INTERNATIONAL TI-LINES

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Merry Christmas
And A Very
Happy New Year
To You All!
From GORDON PITT
W.M.T.I
And from OLD BALDIE!!!

Formerly OXON TI USERS

A PUBLICATION OF THE INTERNATIONAL TI USER GROUP

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{My apologies for the extremely late production of this issue, due to a number of factors beyond my control - not least of which has been the destruction of three large files by DM1000 V3.5 during backup, which necessitated total retyping just five hours before publication!!! Alas, January's will also be late, because of the holiday. PB}

R E A D   T H I S   F I R S T !

Well, my hopes proved to be in vain. The last issue went out much later than usual, partly due to circumstances beyond my control, and partly due to ill-health (I succumbed to the epidemic of gastric 'flu going the rounds at present) so I am not going to express any hopes whatever that this current issue gets to the presses on time - I will do my utmost.

I expressed great enthusiasm about the latest Funnelweb last issue, only to uncover a naughty bug in the ReplaceString function in the Editor as soon as I had finished the magazine! I have no doubt that other Users have identified the bug and advised the authors; in the meantime I will not issue V4.0 to ITUGers until its successor becomes available. I am told that V4.0 may have been a pre-release issue to allow for bugs to arise, in which case I probably shouldn't have shouted too loudly about it in TI-LINES!

ERRATA: No sooner had I carted home the photocopies of V4.6 than I noted a blatant omission: a few of the signal names in BILL REED's articles required lines to be added overhead (to indicate inversion) and I had forgotten to add them in the heat and confusion of getting TI-LINES out before the year turned. In issue 4.6, then, the following pages need to be amended:

Page 11: second paragraph up from the bottom, "...and does not need a pull down to a negative rail on its DATA...". The word DATA should have a line above it.

Page 13: almost halfway down the page, "...by character, on pin 7, and also monitors pin 5 as the printer BUSY...". The word BUSY needs a line above it.

Page 19: two omissions here, both in the paragraph which begins: (b).

The words DATA and CLOCK in that paragraph should both have lines above them.

Sorry about that.

Some of the copies of the last issue were subject to the usual nasties in the photocopier, which was generally producing light copies but just occasionally threw in a dark streak to keep me from being bored. The production schedule is fairly tight, which doