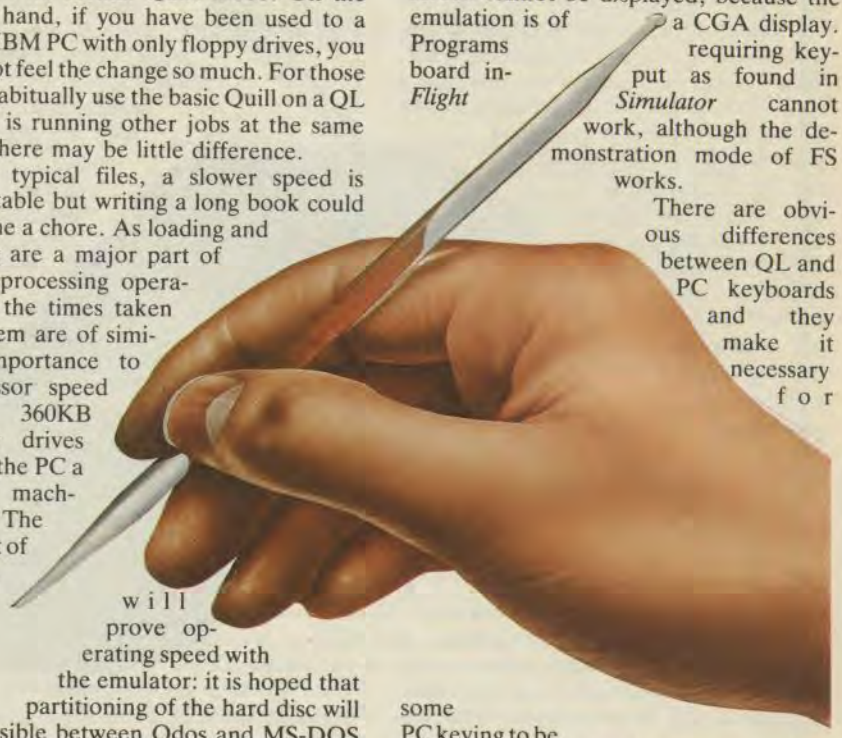
An interesting aspect of this non-hardware approach to emulation is that there should be no argument about whether or not the BIOS, which is on ROM in PCs, is a copy of the original, because it is written in 68000 code and, therefore, looks unlike 8086 code. You need at least one disc drive and a minimum of about 384KB of memory. As PC programs tend to be much larger than their QL equivalents you really need to have a Trump Card fitted to be able to run some of them.

Microdrives and RAM discs are not usable. Speed of operation is quoted as being typically 10 percent of that of a standard PC-XT, which is rather slow. The perceived speed varies considerably with the program and type of job. There is a noticeable lag in characters appearing on the screen when using a word processing program but the usual input buffer allows you to type well ahead of the display without losing characters; response to command keys is good.

When word processing, most of the processor time is spent reading in keyboard input or waiting for it and processor speed is not the most important factor; under those circumstances effective speed may be as high as 90 percent of an XT.

Coming from a fast AT with fast hard disc to the emulator, the slow-down is marked but that is true when the QL is used in its normal Qdos mode. On the other hand, if you have been used to a basic IBM PC with only floppy drives, you will not feel the change so much. For those who habitually use the basic Quill on a QL which is running other jobs at the same time there may be little difference.

For typical files, a slower speed is acceptable but writing a long book could become a chore. As loading and saving are a major part of word processing operations, the times taken for them are of similar importance to processor speed and 360KB floppy drives make the PC a slow machine. The advent of hard disc will improve operating speed with the emulator: it is hoped that partitioning of the hard disc will be possible between Qdos and MS-DOS and the latter already allows partitions for other operating systems such as Unix.



The big thing is that you take not only the progam discs but the data ones also directly from a PC and put them into the QL drives and continue working on the same files, taking them back to the PC after editing. The emulation even has some advantages over the PC; the DOS area available to the user rises from 640KB to 667KB — maximum, on an 896KB system — and the disc drives can be 80-track if you have them and give 720KB storage space on the 5.25in. disc.

You can multi-task Qdos and MS-DOS if your system has sufficient memory. At the moment I am typing into *text87*, running under Qdos and watching Quill text appearing on the screen simultaneously under MS-DOS; there is no doubt the QL is multi-tasking, because two portions of text are being written to the screen at the same time. Disc drives can be allocated separately to Qdos and MS-DOS; the latter can be booted from either drive, the boot drive being regarded by it as A:.

It is recommended that you use a speed-up program such as *Lightning* to improve the rate at which characters are displayed on the screen and also the speed of processing. Appreciably faster running is obtained on the Thor XVI and the Atari QL Emulator — claimed to be 2.5 times as fast as on the QL.

Compatibility is a familiar word in the PC world and The Solution creates no significant problem. It will run almost all the well-known programs — *Lotus 1-2-3, WordStar, WordPerfect, and Word.* Those it cannot run may well not run on PC clones either. There are practical restrictions, which apply equally to PCs; graphics files created using an EGA screen cannot be displayed, because the emulation is of a CGA display. Programs requiring keyboard input as found in *Flight Simulator* cannot work, although the demonstration mode of FS works.

There are obvious differences between QL and PC keyboards and they make it necessary for some PC keying to be altered to suit the QL. F1-F5 are the same but F6-F10 become CTRL+6-CTRL+0; you can customise keying to your requirements if the basic set-up does not suit you.

The "chocolate" version of The Solution is complete with MS-DOS version 4.0, a debugged version which seems to work normally but is suitable only for the PC & XT, not the AT; it includes GW Basic but Microsoft supplies no documentation for it. A public domain Basic is supplied with the "vanilla" version. IBM Basic and BasicA do not run, nor do they on typical PC clones. The main thing is that the emulation is very solid — flickering screens, crashes and error messages are unlikely, provided you have followed a few basic procedures given in the comprehensive manual.

DiscOVER

This was reviewed in the February, 1988 issue of *QL World.* Briefly, it treats one QL disc drive as the host (Qdos) and the other as the "alien" (MS-DOS). Put an appropriate disc into either drive and you can convert the files on it into a form which can be read on the other type of system, the converted files being written to the other drive. This is primarily a disc format change. What the basic program does not do is ensure that special codes used in files for one program are changed to whatever codes are appropriate to

another program. This is not something peculiar to conversion between different types of computer, as it occurs also if you transfer Quill _doc files into *The Editor* on the QL.

The program offers a partial solution to this problem in the form of transfer files. Users of The Editor will grasp the idea easily; you have to make a translation table, listing the special codes which will be found in the original file and the equivalent codes which need to be inserted in their place in the converted file. That file can be loaded when you start a conversion and it will be scanned for the replacement codes to be placed automatically in the converted file. The creation of the translation tables can be a chore and it is a job which will be beyond some users' ability but there is nothing preventing you making any necessary changes when the converted file is loaded into the "other" program.

The process is time-consuming, of course. *DiscOVER* works very smoothly and fast and I have found it a completely successful way of transferring files between QL and PC. Transfers are not limited to QL-IBM but include the Apricot versions of IBM format. What you cannot do is take an Export-ed Abacus file, convert it, and have the formulae present when it is loaded into Abacus on a PC; the data is there but the formulae are not and this is a function of the Psion Export/Import process, not of DiscOVER.

Multi-DiscOVER

This is a development from DiscOVER. It allows transfers to and from a wider range of formats — IBM MS-DOS (including Apricot), BBC DFS/ADFS, CP/M and Unix CPIO. Transfers can be made to and from each of these and Qdos format. Automatic adjustment is made for drive type — 40- or 80-track — and 40-track discs can be read and normally written to in 80-track drives. Directory/sub-directory structures are supported. As with *TexTidy*, there is incompatibility with Lightning, *SpeedScreen* and *Toolkit III*, so that the program has to be run after a computer re-set. The menu screen and controls are similar to those for DiscOVER.

All QL storage devices, including hard disc, are usable; Thor models are supported. As with DiscOVER, the facility provided for looking at the contents of a file can be very useful. Users familiar with *Multi-DiscOVER*, although I find using it rather less intuitive, possibly because of the greater number of features available.

Neither program offers ready-made translation files for dealing with the code changes needed when moving from one program to another but advice is given on creating your own files for this purpose.

TexTidy can be used for some conversion jobs. There is plenty of technical detail about discs for-mats in the instructions; much of the information given will be of general help to users who are not particularly knowledgable about such matters.

XOver

This is a utility supplied with The Solution. It is also supplied with *Media Manager Special Edition* and has the same menu format as that program. It enables files on MS-DOS or TOS (Atari) format discs to be transferred to Qdos format discs and vice versa. Other operations which are provided are Delete and Rename — DOS discs only — and conversion of the IBM version of ASCII character codes to the Qdos version; again, the reverse process is also available.

The latter function deals with the differences between the two company formats in handling characters with codes above decimal 127 and in the end-of-line codes used. Another facility is to format "alien" discs. You can take a Qdos-format disc and make it a DOS-format disc. An unexpected use for this was to format a 3.5in. disc with 40 tracks, since this odd format was required to attempt loading the Ant MS-DOS emulator; MS-DOS 3.2 and 3.3 on my AT refused to format this disc size with 40 tracks.

This was produced to solve some of the difficulties arising from use of DiscOVER. It is not a transfer utility in the same sense but performs the translation operations needed to make a text file look the same when transferred into a "new" program, whether on the QL or another computer. The program can remove any embedded codes from a file, producing pure ASCII output. In the process it can end lines with either line-feed (LF) or line-feed plus carriage-return (LF+CR) codes, as required by the receiving system.

The same operations can be performed on both PC Quill and QL/Thor Quill files. Likewise, WordStar files can be stripped of codes so that they are suitable for input and direct editing by The Editor, or for Importing into Quill. QL and PC Quill document files can be converted into a form suitable for use in WordStar, retaining the control codes for text enhancements such as bold and underlining.

The instructions warn the user that TexTidy has difficulty if run with SpeedScreen, Lightning or Toolkit III — it is satisfactory with Toolkit II — and this means you may have to run it in a "clean machine" rather than when your usual programs are loaded; this will be inconvenient for some users.

The screen presentation is consistent with the associated programs discOVER and Multi-DiscOVER and use is fairly straightforward without the need for the written instructions. For those who wish to transfer files between programs not dealt with, the principles of the process can be observed in TexTidy, for a relatively low price, to help with development of conversion files which can then be used to give automatic conversion with either version of DiscOVER.

SuperBasic C-Port

Originally called plain *Basic C-Port*, this program has been re-launched in improved form. Its purpose is to take source code — program lines — written in QL SuperBasic and convert them into code in the C language. The C code can then be compiled with a C compiler, which has to be ANSI- or Lattice C-compatible; a "Small C" compiler such as the DP Digital C is not fully-compatible.

Compilers for the QL, such as that from Metacomco, are no longer easily obtainable but PDQL expects to introduce a Lattice C compiler soon. As C is a relatively portable language, the code obtained from running SB code through *SuperBasic C-Port* on the QL can be compiled by a PC compiler and run on PCs; the British Standards Institute has cast some doubt on how compatible certain PC compilers are with the ANSI standard but it is not anticipated there will be any major problems compiling files from C-Port.

INFORMATION:

SuperBasic C-Port, £79; TexTidy, £10; Multi-DiscOVER, £39; DiscOVER £29.50:
PDQL Computer Systems, Unit 1, Heaton House, Camden Street, Birmingham B1 3BZ. Tel: 021 200 2313

The Solution MS-DOS emulator (including XOver), £79.95 (£129.95 with MS-DOS 4.0); Success CP/M emulator, £49.95:
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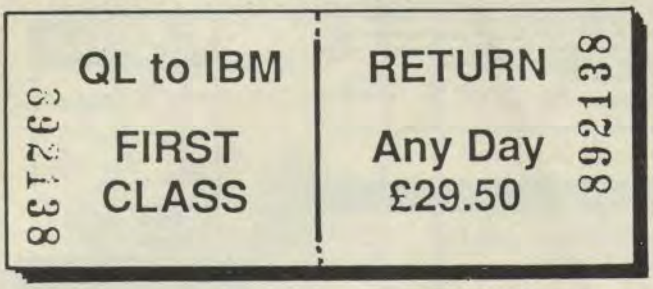

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text87

PIX

DIY TOOLKIT

Each month Simon Goodwin adds new commands to the QL repertoire. This month he shows how to handle default parameters and read the colour of screen points.

I introduced functions to interrogate the channel definition block which stores details of windows and other channels in use a year ago. This month's code goes one step further, reading the QL display memory so that programs can check the colour of any point on the screen. This is a very useful function but curiously it is not available in popular commercial toolkits.

The code of the PIXEL% function illustrates many important features of QL design, including the arrangement of display memory, the way the console device can be extended and, for the first time in DIY Toolkit, the handling of default parameters.

Defaults are important because they allow programmers to simplify their code by omitting parameters. PIXEL% defaults to reading channel #1, which makes it an ideal companion for the USE command, introduced in DIY Toolkit in March last year. You can use a similar technique to add defaults to the channel access functions of your own toolkit code.

The PIXEL% function uses the EXTOP system-call to add extra code to the

QL display device. The workings of EXTOP were explained in the May, 1988 DIY Toolkit.

The first 32K of QL RAM is known as display memory, because any data stored in it appears as a pattern of dots on the screen. The first SuperBasic compiler, *Supercharge*, used screen memory to store details of the program it was compiling. Nowadays serious QL users have expanded memory and such tricks are unnecessary but Supercharge demonstrated that, apart from the mess on the screen display, memory works like normal RAM.

Dot control

Each consecutive pair of bytes or 'word' in display memory controls a row of dots on the QL screen. In the high-resolution MODE 4 each word determines the colour of eight dots. The other mode trades extra colours for a reduced number of dots, so one word controls four dots in MODE 8.

PIXEL% can distinguish automatically between MODE 8 and MODE 4 displays. The difference in stored format is explained in the QL User Guide Memory Map in the Concepts section of the December, 1984 edition.

Dot colour

The function PIXEL% tells you the colour of a specified dot on the QL screen. The name of the function is a contraction of 'PICture ELement' or 'PIcture CEL1', the technical name for the individual dots which make up text and graphics displays. The size of QL pixels varies depending on the graphics mode in use.

MODE 8 displays are made up from a grid of 65,536 pixels — 256 vertically and the same number horizontally — where each dot can be in any one of eight colours, numbered from Black (0) to White (7), ranging through the spectrum in steadily-increasing brightness. MODE 4 gives twice as many pixels — 131,072, made up of 256 lines with 512 pixels on each line.

Colours are numbered the same way regardless of mode but only four colours are allowed in MODE 4, so you can use two values for each displayed colour; 0 and 1 give black, 2 and 3 red, 4 and 5 green, and 6 and 7 white. Once a dot has been displayed PIXEL% cannot tell which variant you used and it makes no difference in any case, so in MODE 4 it returns the values corresponding to the same colours in MODE 8 — 0, 2, 4 and 7.

PIXEL% uses the QL 'pixel co-ordinate scheme', explained in the Concepts section of the QL User Guide. Co-ordinates are relative to the top left corner of the specified window, as in commands like BLOCK. To access the whole screen, just:

```
OPEN #3,SCR_512x256a0x0
```

and read from channel 3. You can read the colour of dots in a window whether or not it is set up to allow character input, so PIXEL% works with CONsole or ACReen windows.

The function has two or three parameters — an optional channel number, followed by the X and Y co-ordinates of the point to be read. It checks that the channel number corresponds to an open display channel normally an 'SCR' or 'CON' channel on a standard QL. You get a 'bad parameter' error if you specify the incorrect number of parameters or the wrong type of channel.

Like BLOCK and WINDOW, PIXEL% uses the same co-ordinate scheme regardless of mode. Horizontal co-ordinates in MODE 8 are always even, so the 256 dots on a line are at co-ordinates 0, 2, 4 . . . 508, 510. If you supply an odd number it is rounded down.

Window mirror

Listing three shows how PIXEL% can be used to mirror the contents of a window. The procedure MIRROR in the listing uses PIXEL% and the CHAN_W% function from May last year to flip the contents of a window from left to right, so it can be read in a mirror.

You can use this procedure to generate projected displays with your QL, or when printing plans. It is particularly useful when building circuit boards; you can design the board from the component side and print a mirror-image of the finished layout when you need to know how everything will look from the solder side of the board.

This routine takes a time, even when compiled, because it uses the BLOCK routine which is optimised for large areas and it accesses each point in the window individually. MIRROR must make more than a quarter of a million system calls to flip a full-sized MODE 4 window. Each call involves much work by the system ROM before the external routine is invoked. The PIXEL% code is trivial

```
* QL WORLD DIY TOOLKIT - pixel graphics function
* Version 0.5, Copyright 1989 Simon N Goodwin.
*
start     lea.l   define,a1
          move.w  $110,a2         BP.INIT vector
          jmp     (a2)
*
* PIXEL%  code - process 2 or 3 parameters
*
pixel     move.w  $112,a2         Vector to get integers
          jsr     (a2)            CA.GTINT
          bne.s   bad_exit
          moveq   #1,d0           Assume channel 1 for now
          subq.w  #2,d3           At least 2 parameters?
          beq.s   get_coords      Exactly 2,  use #1
          bmi.s   bad_param       Less than 2: an error
          subq.w  #1,d3           Only one extra parameter?
          bne.s   bad_param       No, more than 3, complain
          move.w  0(a1,a6.l),d0   Get BASIC channel number
          addq.l  #2,a1           Discard channel parameter
*
get_coords move.w  0(a1,a6.l),d1  Get X co-ordinate
          move.w  2(a1,a6.l),d2   Get Y co-ordinate
          addq.l  #2,a1           Leave room for one INT
          move.l  a1,$58(a6)      Set maths stack pointer
*
* Check and convert channel number in D0 to ID in A0
*
chan_sel  mulu    #40,d0          Channel table size
          add.l   $30(a6),d0      Add base offset
          cmp.l   $34(a6),d0
          bge.s   what_chan       Past end of table?
          move.l  0(a6,d0.l),d0
          bpl.s   chan_open       Negative if closed
*
* Error return points
*
what_chan moveq   #-6,d0          CHANNEL NOT OPEN error
bad_exit  rts                     Error code is in D0
bad_param moveq   #-15,d0         BAD PARAMETER error
          rts
range_err moveq   #-4,d0          Out of Range report code
          rts
*
* Call EXTOP routine passing A0, D1 and D2
*
chan_open move.l  d0,a0           A0 is channel ID
          lea.l   pixtop,a2       Address of routine
          moveq   #-1,d3          Allow infinite time
          moveq   #9,d0           SD.EXTOP key
          trap    #3              Call the device driver
          move.l  $58(a6),a1      Retrieve maths stack pointer
*
return_int move.w  d1,0(a1,a6.l)  Put result in space
          moveq   #3,d4           Indicate type is INT
          rts                     Return EXTOP error code
*
* PIxel eXTended OPeration routine: reads pixel data.
* D1.W is the X co-ordinate, D2.W is the Y co-ordinate
* The result is returned in D1, or error code -4 in D0
*
pixtop    tst.w   d2              Check Y >= 0
          bmi.s   range_err
          cmp.w   30(a0),d2       Check Y < CH.HEIGHT
          bcc.s   range_err
          tst.w   d1              Check X >= 0
          bmi.s   range_err
          cmp.w   28(a0),d1       Check X < CH.WIDTH
          bcc.s   range_err
          add.w   24(a0),d1       Add window offset to X
          add.w   26(a0),d2       Add window offset to Y
*
* Find the relevant word in video memory
*
mode4     move.l  50(a0),a2       Get screen base address
          lsl.w   #7,d2           1 line uses 2^7 = 128 bytes
          add.w   d2,a2           Get address of start of line
          move.w  d1,d2           Save original X co-ordinate
          lsr.w   #2,d1           Get word offset on line
          and.w   #126,d1         Ensure offset is even, 0-126
          add.w   d1,a2           A2 -> relevant screen word
          move.w  (a2),d1         D1.W is the video word
          and.w   #7,d2           D2 = pixel offset in word, 0-7
*
* Extract the pixel in mode 4 or 8
*
          btst    #3,52(a6)       Check mode
          bne.s   mode8           Use mask for 8 colours
          moveq   #7,d0
          sub.w   d2,d0           Reverse offset to 7-0
          lsr.w   d0,d1           Move pixel data to LS bits
          and.w   #257,d1         Mask for 4 colours
          add.b   d1,d1           Double red bit weight
          move.w  d1,d2           D2 = 00000006 000000R0
          lsr.w   #6,d2           D2.B =  00000G00
          or.b    d2,d1           D1.B =  00000GR0
          cmp.b   #6,d1           Conventional value 0, 2, 4 ?
          bne.s   got_value
          addq.b  #1,d1           Translate 6 to 7 (White)
          bra.s   got_value
*
mode8     moveq   #6,d0
          bclr    #0,d2           Ensure even X in MODE 8
          sub.w   d2,d0           Reverse offset to 6-0
          lsr.w   d0,d1           Move pixel data to LS bits
          and.w   #515,d1         Mask for 8 colours
          move.w  d1,d2           D2 = 00000060  000000RB
          lsr.w   #7,d2           D2.B =  00000G00
          or.b    d2,d1           D1.B =  00000GRB
got_value ext.w   d1
          moveq   #0,d0           Signal no error
          rts
*
define    dc.w    0,0             No procedures
          dc.w    1               One function
          dc.w    pixel-*
          dc.b    6,'PIXEL%'
          ds.w    0
          dc.w    0               End of list
          end
```

compared to the BLOCK routine and the unavoidable Sinclair TRAP handler.

For best results with Turbo add IMPLICIT% x,y at the head of the program. If you want the code to run really fast you must write a new code to process several dots at once.

Listing three will not work in MODE 8 without changes, because of the smaller number of pixels in that mode. The BLOCK 1,1 commands set a single MODE 4 pixel, which Sinclair rounds down to no MODE 8 pixels at all.

To flip a window in MODE 8, change lines 200 and 210 to start BLOCK 2,1 . . . and add STEP 2 at the end of line 180, so the program reads only even X co-ordinates. The good news is that the MODE 8 version will be twice as fast, because it has half as many pixels to read for a given display area.

You can use PIXEL% for many other applications when speed is less of a problem — for instance to check when moving graphics collide on the screen.

No MODE 12

The functions have been written to work reliably on any QL or compatible, including the CST Thor and Thor 16. They do not handle the Thor 16-colour MODE 12, because designer David Oliver failed to supply information about Thor-specific features, but it should be easy to adapt the MODE 8 code to suit MODE 12 if you can obtain the information from CST.

Like the CHAN functions, PIXEL% uses the SD.EXTOP routine to access channel details. That means it is not disturbed by the extra channel information which QRAM and Thor windowing systems tack on to the start of a channel block. QLs and most Thors keep the display information at a fixed address, 131072, but the Thor 16 is more flexible and can have several 32K display maps at different addresses. PIXEL% reads the base address of the display from offset 50 in the channel details, so it takes multiple display areas in its stride.

The code for the channel access functions is listed in two forms. Listing two gives you a quick way to enter the code without using an assembler. It loads the equivalent machine code from DATA statements and saves the code in a file. Once you have loaded that file, as follows, you can use PIXEL% in your own programs:

base=RESPR(242) : LBYTES "file name", base : CALL base

Type NEW after loading the code on an AH or JM QL to ensure that early QL ROMs are not confused by prior use of the name PIXEL%.

Loader

The first part of listing two is Marcus Jeffery's standard loader, used in every month's DIY Toolkit project. Only the DATA, from line 590 onwards, changes from month to month. Listing one is the assembly code program, assembled using HiSoft *DevPac*. You can type this text into your assembler if you want to customise the code or merge it with other routines.

The START routine calls BP.INIT, the ROM vector which adds new commands to SuperBasic. The table labelled DEFINE, at the end of the listing, indicates the name and address of the PIXEL routine.

The first step is to read the parameters — the optional channel number and two co-ordinates. They are all integers, so we call CA.GTINT to fetch them from the place indicated by A3 and A5. GTINT returns with a non-zero result, signifying a 'bad parameter' or 'error in expression' if it cannot find suitable values. Otherwise it puts them on the maths stack, pointed to by A1 offset from A6, with the first parameter at the lowest address on the stack.

The total number of parameters fetched

```
DIY Toolkit June 1989, listing 2.

100 REMark Sinclair QL World HEX LOADER
110 REMark by Marcus Jeffery & Simon N Goodwin
120 :
150 CLS: RESTORE : READ space: start=RESPR(space)
160 PRINT "Loading Hex..." : HEX_LOAD start
170 INPUT "Save to file...";f$
180 SBYTES f$,start,byte : STOP
190 :
200 DEFine FuNction DECIMAL(x)
210 RETurn CODE(h$(x))-48-7*(h$(x)>"9")
220 END DEFine DECIMAL
230 :
240 DEFine PROCedure HEX_LOAD(start)
290 byte = 0 : checksum = 0
300 REPeat load_hex_digits
310    READ h$
320    IF h$="*" : EXIT load_hex_digits
330    IF LEN(h$) MOD 2
340       PRINT"Odd number of hex digits in: ";h$
350       STOP
360    END IF
370    FOR b = 1 TO LEN(h$) STEP 2
380       hb = DECIMAL(b) : lb = DECIMAL(b+1)
390       IF hb<0 OR hb>15 OR lb<0 OR lb>15
400          PRINT"Illegal hex digit in: ";h$ : STOP
420       END IF
430       POKE start+byte,16*hb+lb
440       checksum = checksum + 16*hb + lb
450       byte = byte + 1
460    END FOR b
470 END REPeat load_hex_digits
480 READ check
490 IF check <> checksum
500    PRINT"Checksum incorrect. Recheck data.":STOP
520 END IF
530 PRINT"Checksum correct, data entered at: ";start
560 END DEFine HEX_LOAD
570 :
580 REMark Space requirements for the machine code
590 DATA 242
600 :
610 REMark Machine code data
620 DATA "43FA00DE34790000","01104ED234790000"
630 DATA "01124E9266367001","5543670C6B305343"
640 DATA "662C3031E8005489","3231E8003431E802"
650 DATA "54892D490058C0FC","0028D0AE0030B0AE"
660 DATA "00346C0620360800","6A0C70FA4E7570F1"
670 DATA "4E7570FC4E752040","45FA001476FF7009"
680 DATA "4E43226E00583381","E80078034E754A42"
690 DATA "6BE0B468001E64DA","4A416BD6B268001C"
700 DATA "64D0D2680018D468","001A24680032EF4A"
710 DATA "D4C23401E4490241","007ED4C132120242"
720 DATA "0007082E00030034","661C70079042E069"
730 DATA "02410101D2013401","EC4A8202B23C0006"
740 DATA "6618520160147006","0882000090 42E069"
750 DATA "0241020334 01EE4A","8202488170004E75"
760 DATA "000000000001FF26","065049584 54C2500"
770 DATA "0000","*",19106
```

```
DIY Toolkit June 1989, listing 3.

100 REMark MODE 4 Window reflecting routine
110 REMark QL World DIY Toolkit June 1989
120 REMark Copyright 1989 Simon N Goodwin
130 :
140 DEFine PROCedure MIRROR(ch%)
150 LOCal max_x%,y,x,dot%
160 max_x%=CHAN_W%(ch%,28)-1
170 FOR y=0 TO CHAN_W%(ch%,30)-1
180 FOR x=0 TO max_x% DIV 2
190   dot%=PIXEL%(#ch%,max_x%-x,y)
200   BLOCK 1,1,max_x%-x,y,PIXEL%(#ch%,x,y)
210   BLOCK 1,1,x,y,dot%
220 END FOR x
230 END FOR y
240 END DEFine MIRROR
```

is returned in D3. If that is fewer than two or more than three, we get a 'bad parameter' error. If we have three parameters the first is a channel number; otherwise we assume channel #1. The parameters end up in registers D0, D1 and D2 and the maths stack is adjusted to leave room for a single integer result.

Not open

The familiar CHAN_SEL code converts a Basic channel number into an internal system identifier, by looking through the SuperBasic table of channel details. If the identifier is negative, or the entry would be outside the limits of the table, the code reports 'channel not open'.

Next we call SD.EXTOP, which lets us add new code to a display device. The ROM code invoked by the TRAP #3 converts the channel identifier in A0 into the address of the first documented part of the channel block. Only screen and console channels recognise EXTOP; others give a 'bad parameter' error.

It is possible that another task is already using the channel, in which case Qdos cannot use SD.EXTOP immediately as only one task can use a particular channel at any time. The timeout value -1 in D3 ensures that the system keeps trying to perform the operation every time tasks are swapped, until it succeeds because the other task has finished with the channel.

This is called an 'infinite' timeout, with good reason, but should not cause problems; if necessary you can set up a separate window overlaying the others, just for PIXEL% calls.

Eventually the console driver calls the routine pointed to by A2, the code which finds and interrogates a pixel. PIXEL% uses D1 and D2 to pass the co-ordinates and D1 to read the resultant colour. A1 is also passed back and forth by EXTOP but PIXEL% does not use it. The original value of D2 is reinstated when the call is complete.

```
QL World DIY Toolkit PIXEL% demonstration.

100 REMark MODE 4 Window reflecting routine
110 REMark QL World DIY Toolkit June 1989
120 REMark Copyright 1989 Simon N Goodwin
130 :
140 DEFine PROCedure MIRROR(ch%)
150 LOCal max_x%,y,x,dot%
160 max_x%=CHAN_W%(ch%,28)-1
170 FOR y=0 TO CHAN_W%(ch%,30)-1
180 FOR x=0 TO max_x% DIV 2
190   dot%=PIXEL%(#ch%,max_x%-x,y)
200   BLOCK 1,1,max_x%-x,y,PIXEL%(#ch%,x,y)
210   BLOCK 1,1,x,y,dot%
220 END FOR x
230 END FOR y
240 END DEFine MIRROR
```

Pixtop

The PIXTOP routine starts by checking that the co-ordinates fit inside the window; then it adds the window offsets, making the co-ordinates relative to the top left corner of the screen.

The next step is to find the word of video memory which stores the pixel colour. Each line takes 128 bytes, so the start of memory for the relevant line of pixels is found by adding Y% * 128 to the start address of video memory, taken from the channel details. There are 512 possible X co-ordinates on each 64-word line. We find the required word by converting the pixel co-ordinate, 0-511, into an even offset between 0 and 126.

The LSR.W divides D1 by 4 quickly, while the AND.W ensures an even result. The last three bits of the X co-ordinate tell us the location of the pixel data inside the word and end up in D2. Later the value is

'Defaults are important, because they simplify code by omitting parameters.'

'reversed', as solid colour numbers use the lowest bits of a byte, whereas pixel offset 0 corresponds to the most significant bits in a video word, which need to be shifted most.

Bit #3 of the system variable SV.MCSTA is set if we are in MODE 8; it is easy to check this, as A6 points to the system variables when an EXTOP routine is called. The 'flash' bit is ignored in MODE 8, as flashing is little-used and you cannot work out whether or not a particular pixel is flashing without scanning the previous part of the line. A set flash bit affects all the pixels up to the end of the line or the next set flash bit.

The code for each mode uses a succession of shifts to extract the details of one pixel and convert it into a standard colour number. The comments alongside the code show the way red, green and blue colour information is shuffled. A successful call returns with the result in D1 and zero in D0.

● Next month I will have more code and commentary. Please send your suggestions if you would like me to explore a specific area in this column, or implement new commands – particularly ones unavailable in commercial toolkits.

Quanta shows the hard discs

Simon Goodwin dons a pair of his hats at Northampton.

Hard discs were the dominant theme at the latest Quanta QL User Group workshop at Northampton; three systems were on show, with several others promised. David Richards was demonstrating the official Quanta prototype disc and interface. It runs up to four IBM-type hard discs or floppy drives and uses the M212 transputer intelligent disc controller. A 10MB system costs around £350.

The Miracle Systems £399 Winchester drive was on display, running Tony Tebby control software and having a capacity of almost 32MB. It uses an IBM filecard internally but improves on the reliability of a PC with an auto-park routine. It moves the vibration-sensitive disc head safely out of harm's way if the drive is not accessed for five seconds or more.

That reduces the risk of a data-scrambling head crash but even then Winchester users would be wise to buy a copy of the PDQL HardBack back-up utility; 32MB is a great deal of re-typing if the worst happens.

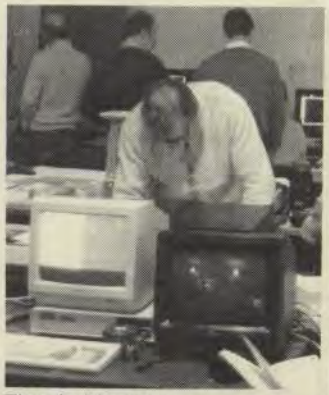
The surprise arrival was a second commercial hard disc system from Rebel Electronics of York. Its RB-100 interface works with one or two standard Winchester drives, each with a capacity of 20, 40, 60 or 80MB.

The interface ROM includes in-house disc control software and a faster, more flexible version of *Speedscreen*, the QL text accelerator. An 8K sector buffer on the board gives extra disc speed.

The Rebel hard disc interface plugs into the main QL expansion connector. It uses reliable but expensive Western Digital chips and costs slightly less than £200, plus the cost of the drive. Rebel launched simultaneously a much-needed expansion backplane which fans out the QL expansion connector, allowing up to four peripheral cards to plug in at once.

The £83 RB-50E includes fast buffers, firmware to link devices into Qdos and a socket for a second power supply, in case you decide to cascade power-hungry peripherals. A complete expansion of Winchester interface, four-way backplane and 80MB drive costs £699, or £664 to Quanta members.

Tony Tebby of QJump addresses the multitude.



Thor in his glory.

Freddy Vaccha of Digital Precision joins in.

Johnathan Oakley (QJump) and Simon Goodwin compute.

As usual, the workshop featured presentations from a succession of QL luminaries, including John Silk of PDQL and Freddy Vachha of Digital Precision. Tony Tebby led the way with a talk on his *QJump* products. It seems that work on the Miracle hard disc has rekindled his enthusiasm for the QL, although *QRAM 2* is still far from complete.

Creative CodeWorks boss and *QL World* contributor Simon Goodwin discussed work in progress, including a secret weapon due for launch in the autumn. He rounded off his presentation with a personal impression of the quirks of magazine publishing, from his perspective as the compiler of DIY Toolkit, and later had to endure an interrogative telephone call from the editor on the strength of this.

In the next room hardware and communications specialist Tony Firshman slaved over a hot soldering iron, fitting the Futura Datacentre QL emulator into a succession of Atari STs. A plethora of QL spares was available from him and Dennis Briggs of Quanta in the packed machine room upstairs.

Former Sinclair and *QJump* programmer Jonathan Oakley discussed Tyche, the ill-fated Sinclair QL follow-up, and his plans to build a professional Midi synthesiser interface based on the 68681 dual UART chip. The interface is the easy part; it is the device driver and Midi editor which will need a good deal work. Oakley wrote *QRAM*, so he has the experience to make a good job of a QL Midi device.

This was the second QL workshop at Northampton and more than 200 QL enthusiasts appeared during the weekend. Quanta organisers plan another workshop in the same area in the autumn. The QL scene is buzzing at the moment, with Quanta members at the forefront and prospects for new hardware and software in 1989 look excellent.

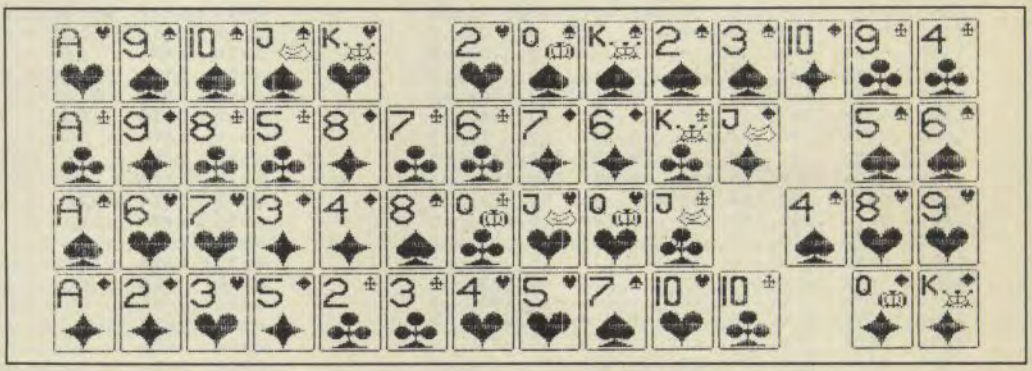
Further information about Quanta, the Independent QL User Group, is available from the membership secretary, Philip Borman, at 15 Grosvenor Crescent, Grimsby DN32 0QJ.

THE P·R·O·G·S

If you have a program worthy of consideration, send it to 'The Progs', Sinclair QL World, Greencoat House, Francis Street, London SW1P 1DG. We pay for everything published at the usual page rates.

Program of the month

CRAZY CARDS by Quintens Pierre



The aim of the game is to place each card in increasing order after the corresponding ace. To do this you must move the appropriate card into a free place, so that the card on its left is the same colour and one value below the card moving in. This is repeated until it is impossible to move further. Then the program will reshuffle the unused cards for the next round. There is a maximum of four rounds.

Use the left, right, up and down keys to move the vertical and horizontal cursors; use the space bar to move cards. The F4 key toggles between a default mode — the indicated free place is filed by the right card — and an alternative — the space bar moves the indicated card to the correct free place. F5 reshuffles the cards. Exit from the game is via escape.

It may look simple but it is extremely addictive.

We are not able to offer Crazy Cards on the Microdrive Exchange this month, although we hope to do so in future. Please could the author write to us?

```
10 CLS
20 PRINT 'CRAZY CARDS'
30 PRINT 'BY QUINTENS PIERRE'
40 PRINT '1 rue Henneumont'
50 PRINT '5198      ANHEE'
60 PRINT 'BELGIUM'
70 PRINT 'PHONE 082/612677'
80 AD=RESPR(6144)
90 LBYTES MDV1_CRAZY_CDE,AD
100 CALL AD

10 REMark          CRAZY-CARDS
20 REMark               BY
30 REMark        QUINTENS PIERRE
40 REMark         COPYRIGHT  87
100 DIM CK(18)
110 AD=RESPR(0)
120 IF RESPR(0)=262144 THEN AD=RESPR(6144)
130 FOR F=1 TO 18
140 CK(F)=0
150 FOR G=0 TO 191
160 READ D
170 CK(F)=CK(F)+D
180 POKE AD+(F-1)*192+G,D
190 NEXT G
200 NEXT F
220 RESTORE 10000
230 FOR F=1 TO 18
240 READ N
250 IF CK(F)<>N THEN
260     PRINT 'ERROR AFTER LINE ';
270     PRINT 1000+(F-1)*240
280 END IF
290 NEXT F
300 SBYTES MDV1_CRAZY_C,AD,3456
310 PRINT 'NOW TYPE : '\\
320 PRINT ' - NEW;'
330 PRINT ' - LBYTES MDV1_CRAZY_C,RESPR(0);'
340 PRINT ' - CALL RESPR(0).'
350 STOP
1000  DATA   56,120,  0,198, 67,250,  0,196
1010  DATA   78,148, 67,250,  0,184, 34,136
1020  DATA  112, 16,114,  0,116,  1, 78, 65
1030  DATA   75,250,  1, 56,116, 13, 66,157
1040  DATA   81,202,255,252, 73,250,  1, 36
1050  DATA   40,188, 13, 27, 41, 55, 73,250
1060  DATA    2,210, 40,188,  0,  0,  0,  0
1070  DATA   73,250,  4,116, 40,188,  0,  0
1080  DATA    0,  0,112, 32,118,255, 78, 67
1090  DATA  112, 45,114,  2,116,  1, 78, 67
1100  DATA   97,  0,  0,132, 32,122,  0,110
1110  DATA  112, 16,114,  9,116, 11,118,255
1120  DATA   78, 67,112,  7,116, 10,118,255
1130  DATA   67,250,  2,156, 78, 67,112, 16
1140  DATA  114, 17,116, 11, 78, 67,112,  5
1150  DATA   34,122,  2,136, 34, 17,  6,  1
1160  DATA    0, 49,118,255, 78, 67, 75,249
1170  DATA    0,  2,104, 16,124, 51,126,  7
1180  DATA   58,188,255,255,219,252,  0,  0
1190  DATA    0,128, 81,207,255,244,155,252
1200  DATA    0,  0,  3,254, 81,206,255,232
1210  DATA   75,249,  0,  2,  4,122, 60, 60
```

```
1220 DATA 0,191, 58,188,255,255,219,252
1230 DATA 0, 0, 0,128, 81,206,255,244
1240 DATA 96, 0, 1, 18, 0, 0, 0, 0
1250 DATA 0, 0,246, 2,144, 50, 2, 0
1260 DATA 1, 0, 0, 0, 0, 0, 75,250
1270 DATA 0,122,122, 55, 12, 5, 0, 0
1280 DATA 109, 0, 0,100, 12, 21, 0, 0
1290 DATA 103, 0, 0, 10, 82,141, 83, 5
1300 DATA 96, 0,255,234, 73,250, 0, 84
1310 DATA 124, 3,186, 28,103, 0, 0, 10
1320 DATA 81,206,255,248, 96, 0, 0, 10
1330 DATA 82,141, 83, 5, 96, 0,255,206
1340 DATA 50, 57, 0, 2,128, 46, 52, 1
1350 DATA 238, 90,213,121, 0, 2,128, 46
1360 DATA 2,129, 0, 0, 0, 63, 82, 1
1370 DATA 12, 1, 0, 52, 98, 0,255,226
1380 DATA 71,250, 0, 32,126, 55,178, 27
1390 DATA 103, 0,255,214, 81,207,255,248
1400 DATA 26,193, 93,205,255,152, 96, 0
1410 DATA 0, 70, 0, 0, 0, 0, 0, 0
1420 DATA 0, 0, 0, 0, 0, 0, 0, 0
1430 DATA 0, 0, 0, 0, 0, 0, 0, 0
1440 DATA 0, 0, 0, 0, 0, 0, 0, 0
1450 DATA 0, 0, 0, 0, 0, 0, 0, 0
1460 DATA 0, 0, 0, 0, 0, 0, 0, 0
1470 DATA 0, 0, 0, 0, 0, 0, 0, 0
1480 DATA 0, 0, 0, 0, 0, 0, 0, 0
1490 DATA 0, 0, 0, 0, 0, 0, 73,250
1500 DATA 255,194,124, 55, 18, 28, 97, 0
1510 DATA 5, 4, 71,250, 0, 32, 72,227
1520 DATA 2, 8, 97, 0, 5, 68, 71,250
1530 DATA 0, 12, 76,219, 16, 64, 81,206
1540 DATA 255,228, 78,117, 0, 0, 0, 0
1550 DATA 0, 0, 0, 0, 0, 0, 0, 0
1560 DATA 0, 0, 0, 0, 0, 0, 0, 0
1570 DATA 0, 0, 0, 0, 0, 0, 0, 0
1580 DATA 0, 0, 0, 0, 66,134, 66,135
1590 DATA 75,250, 2,212, 60, 29, 62, 21
1600 DATA 48, 60,255, 0, 97, 0, 2,146
1610 DATA 97, 0, 2,172, 73,250,255,100
1620 DATA 120, 55,124, 55, 71,250,255, 84
1630 DATA 38,188, 13, 27, 41, 55, 71,250
1640 DATA 255, 74,118, 3,188, 27,103, 0
1650 DATA 0, 10, 81,203,255,248, 96, 0
1660 DATA 0, 8, 82,140, 4, 6, 0, 1
1670 DATA 18, 28, 12, 1, 0, 1,103, 0
1680 DATA 0, 34, 12, 1, 0, 14,103, 0
1690 DATA 0, 26, 12, 1, 0, 27,103, 0
1700 DATA 0, 18, 12, 1, 0, 40,103, 0
1710 DATA 0, 10, 81,206,255,194, 96, 0
1720 DATA 0, 70,118, 55,150, 4, 71,250
1730 DATA 255, 10, 23,129, 48, 0, 71,250
1740 DATA 255,112, 72,227, 10, 8, 25, 60
1750 DATA 0, 0, 28, 4, 97, 0, 4, 62
1760 DATA 97, 0, 4,134, 71,250,255, 78
1770 DATA 76,219, 16, 80,114, 0, 97, 0
1780 DATA 4, 44, 97, 0, 4,116, 71,250
1790 DATA 255, 60, 76,219, 16, 80, 4, 4
1800 DATA 0, 14, 96, 0,255,182, 73,250
1810 DATA 254,202,124, 55,126, 0, 18, 28
1820 DATA 12, 1, 0, 13,103, 0, 0, 42
1830 DATA 12, 1, 0, 26,103, 0, 0, 34
1840 DATA 12, 1, 0, 39,103, 0, 0, 26
1850 DATA 12, 1, 0, 52,103, 0, 0, 18
1860 DATA 81,206,255,220, 12, 7, 0, 4
1870 DATA 109, 0, 0,226, 96, 0, 0, 36
1880 DATA 122, 3, 12, 6, 0, 0,111, 0
1890 DATA 255,232, 12, 20, 0, 0,102, 0
1900 DATA 255,224, 82, 7, 82,140, 4, 6
1910 DATA 0, 1, 81,205,255,230, 96, 0
1920 DATA 255,208, 73,250,254,110,122, 3
1930 DATA 124, 11, 18, 28, 82, 1,178, 20
1940 DATA 102, 0, 0, 30, 81,206,255,244
1950 DATA 84,140, 81,205,255,236, 96, 0
1960 DATA 2,194, 0, 0, 0, 0, 65, 84
1970 DATA 84, 69, 77, 80, 84, 32, 58, 32
1980 DATA 112, 16,114, 17,116, 11, 32,122
1990 DATA 253,172, 78, 67,112, 5, 67,250
2000 DATA 255,226, 6,145, 0, 0, 0, 1
2010 DATA 34, 17, 12, 1, 0, 4,108, 0
2020 DATA 2,242, 6,129, 0, 0, 0, 49
2030 DATA 118,255, 32,122,253,136, 78, 67
2040 DATA 75,250,254, 8, 73,250,254, 13
2050 DATA 120, 54, 97, 0, 0, 40, 73,250
2060 DATA 254, 17,120, 40, 97, 0, 0, 30
2070 DATA 73,250,254, 21,120, 26, 97, 0
2080 DATA 0, 20, 73,250,254, 25,120, 12
2090 DATA 97, 0, 0, 10, 97, 0,253,104
2100 DATA 96, 0, 0, 42,116, 12, 18, 20
2110 DATA 4, 1, 0, 1,178, 44,255,255
2120 DATA 102, 0, 0, 14, 82,140, 4, 4
2130 DATA 0, 1, 81,202,255,234, 78,117
2140 DATA 26,196, 24,252, 0, 0, 81,202
2150 DATA 255,250, 78,117,112, 1,118,255
2160 DATA 32,122,253, 34, 78, 67,126, 0
2170 DATA 48, 60,255,255, 75,250, 1, 0
2180 DATA 44, 21, 62, 6, 66, 70, 72, 70
2190 DATA 12, 1, 0,244,102, 0, 0, 22
2200 DATA 67,250,253, 6, 74, 81,103, 0
2210 DATA 0, 8, 66, 81, 96, 0, 0, 6
2220 DATA 50,188, 0, 1, 12, 1, 0,248
2230 DATA 103, 0,255, 8, 12, 1, 0, 27
2240 DATA 103, 0, 2,174, 12, 1, 0, 32
2250 DATA 103, 0, 0, 0,204, 12, 1, 0,192
2260 DATA 102, 0, 0, 22, 12, 70, 0, 0
2270 DATA 103, 0,255,162, 97, 0, 0,122
2280 DATA 4, 70, 0, 8, 96, 0, 0, 82
2290 DATA 12, 1, 0,200,102, 0, 0, 22
2300 DATA 12, 70, 0, 96,103, 0,255,134
2310 DATA 97, 0, 0, 94, 6, 70, 0, 8
2320 DATA 96, 0, 0, 54, 12, 1, 0,208
2330 DATA 102, 0, 0, 22, 12, 71, 0, 0
2340 DATA 103, 0,255,106, 97, 0, 0, 96
2350 DATA 4, 71, 24, 0, 96, 0, 0, 26
2360 DATA 12, 1, 0,216,102, 0,255, 86
2370 DATA 12, 71, 72, 0,103, 0,255, 78
2380 DATA 97, 0, 0, 68, 6, 71, 24, 0
2390 DATA 58,198, 58,135, 48, 60,255, 0
2400 DATA 12, 1, 0,200,110, 0, 0, 10
2410 DATA 97, 0, 0, 14, 96, 0,254, 24
2420 DATA 97, 0, 0, 36, 96, 0,254, 16
2430 DATA 73,249, 0, 2,104, 16,217,198
2440 DATA 116, 7,118, 3, 56,192, 81,203
2450 DATA 255,252,217,252, 0, 0, 0,120
2460 DATA 81,202,255,240, 78,117, 73,249
2470 DATA 0, 2, 4,122,217,199,116, 47
2480 DATA 56,128,217,252, 0, 0, 0,128
2490 DATA 81,202,255,246, 78,117, 0, 0
2500 DATA 0, 0, 0, 0, 0, 0,140,252
2510 DATA 0, 8,142,252, 24, 0, 2,134
2520 DATA 0, 0, 0,255, 2,135, 0, 0
2530 DATA 0,255, 82, 6,206,252, 0, 14
2540 DATA 222, 6, 75,250,251,244, 74, 85
2550 DATA 102, 0, 0,128, 75,250,252,116
2560 DATA 12, 53, 0, 0,112, 0,102, 0
2570 DATA 254,180, 18, 53,112,255, 12, 1
2580 DATA 0, 0,103, 0,254,168, 12, 1
2590 DATA 0, 13,103, 0,254,160, 12, 1
2600 DATA 0, 26,103, 0,254,152, 12, 1
2610 DATA 0, 39,103, 0,254,144, 12, 1
2620 DATA 0, 52,103, 0,254,136, 82, 1
2630 DATA 124, 55,156, 7, 71,250,252,162
2640 DATA 72,227, 65, 4, 97, 0, 1,118
2650 DATA 97, 0, 1,190, 71,250,252,134
2660 DATA 76,219, 32,130, 73,250,252, 28
2670 DATA 124, 55,178, 28,103, 0, 0, 6
2680 DATA 81,206,255,248, 25, 60, 0, 0
2690 DATA 27,129,112, 0, 97, 0, 1, 78
2700 DATA 114, 0, 97, 0, 1,148, 96, 0
2710 DATA 253, 46, 75,250,251,246, 12, 53
2720 DATA 0, 0,112, 0,103, 0,254, 54
2730 DATA 18, 53,112, 0, 73,250,251,228
2740 DATA 124, 54, 4, 1, 0, 1,178, 28
2750 DATA 103, 0, 0, 6, 81,206,255,248
2760 DATA 12, 20, 0, 0,102, 0,254, 22
2770 DATA 82, 1, 27,188, 0, 0,112, 0
2780 DATA 71,250,252, 34, 72,211, 32,192
2790 DATA 126, 55,158, 6, 27,129,112, 0
2800 DATA 78,186, 0,250, 78,186, 1, 66
2810 DATA 71,250,252, 10, 76,211, 32,192
2820 DATA 114, 0,124, 55,156, 7, 97, 0
2830 DATA 0,228, 97, 0, 1, 44, 96, 0
2840 DATA 252,198, 32,122,251, 0,112, 32
2850 DATA 118,255, 78, 67, 67,250, 0, 14
2860 DATA 116, 70,118,255,112, 7, 78, 67
2870 DATA 96, 0, 0,168, 10, 10, 10, 10
2880 DATA 32, 32, 32, 32, 32, 32, 32, 32
2890 DATA 32, 32, 32, 32, 32, 67, 79, 78
2900 DATA 71, 82, 65, 76, 85, 84, 65, 84
2910 DATA 73, 79, 78, 83, 32, 10, 10, 10
2920 DATA 32, 32, 32, 32, 32, 32, 32, 80
2930 DATA 82, 69, 83, 83, 32, 65, 78, 89
2940 DATA 32, 75, 69, 89, 32, 84, 79, 32
2950 DATA 80, 76, 65, 89, 32, 65, 71, 65
2960 DATA 73, 78, 32,122,250,160,112, 32
2970 DATA 118,255, 78, 67, 67,250, 0, 14
2980 DATA 116, 70,118,255,112, 7, 78, 67
2990 DATA 96, 0, 0, 72, 10, 10, 10, 10
3000 DATA 32, 32, 32, 32, 32, 32, 32, 32
3010 DATA 32, 32, 32, 83, 79, 82, 82, 89
3020 DATA 32, 66, 85, 84, 32, 89, 79, 85
3030 DATA 32, 70, 65, 73, 76, 10, 10, 10
```

```
3040 DATA 32, 32, 32, 32, 32, 32, 32, 80
3050 DATA 82, 69, 83, 83, 32, 65, 78, 89
3060 DATA 32, 75, 69, 89, 32, 84, 79, 32
3070 DATA 80, 76, 65, 89, 32, 65, 71, 65
3080 DATA 73, 78,112,  1,118,255, 32,122
3090 DATA 250, 60, 78, 67, 96,  0,249,138
3100 DATA 32,122,250, 50,112,  2, 78, 66
3110 DATA 66,128, 78,117,126, 55,158,  6
3120 DATA 75,249,  0,  2,  4,  8, 12,  7
3130 DATA  0, 14,109,  0,  0, 52, 12,  7
3140 DATA  0, 28,108,  0,  0, 14,  4,  7
3150 DATA  0, 14,219,252,  0,  0, 24,  0
3160 DATA 96, 30, 12,  7,  0, 42,108,  0
3170 DATA  0, 14,  4,  7,  0, 28,219,252
3180 DATA  0,  0, 48,  0, 96, 10,  4,  7
3190 DATA  0, 42,219,252,  0,  0, 72,  0
3200 DATA 207,252,  0,  8,219,199, 78,117
3210 DATA 16,  1, 66,129, 18,  0, 66,128
3220 DATA 12,  1,  0,  0,103,  0,  0,248
3230 DATA  4,  1,  0,  1,131,252,  0, 13
3240 DATA 48,  1, 66, 65, 72, 65, 67,250
3250 DATA  1,  4, 69,250,  3,112, 71,250
3260 DATA  4, 44, 73,250,  4,184, 40,  1
3270 DATA  4,132,  0,  0,  0, 10,201,252
3280 DATA  0, 48,195,252,  0, 48,193,252
3290 DATA  0, 48, 36,  0,208,128,124, 23
3300 DATA 126,  1, 26,177, 16,  0, 27,113
3310 DATA 16,  0,  0,  1, 27,114, 32,  0
3320 DATA  0,  4, 27,114, 32,  0,  0,  5
3330 DATA 27,116,  0,  0, 12,  0, 27,116
3340 DATA  0,  0, 12,  1, 27,116,  0,  2
3350 DATA 12,  4, 27,116,  0,  2, 12,  5
3360 DATA 10, 85,255,255, 10,109,255,255
3370 DATA  0,  4, 10,109,255,255, 12,  0
3380 DATA 10,109,255,255, 12,  4, 12, 64
3390 DATA  0,144,109,  0,  0, 26, 27,124
3400 DATA  0,255,  0,  1, 27,124,  0,255
3410 DATA  0,  5, 27,124,  0,255, 12,  1
3420 DATA 27,124,  0,255, 12,  5, 12, 68
3430 DATA  0,  0,109,  0,  0, 54, 22, 45
3440 DATA  0,  4, 10,  3,  0,255,134, 51
3450 DATA 64,  0, 27, 67,  0,  4, 12, 64
3460 DATA  0,144,109,  0,  0, 18, 10, 45
3470 DATA  0,255,  0,  4, 27,124,  0,255
3480 DATA  0,  5, 96,  0,  0, 12, 27, 67
3490 DATA  0,  5, 10,109,255,255,  0,  4
3500 DATA 82,139, 84,141, 82,137, 82,138
3510 DATA 82,140, 81,207,255, 86,219,252
3520 DATA  0,  0,  0,124, 84,140, 81,206
3530 DATA 255, 72, 66,128, 78,117,124, 47
3540 DATA 42,188,255,255,255,255, 43,124
3550 DATA 255,255,255,255,  0,  4,219,252
3560 DATA  0,  0,  0,128, 81,206,255,234
3570 DATA 66,128, 78,117,  0,  0, 63,255
3580 DATA 64,  0, 64,  0, 67,240, 71,248
3590 DATA 78, 28, 76, 12, 76, 12, 92, 14
3600 DATA 88,  6, 88,  6, 95,254, 95,254
3610 DATA 88,  6, 88,  6, 88,  6, 88,  6
3620 DATA 88,  6, 88,  6, 88,  6, 64,  0
3630 DATA 64,  0, 64,  0,  0,  0, 63,255
3640 DATA 64,  0, 64,  0, 67,240, 71,248
3650 DATA 78, 28, 92, 14, 88,  6, 64,  6
3660 DATA 64,  6, 64, 14, 65,252, 67,248
3670 DATA 71,  0, 78,  0, 76,  0, 92,  0
3680 DATA 88,  0, 95,254, 95,254, 64,  0
3690 DATA 64,  0, 64,  0,  0,  0, 63,255
3700 DATA 64,  0, 64,  0, 67,240, 71,248
3710 DATA 78, 28, 92, 14, 88,  6, 64,  6
3720 DATA 64, 14, 64,252, 64,252, 64,  6
3730 DATA 64,  6, 64,  6, 88,  6, 92, 14
3740 DATA 78, 28, 71,248, 67,240, 64,  0
3750 DATA 64,  0, 64,  0,  0,  0, 63,255
3760 DATA 64,  0, 64,  0, 64, 24, 64, 56
3770 DATA 64,120, 64,248, 65,216, 67,152
3780 DATA 71, 24, 78, 24, 95,254, 95,254
3790 DATA 64, 24, 64, 24, 64, 24, 64, 24
3800 DATA 64, 24, 64, 24, 64, 24, 64,  0
3810 DATA 64,  0, 64,  0,  0,  0, 63,255
3820 DATA 64,  0, 64,  0, 79,254, 95,254
3830 DATA 92,  0, 88,  0, 88,  0, 88,  0
3840 DATA 92,  0, 95,248, 79,252, 64, 14
3850 DATA 64,  6, 64,  6, 88,  6, 92, 14
3860 DATA 78, 28, 71,248, 67,240, 64,  0
3870 DATA 64,  0, 64,  0,  0,  0, 63,255
3880 DATA 64,  0, 64,  0, 67,240, 71,248
3890 DATA 78, 28, 92, 14, 88,  6, 88,  0
3900 DATA 88,  0, 91,240, 95,248, 94, 28
3910 DATA 92, 14, 88,  6, 88,  6, 92, 14
3920 DATA 78, 28, 71,248, 67,240, 64,  0
3930 DATA 64,  0, 64,  0,  0,  0, 63,255
3940 DATA 64,  0, 64,  0, 95,254, 95,254
3950 DATA 64,  6, 64,  6, 64, 30, 64, 56
3960 DATA 64,112, 64,224, 65,192, 67,128
3970 DATA 71,  0, 78,  0, 76,  0, 88,  0
3980 DATA 88,  0, 88,  0, 88,  0, 64,  0
3990 DATA 64,  0, 64,  0,  0,  0, 63,255
4000 DATA 64,  0, 64,  0, 67,240, 71,248
4010 DATA 78, 28, 92, 14, 88,  6, 92, 14
4020 DATA 78, 28, 71,248, 71,248, 78, 28
4030 DATA 92, 14, 88,  6, 88,  6, 92, 14
4040 DATA 78, 28, 71,248, 67,240, 64,  0
4050 DATA 64,  0, 64,  0,  0,  0, 63,255
4060 DATA 64,  0, 64,  0, 67,240, 71,248
4070 DATA 78, 28, 92, 14, 88,  6, 88,  6
4080 DATA 92, 14, 78, 30, 71,254, 67,246
4090 DATA 64,  6, 64,  6, 88,  6, 92, 14
4100 DATA 78, 30, 71,248, 67,240, 64,  0
4110 DATA 64,  0, 64,  0,  0,  0, 63,255
4120 DATA 64,  0, 64,  0, 88,252, 89,254
4130 DATA 89,206, 89,134, 89,134, 89,134
4140 DATA 89,134, 89,134, 89,134, 89,134
4150 DATA 89,134, 89,134, 89,134, 89,134
4160 DATA 89,206, 89,254, 88,252, 64,  0
4170 DATA 64,  0, 64,  0,  0,  0, 63,255
4180 DATA 64,  0, 64,  0, 95,224, 95,224
4190 DATA 64, 96, 64, 96, 64, 96, 64, 96
4200 DATA 88, 96, 88, 96, 88, 96, 92,224
4210 DATA 79,192, 71,129, 64,  1, 64,  2
4220 DATA 64,  4, 64,  2, 64,  1, 64,  0
4230 DATA 64,  0, 64,  0,  0,  0, 63,255
4240 DATA 64,  0, 64,  0, 71,128, 79,192
4250 DATA 92,224, 88, 96, 88, 96, 88, 96
4260 DATA 88, 96, 88, 96, 89, 96, 92,224
4270 DATA 79,192, 71,161, 64,  3, 64,  3
4280 DATA 64,  3, 64,  3, 64,  3, 64,  1
4290 DATA 64,  0, 64,  0,  0,  0, 63,255
4300 DATA 64,  0, 64,  0, 88, 96, 88,224
4310 DATA 89,192, 91,128, 95,  0, 94,  0
4320 DATA 95,  0, 91,128, 89,192, 88,230
4330 DATA 88,102, 88, 97, 64,  0, 64,  0
4340 DATA 64,  0, 64,  1, 64,  1, 64,  3
4350 DATA 64,  4, 64,  0,  0,  0,255,252
4360 DATA  0,  2,  0, 66,  0,226,  1,242
4370 DATA  1,242,  3,250,  3, 90,  0, 66
4380 DATA  1,242,  0,  2,  0,  2,  0,  2
4390 DATA  0,  2,  0,  2,  0,  2,  0,  2
4400 DATA  0,  2,  0,  2,  0,  2,  0,  2
4410 DATA  0,  2,  0,  2,  0,  0,255,252
4420 DATA  0,  2,  0, 66,  0,226,  0, 66
4430 DATA  1, 82,  3,250,  1, 82,  0, 66
4440 DATA  1,242,  0,  2,  0,  2,  0,  2
4450 DATA  0,  2,  0,  2,  0,  2,  0,  2
4460 DATA  0,  2,  0,  2,  0,  2,  0,  2
4470 DATA  0,  2,  0,  2,  0,  0,255,252
4480 DATA  0,  2,  0, 66,  0,226,  1,242
4490 DATA  3,250,  3,250,  1,242,  0,226
4500 DATA  0, 66,  0,  2,  0,  2,  0,  2
4510 DATA  0,  2,  0,  2,  0,  2,  0,  2
4520 DATA  0,  2,  0,  2,  0,  2,  0,  2
4530 DATA  0,  2,  0,  2,  0,  0,255,252
4540 DATA  0,  2,  1,178,  3,186,  3,250
4550 DATA  3,250,  1,242,  1,242,  0,226
4560 DATA  0, 66,  0,  2,  0,  2,  0,  2
4570 DATA  0,  2,  0,  2,  0,  2,  0,  2
4580 DATA  0,  2,  0,  2,  0,  2,  0,  2
4590 DATA  0,  2,  0,  2,  0,  0,255,252
4600 DATA  0,  2,  0,  2,  0,  2,  0,  2
4610 DATA  0,  2,  0,  2,  0,  2,  0,  2
4620 DATA  0,  2,  0,  2,  0,  2,128, 66
4630 DATA 128,194, 99, 34, 28, 34,  0,146
4640 DATA 99, 10, 28, 10,  0, 18,191,162
4650 DATA 64, 66,  0,  2,  0,  0,255,252
4660 DATA  0,  2,  0,  2,  0,  2,  0,  2
4670 DATA  0,  2,  0,  2,  0,  2,  0,  2
4680 DATA  0,  2,  0,  2,  0,  2, 30,  2
4690 DATA 204,194, 63, 34, 68,178, 68,178
4700 DATA 68,178, 68,178, 37, 50,127,162
4710 DATA 164, 66,  0,  2,  0,  0,255,252
4720 DATA  0,  2,  0,  2,  0,  2,  0,  2
4730 DATA  0,  2,  0,  2,  0,  2,  0,  2
4740 DATA  0,  2,  0,  2,  0,  2, 28, 50
4750 DATA 28, 50,  8, 66,255,130,136,130
4760 DATA 136,130, 73, 66, 62, 66,193,226
4770 DATA 170,146,  0,  2, 64,  1,  0,  2
4780 DATA 64,  1,  0,  2, 64,  3,128,  2
4790 DATA 64,  7,192,  2, 64, 15,224,  2
4800 DATA 64, 31,240,  2, 64, 63,248,  2
4810 DATA 64,127,252,  2, 64,255,254,  2
4820 DATA 65,255,255,  2, 67,255,255,130
4830 DATA 67,255,255,130, 67,255,255,130
4840 DATA 67,255,255,130, 65,255,255,  2
4850 DATA 64,255,254,  2, 64,121, 60,  2
```

```
4860  DATA   64,  3,128,  2, 64, 15,224,  2
4870  DATA   64, 63,248,  2, 65,255,255,  2
4880  DATA   64,  0,  0,  2, 63,255,255,252
4890  DATA    0,  0,  0,  0, 64,  7,192,  2
4900  DATA   64, 15,224,  2, 64, 31,240,  2
4910  DATA   64, 31,240,  2, 64, 31,240,  2
4920  DATA   64, 31,240,  2, 64, 15,224,  2
4930  DATA   64,  7,192,  2, 65,225, 15,  2
4940  DATA   67,241, 31,130, 71,249, 63,194
4950  DATA   71,255,255,194, 71,255,255,194
4960  DATA   71,251,191,194, 67,241, 31,130
4970  DATA   65,225, 15,  2, 64,  1,  0,  2
4980  DATA   64,  3,128,  2, 64, 15,224,  2
4990  DATA   64, 63,240,  2, 65,255,255,  2
5000  DATA   64,  0,  0,  2, 63,255,255,252
5010  DATA    0,  0,  0,  0, 64,  1,  0,  2
5020  DATA   64,  1,  0,  2, 64,  3,128,  2
5030  DATA   64,  3,128,  2, 64,  7,192,  2
5040  DATA   64,  7,192,  2, 64, 15,224,  2
5050  DATA   64, 31,240,  2, 64,127,252,  2
5060  DATA   65,255,255,  2, 71,255,255,194
5070  DATA   65,255,255,  2, 64,127,252,  2
5080  DATA   64, 31,240,  2, 64, 15,224,  2
5090  DATA   64,  7,192,  2, 64,  7,192,  2
5100  DATA   64,  3,128,  2, 64,  3,128,  2
5110  DATA   64,  1,  0,  2, 64,  1,  0,  2
5120  DATA   64,  0,  0,  2, 63,255,255,252
5130  DATA    0,  0,  0,  0, 64, 96, 12,  2
5140  DATA   65,248, 63,  2, 67,252,127,130
5150  DATA   67,252,127,130, 71,254,255,194
5160  DATA   71,254,255,194, 71,255,255,194
5170  DATA   71,255,255,194, 67,255,255,130
5180  DATA   67,255,255,130, 65,255,255,  2
5190  DATA   64,255,254,  2, 64, 63,248,  2
5200  DATA   64, 31,240,  2, 64, 15,224,  2
5210  DATA   64,  7,192,  2, 64,  3,128,  2
5220  DATA   64,  3,128,  2, 64,  1,  0,  2
5230  DATA   64,  1,  0,  2, 64,  1,  0,  2
5240  DATA   64,  0,  0,  2, 63,255,255,252
5250  DATA    0,  0,  0,  0,  0,  2, 63,255
5260  DATA  255,252,  0,  0,  0,  0,  0,  0
5270  DATA    0,  0,  0,  0,  0,  0,  0,  0
5280  DATA    0,  0,  0,  0,  0,  0,  0,  0
5290  DATA    0,  0,  0,  0,  0,  0,  0,  0
5300  DATA    0,  0,  0,  0,  0,  0,  0,  0
5310  DATA    0,  0,  0,  0,  0,  0,  0,  0
10000 REMark DATAS TO CHECK YOUR ERRORS
10010 DATA 18597,10364,11388,15197,15999
10020 DATA 11293,18109,15865,12640,12509
10030 DATA 15798,13960,14105,15945,7887
10040 DATA 12190,18252,13556
```

```
      MOVEA.W $C6,A4
      LEA     PARAMS,A1
      JSR     (A4)
      LEA     ID,A1
      MOVE.L  A0,(A1)

      MOVEQ   #16,D0
      MOVEQ   #0,D1
      MOVEQ   #1,D2
      TRAP    #1
INIT  LEA     BUF,A5
      MOVEQ   #13,D2
_1IN  CLR.L   (A5)+
      DBF     D2,L1IN
      LEA     TRO,A4
      MOVE.L  #219883831,(A4)
      LEA     CPT,A4
      MOVE.L  #0,(A4)
      LEA     CUR,A4
      MOVE.L  #0,(A4)
      MOVEQ   #$20,D0
      MOVEQ   #-1,D3
      TRAP    #3
      MOVEQ   #$2D,D0
      MOVEQ   #2,D1
      MOVEQ   #1,D2
      TRAP    #3
      BSR     TROU
      MOVE.L  ID,A0
      MOVEQ   #16,D0
      MOVEQ   #9,D1
      MOVEQ   #11,D2
      MOVEQ   #-1,D3
      TRAP    #3
      MOVEQ   #7,D0
      MOVEQ   #10,D2
      MOVEQ   #-1,D3
      LEA     MESS,A1
      TRAP    #3
      MOVEQ   #16,D0
      MOVEQ   #17,D1
      MOVEQ   #11,D2
      TRAP    #3
      MOVEQ   #5,D0
      MOVE.L  CPT,A1
      MOVE.L  (A1),D1
      ADDI.B  #49,D1
      MOVEQ   #-1,D3
      TRAP    #3
      LEA     157712,A5
      MOVEQ   #51,D6
L3IN  MOVEQ   #7,D7
L2IN  MOVE.W  #-1,(A5)
      ADDA.L  #128,A5
      DBF     D7,L2IN
      SUBA.L  #1022,A5
      DBF     D6,L3IN
      LEA     132218,A5
      MOVE.W  #191,D6
L4IN  MOVE.W  #-1,(A5)
      ADDA.L  #128,A5
      DBF     D6,L4IN
      BRA     AS

ID    DS.L    1
SW    DS.W    1
PARAMS DC.B   246,2,144,50
      DC.W    512,256,0,0
      EVEN

TROU
      LEA     BUF,A5
      MOVEQ   #55,D5

RND
S1RN  CMPI.B  #0,D5
      BLT     S3RN
      CMPI.B  #0,(A5)
      BEQ     TRU
      ADDQ.L  #1,A5
      SUBQ.B  #1,D5
      BRA     S1RN
TRU   LEA     TRO,A4
      MOVEQ   #3,D6
L1TR  CMP.B   (A4)+,D5
      BEQ     S1TR
      DBF     D6,L1TR
      BRA     L1RN
S1TR  ADDQ.L  #1,A5
      SUBQ.B  #1,D5
      BRA     S1RN

L1RN  MOVE.W  $2802E,D1
      MOVE.W  D1,D2
      ROR.W   #7,D2
      ADD.W   D2,$2802E
      AND.L   #63,D1
      ADDQ.B  #1,D1
      CMPI.B  #52,D1
      BHI     L1RN
      LEA     BUF,A3
      MOVEQ   #55,D7
L2RN  CMP.B   (A3)+,D1
      BEQ     L1RN
      DBF     D7,L2RN

S2RN  MOVE.B  D1,(A5)+
      DBLT    D5,S1RN
S3RN  BRA     DISP52
TRO   DS.L    2

BUF   DS.B    60
      EVEN

DISP52
      LEA     BUF,A4
      MOVEQ   #55,D6
L1D15 MOVE.B  (A4)+,D1
      BSR     ADDR
      LEA     STOR+8,A3
      MOVEM.L D6/A4,-(A3)
      BSR     DISPLAY
      LEA     STOR,A3
      MOVEM.L (A3)+,D6/A4
      DBF     D6,L1D15
      RTS
STOR  DS.L    8

AS    CLR.L   D6
      CLR.L   D7
      LEA     CUR,A5
      MOVE.W  (A5)+,D6
      MOVE.W  (A5),D7
      MOVE.W  #65280,D0
      BSR     HORIZ
      BSR     VERTI
      LEA     BUF,A4
      MOVEQ   #55,D4
      MOVEQ   #55,D6
      LEA     TRO,A3
      MOVE.L  #219883831,(A3)
L1AS  LEA     TRO,A3
      MOVEQ   #3,D3
L2AS  CMP.B   (A3)+,D6
      BEQ     S3AS
      DBF     D3,L2AS
      BRA     S4AS
S3AS  ADDQ.L  #1,A4
      SUBI.B  #1,D6
S4AS  MOVE.B  (A4)+,D1
      CMPI.B  #1,D1
      BEQ     S1AS
      CMPI.B  #14,D1
      BEQ     S1AS
      CMPI.B  #27,D1
      BEQ     S1AS
      CMPI.B  #40,D1
      BEQ     S1AS
      DBF     D6,L1AS
      BRA     TROUS4
S1AS  MOVEQ   #55,D3
      SUB.B   D4,D3
      LEA     BUF,A3
      MOVE.B  D1,0(A3,D3)
```

520ST-FM SUPER PACK

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DTP ☐

```
        LEA     STOR+12,A3
        MOVEM.L A4/D6/D4,-(A3)
        MOVE.B  #0,-(A4)
        MOVE.B  D4,D6
        BSR     ADDR
        BSR     DISPLAY
        LEA     STOR,A3
        MOVEM.L (A3)+,A4/D6/D4
        MOVEQ   #0,D1
        BSR     ADDR
        BSR     DISPLAY
        LEA     STOR,A3
        MOVEM.L (A3)+,A4/D6/D4
        SUBI.B  #14,D4
        BRA     S2AS
TROUS4  LEA     BUF,A4
        MOVEQ   #55,D6
        MOVEQ   #0,D7
L1TR4   MOVE.B  (A4)+,D1
        CMPI.B  #13,D1
        BEQ     S1TR4
        CMPI.B  #26,D1
        BEQ     S1TR4
        CMPI.B  #39,D1
        BEQ     S1TR4
        CMPI.B  #52,D1
        BEQ     S1TR4
S2TR4   DBF     D6,L1TR4
        CMPI.B  #4,D7
        BLT     CURSEUR
        BRA     BIENP
S1TR4   MOVEQ   #3,D5
L2TR4   CMPI.B  #0,D6
        BLE     S2TR4
        CMPI.B  #0,(A4)
        BNE     S2TR4
        ADDQ.B  #1,D7
        ADDQ.L  #1,A4
        SUBI.B  #1,D6
        DBF     D5,L2TR4
        BRA     S2TR4

BIENP   LEA     BUF,A4
        MOVEQ   #3,D5
L2BI    MOVEQ   #11,D6
L1BI    MOVE.B  (A4)+,D1
        ADDQ.B  #1,D1
        CMP.B   (A4),D1
        BNE     QUATRE
        DBF     D6,L1BI
        ADDQ.L  #2,A4
        DBF     D5,L2BI
        BRA     GAGNE

CPT     DS.L    1
MESS    DC.B    'ATTEMPT : '

QUATRE  MOVEQ   #16,D0
        MOVEQ   #17,D1
        MOVEQ   #11,D2
        MOVE.L  ID,A0
        TRAP    #3
        MOVEQ   #5,D0
        LEA     CPT,A1
        ADDI.L  #1,(A1)
        MOVE.L  (A1),D1
        CMPI.B  #4,D1
        BGE     PERDU
        ADDI.L  #49,D1
        MOVEQ   #-1,D3
        MOVE.L  ID,A0
        TRAP    #3

EFFACE  LEA     TRO,A5
        LEA     BUF+1,A4
        MOVEQ   #54,D4
        BSR     ZERO
        LEA     BUF+15,A4
        MOVEQ   #40,D4
        BSR     ZERO
        LEA     BUF+29,A4
        MOVEQ   #26,D4
        BSR     ZERO
        LEA     BUF+43,A4
        MOVEQ   #12,D4
        BSR     ZERO
        BSR     TROU
        BRA     CURSEUR

ZERO    MOVEQ   #12,D2
L1ZE    MOVE.B  (A4),D1
        SUBI.B  #1,D1
        CMP.B   -1(A4),D1
        BNE     S2ZE
        ADDQ.L  #1,A4
        SUBI.B  #1,D4
        DBF     D2,L1ZE
        RTS
S2ZE    MOVE.B  D4,(A5)+
L2ZE    MOVE.B  #0,(A4)+
        DBF     D2,L2ZE
        RTS

CURSEUR MOVEQ   #1,D0
        MOVEQ   #-1,D3
        MOVE.L  ID,A0
        TRAP    #3
        MOVEQ   #0,D7
        MOVE.W  #-1,D0
        LEA     CUR,A5
        MOVE.L  (A5),D6
        MOVE.W  D6,D7
        CLR.W   D6
        SWAP    D6
        CMP.B   #244,D1
        BNE     S4CU
        LEA     SW,A1
        TST.W   (A1)
        BEQ     S5CU
        CLR.W   (A1)
        BRA     S4CU
S5CU    MOVE.W  #1,(A1)
S4CU    CMP.B   #248,D1
        BEQ     BIENP
        CMP.B   #27,D1
        BEQ     EXIT
        CMP.B   #32,D1
        BEQ     EMPLA
        CMP.B   #192,D1
        BNE     S1CU
        CMP.W   #0,D6
        BEQ     CURSEUR
        BSR     HORIZ
        SUB.W   #8,D6
        BRA     AFFCU
S1CU    CMP.B   #200,D1
        BNE     S2CU
        CMP.W   #96,D6
        BEQ     CURSEUR
        BSR     HORIZ
        ADD.W   #8,D6
        BRA     AFFCU
S2CU    CMP.B   #208,D1
        BNE     S3CU
        CMP.W   #0,D7
        BEQ     CURSEUR
        BSR     VERTI
        SUB.W   #6144,D7
        BRA     AFFCU
S3CU    CMP.B   #216,D1
        BNE     CURSEUR
        CMP.W   #18432,D7
        BEQ     CURSEUR
        BSR     VERTI
        ADD.W   #6144,D7

AFFCU   MOVE.W  D6,(A5)+
        MOVE.W  D7,(A5)
        MOVE.W  #65280,D0
        CMP.B   #200,D1
        BGT     S1AFC
        BSR     HORIZ
        BRA     TROUS4
S1AFC   BSR     VERTI
        BRA     TROUS4

HORIZ   LEA     157712,A4
        ADDA.L  D6,A4
        MOVEQ   #7,D2
L2HO    MOVEQ   #3,D3
L1HO    MOVE.W  D0,(A4)+
        DBF     D3,L1HO
        ADDA.L  #120,A4
        DBF     D2,L2HO
        RTS

VERTI   LEA     132218,A4
        ADDA.L  D7,A4
        MOVEQ   #47,D2
L1VE    MOVE.W  D0,(A4)
        ADDA.L  #128,A4
        DBF     D2,L1VE
        RTS

CUR     DS.L    2

EMPLA   DIVU    #8,D6
        DIVU    #6144,D7
        AND.L   #255,D6
        AND.L   #255,D7
        ADDQ.B  #1,D6
        MULU    #14,D7
        ADD.B   D6,D7
        LEA     SW,A5
        TST.W   (A5)
        BNE     EMPLPL

EMPLVI  LEA     BUF,A5
        CMPI.B  #0,0(A5,D7)
        BNE     CURSEUR
        MOVE.B  -1(A5,D7),D1
        CMPI.B  #0,D1
        BEQ     CURSEUR
        CMPI.B  #13,D1
        BEQ     CURSEUR
        CMPI.B  #26,D1
        BEQ     CURSEUR
        CMPI.B  #39,D1
        BEQ     CURSEUR
        CMPI.B  #52,D1
        BEQ     CURSEUR
        ADDQ.B  #1,D1
        MOVEQ   #55,D6
        SUB.B   D7,D6
        LEA     STOR+12,A3
        MOVEM.L A5/D1/D7,-(A3)
        BSR     ADDR
        BSR     DISPLAY
        LEA     STOR,A3
        MOVEM.L (A3)+,A5/D1/D7
        LEA     BUF,A4
        MOVEQ   #55,D6
L1EMP   CMP.B   (A4)+,D1
        BEQ     TROUVE
        DBF     D6,L1EMP
TROUVE  MOVE.B  #0,-(A4)
        MOVE.B  D1,0(A5,D7)
        BSR     ADDR
        MOVEQ   #0,D1
        BSR     DISPLAY
        BRA     TROUS4

EMPLPL  LEA     BUF,A5
        CMPI.B  #0,0(A5,D7.W)
        BEQ     CURSEUR
        MOVE.B  0(A5,D7.W),D1
        LEA     BUF,A4
        MOVEQ   #54,D6
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```
        SUBI.B  #1,D1
L1EMPL  CMP.B   (A4)+,D1
        BEQ     S1EMPL
        DBF     D6,L1EMPL
S1EMPL  CMP.B   #0,(A4)
        BNE     CURSEUR
        ADDQ.B  #1,D1
        MOVE.B  #0,0(A5,D7)
        LEA     STOR,A3
        MOVEM.L A5/D6/D7,(A3)
        MOVEQ   #55,D7
        SUB.B   D6,D7
        MOVE.B  D1,0(A5,D7.W)
        JSR     ADDR
        JSR     DISPLAY
        LEA     STOR,A3
        MOVEM.L (A3),A5/D6/D7
        MOVEQ   #0,D1
        MOVEQ   #55,D6
        SUB.B   D7,D6
        BSR     ADDR
        BSR     DISPLAY
        BRA     TROUS4

GAGNE   MOVE.L  ID,A0
        MOVEQ   #$20,D0
        MOVEQ   #-1,D3
        TRAP    #3
        LEA     MESSG,A1
        MOVEQ   #70,D2
        MOVEQ   #-1,D3
        MOVEQ   #7,D0
        TRAP    #3
        BRA     GETKEY

MESSG   DC.B    10,10,10,10
        DC.B    '
        DC.B    'CONGRALUTATIONS
        DC.B    10,10,10
        DC.B    '       PRESS '
        DC.B    'ANY KEY TO '
        DC.B    'PLAY AGAIN'

PERDU   MOVE.L  ID,A0
        MOVEQ   #$20,D0
        MOVEQ   #-1,D3
        TRAP    #3
        LEA     MESSP,A1
        MOVEQ   #70,D2
        MOVEQ   #-1,D3
        MOVEQ   #7,D0
        TRAP    #3
        BRA     GETKEY

MESSP   DC.B    10,10,10,10
        DC.B    '           '
        DC.B    'SORRY BUT YOU
        DC.B    'FAIL',10,10,10
        DC.B    '       PRESS '
        DC.B    'ANY KEY TO '
        DC.B    'PLAY AGAIN'

GETKEY  MOVEQ   #1,D0
        MOVEQ   #-1,D3
        MOVE.L  ID,A0
        TRAP    #3
        BRA     INIT

EXIT    MOVE.L  ID,A0
        MOVEQ   #2,D0
        TRAP    #2
        CLR.L   D0
        RTS

ADDR    MOVEQ   #55,D7
        SUB.B   D6,D7
        LEA     132104,A5
        CMPI.B  #14,D7
        BLT     S1AD5
        CMPI.B  #28,D7
        BGE     S2AD5
        SUBI.B  #14,D7
        ADDA.L  #6144,A5
        BRA.S   S1AD5
S2AD5   CMPI.B  #42,D7
        BGE     S3AD5
        SUBI.B  #28,D7
        ADDA.L  #12288,A5
        BRA.S   S1AD5
S3AD5   SUBI.B  #42,D7
        ADDA.L  #18432,A5
S1AD5   MULS    #8,D7
        ADD.L   D7,A5
        RTS
DISPLAY

        MOVE.B  D1,D0
        CLR.L   D1
        MOVE.B  D0,D1
        CLR.L   D0
        CMPI.B  #0,D1
        BEQ     CLS
        SUBI.B  #1,D1
        DIVS    #13,D1
        MOVE.W  D1,D0
        CLR.W   D1
        SWAP    D1
        LEA     UDG,A1
        LEA     UDG+624,A2
        LEA     UDG+816,A3
        LEA     UDG+960,A4
        MOVE.L  D1,D4
        SUBI.L  #10,D4
        MULS    #48,D4
        MULS    #48,D1
        MULS    #48,D0
        MOVE.L  D0,D2
        ADD.L   D0,D0
        MOVEQ   #23,D6
L2DIS   MOVEQ   #1,D7
L1DIS   MOVE.B  0(A1,D1),(A5)
        MOVE.B  0(A1,D1),1(A5)
        MOVE.B  0(A2,D2),4(A5)
        MOVE.B  0(A2,D2),5(A5)
        MOVE.B  0(A4,D0),3072(A5)
        MOVE.B  0(A4,D0),3073(A5)
        MOVE.B  2(A4,D0),3076(A5)
        MOVE.B  2(A4,D0),3077(A5)
        EORI.W  #65535,(A5)
        EORI.W  #65535,4(A5)
        EORI.W  #65535,3072(A5)
        EORI.W  #65535,3076(A5)
        CMP.W   #144,D0
        BLT     S1DIS
        MOVE.B  #255,1(A5)
        MOVE.B  #255,5(A5)
        MOVE.B  #255,3073(A5)
        MOVE.B  #255,3077(A5)
S1DIS   CMPI.W  #0,D4
        BLT     S2DIS
        MOVE.B  4(A5),D3
        EORI.B  #255,D3
        OR.B    0(A3,D4),D3
        MOVE.B  D3,4(A5)
        CMP.W   #144,D0
        BLT     S3DIS
        EORI.B  #255,4(A5)
        MOVE.B  #255,5(A5)
        BRA     S4DIS
S3DIS   MOVE.B  D3,5(A5)
        EORI.W  #65535,4(A5)
S4DIS   ADDQ.L  #1,A3
S2DIS   ADDQ.L  #2,A5
        ADDQ.L  #1,A1
        ADDQ.L  #1,A2
        ADDQ.L  #1,A4
        DBF     D7,L1DIS
        ADDA.L  #124,A5
        ADDQ.L  #2,A4
        DBF     D6,L2DIS
        CLR.L   D0
        RTS
CLS     MOVEQ   #47,D6
L1CL    MOVE.L  #-1,(A5)
        MOVE.L  #-1,4(A5)
        ADDA.L  #128,A5
        DBF     D6,L1CL
        CLR.L   D0
        RTS
UDG
        DC.W    0,16383,16384,16384
        DC.W    17392,18424,19996,19468
        DC.W    19468,23566,22534,22534
        DC.W    24574,24574,22534,22534
        DC.W    22534,22534,22534,22534
        DC.W    22534,16384,16384,16384
        DC.W    0,16383,16384,16384
        DC.W    17392,18424,19996,23566
        DC.W    22534,16390,16390,16398
        DC.W    16892,17400,18176,19968
        DC.W    19456,23552,22528,24574
        DC.W    24574,16384,16384,16384
        DC.W    0,16383,16384,16384
        DC.W    17392,18424,19996,23566
        DC.W    22534,16390,16398,16636
        DC.W    16636,16390,16390,16390
        DC.W    22534,23566,19996,18424
        DC.W    17392,16384,16384,16384
        DC.W    0,16383,16384,16384
        DC.W    16408,16440,16504,16632
        DC.W    16856,17304,18200,19992
        DC.W    24574,24574,16408,16408
        DC.W    16408,16408,16408,16408
        DC.W    16408,16384,16384,16384
        DC.W    0,16383,16384,16384
        DC.W    20478,24574,23552,22528
        DC.W    22528,22528,23552,24568
        DC.W    20476,16398,16390,16390
        DC.W    22534,23566,19996,18424
        DC.W    17392,16384,16384,16384
        DC.W    0,16383,16384,16384
        DC.W    17392,18424,19996,23566
        DC.W    22534,22528,22528,23536
        DC.W    24568,24092,23566,22534
        DC.W    22534,23566,19996,18424
        DC.W    17392,16384,16384,16384
        DC.W    0,16383,16384,16384
        DC.W    24574,24574,16390,16390
        DC.W    16414,16440,16496,16608
        DC.W    16832,17280,18176,19968
        DC.W    19456,22528,22528,22528
        DC.W    22528,16384,16384,16384
        DC.W    0,16383,16384,16384
        DC.W    17392,18424,19996,23566
        DC.W    22534,23566,19996,18424
        DC.W    18424,19996,23566,22534
        DC.W    22534,23566,19996,18424
        DC.W    17392,16384,16384,16384
        DC.W    0,16383,16384,16384
        DC.W    17392,18424,19996,23566
        DC.W    22534,22534,23566,19998
        DC.W    18430,17398,16390,16390
        DC.W    22534,23566,19998,18424
        DC.W    17392,16384,16384,16384
        DC.W    0,16383,16384,16384
        DC.W    22780,23038,22990,22918
        DC.W    22918,22918,22918,22918
        DC.W    22918,22918,22918,22918
        DC.W    22918,22918,22990,23038
        DC.W    22780,16384,16384,16384
        DC.W    0,16383,16384,16384
        DC.W    24544,24544,16480,16480
        DC.W    16480,16480,22624,22624
        DC.W    22624,23776,20416,18305
        DC.W    16385,16386,16388,16386
```

```
DC.W 16385,16384,16384,16384
DC.W     0,16383,16384,16384
DC.W 18304,20416,23776,22624
DC.W 22624,22624,22624,22624
DC.W 22880,23776,20416,18337
DC.W 16387,16387,16387,16387
DC.W 16387,16385,16384,16384
DC.W     0,16383,16384,16384
DC.W 22624,22752,22976,23424
DC.W 24320,24064,24320,23424
DC.W 22976,22758,22630,22625
DC.W 16384,16384,16384,16385
DC.W 16385,16387,16388,16384
DC.W     0,65532,     2,   66
DC.W   226,   498,   498, 1018
DC.W   858,    66,   498,    2
DC.W     2,     2,     2,    2
DC.W     2,     2,     2,    2
DC.W     2,     2,     2,    2
DC.W     0,65532,     2,   66
DC.W   226,    66,   338, 1018
DC.W   338,    66,   498,    2
DC.W     2,     2,     2,    2
DC.W     2,     2,     2,    2
DC.W     2,     2,     2,    2
DC.W     0,65532,     2,   66
DC.W   226,   498,  1018, 1018
DC.W   498,   226,    66,    2
DC.W     2,     2,     2,    2
DC.W     2,     2,     2,    2
DC.W     2,     2,     2,    2
DC.W     0,65532,     2,  434
DC.W   954,  1018,  1018,  498
DC.W   498,   226,    66,    2
DC.W     2,     2,     2,    2
DC.W     2,     2,     2,    2
DC.W     2,     2,     2,    2
DC.W     0,65532,     2,    2
DC.W     2,     2,     2,    2
DC.W     2,     2,     2,    2
```

```
DC.W     2,32834,32962,25378
DC.W  7202,  146,25354, 7178
DC.W    18,49058,16450,    2
DC.W     0,65532,    2,    2
DC.W     2,    2,    2,    2
DC.W     2,    2,    2,    2
DC.W     2, 7682,52418,16162
DC.W 17586,17586,17586,17586
DC.W  9522,32674,42050,    2
DC.W     0,65532,    2,    2
DC.W     2,    2,    2,    2
DC.W     2,    2,    2,    2
DC.W     2, 7218, 7218, 2114
DC.W 65410,34946,34946,18754
DC.W 15938,49634,43666,    2
DC.W 16385,    2,16385,    2
DC.W 16387,32770,16391,49154
DC.W 16399,57346,16415,61442
DC.W 16447,63490,16511,64514
DC.W 16639,65026,16895,65282
DC.W 17407,65410,17407,65410
DC.W 17407,65410,17407,65410
DC.W 16895,65282,16639,65026
DC.W 16505,15362,16387,32770
DC.W 16399,57346,16447,63490
DC.W 16895,65282,16384,    2
DC.W 16383,65532,    0,    0
DC.W 16391,49154,16399,57346
DC.W 16415,61442,16415,61442
DC.W 16415,61442,16415,61442
DC.W 16399,57346,16391,49154
DC.W 16865, 3842,17393, 8066
DC.W 18425,16322,18431,65474
DC.W 18431,65474,18427,49090
DC.W 17393, 8066,16865, 3842
DC.W 16385,    2,16387,32770
DC.W 16399,57346,16447,61442
DC.W 16895,65282,16384,    2
DC.W 16383,65532,    0,    0
DC.W 16385,    2,16385,    2
```

```
DC.W 16387,32770,16387,32770
DC.W 16391,49154,16391,49154
DC.W 16399,57346,16415,61442
DC.W 16511,64514,16895,65282
DC.W 18431,65474,16895,65282
DC.W 16511,64514,16415,61442
DC.W 16399,57346,16391,49154
DC.W 16391,49154,16387,32770
DC.W 16387,32770,16385,    2
DC.W 16385,    2,16384,    2
DC.W 16383,65532,    0,    0
DC.W 16480, 3074,16888,16130
DC.W 17404,32642,17404,32642
DC.W 18430,65474,18430,65474
DC.W 18431,65474,18431,65474
DC.W 17407,65410,17407,65410
DC.W 16895,65282,16639,65026
DC.W 16447,63490,16415,61442
DC.W 16399,57346,16391,49154
DC.W 16387,32770,16387,32770
DC.W 16385,    2,16385,    2
DC.W 16385,    2,16384,    2
DC.W 16383,65532,    0,    0
DC.W     2,16383,65532,    0
DC.W     0,    0,    0,    0
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MICRODRIVE

KEY

B = SuperBasic; A + O = assembler and object code; M + B = machine code and Basic loader; A+B+O = assembler and Basic loader and object code; S = supercharged; L = QLiberated; f1 = monitor mode; f2 = TV mode

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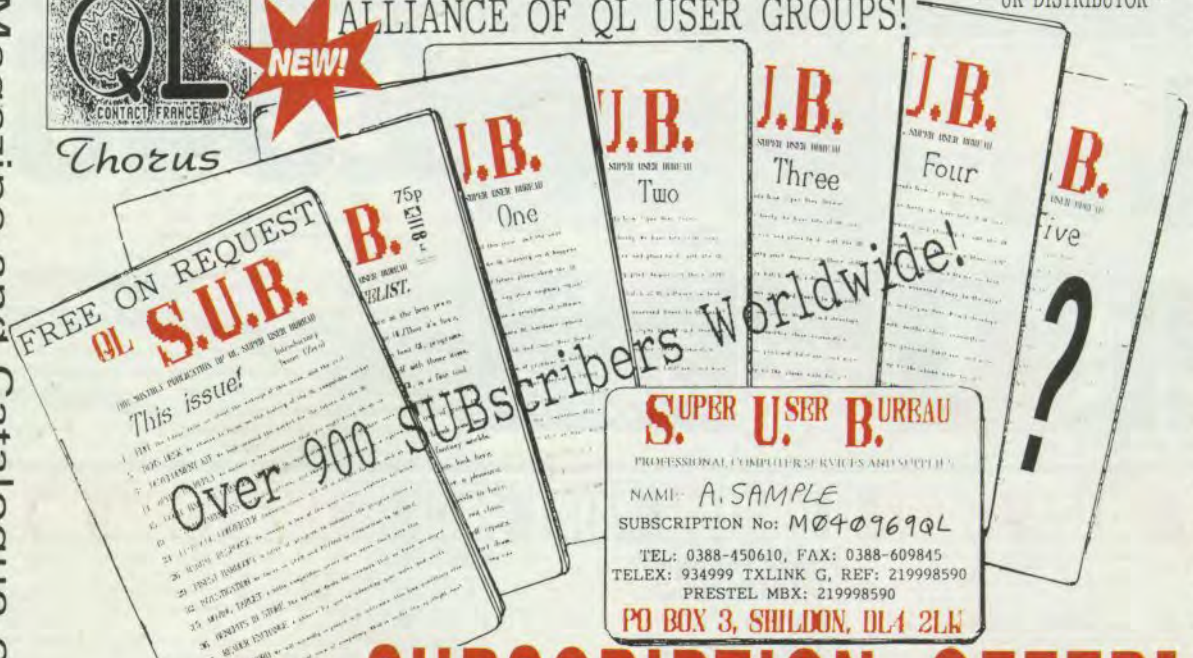

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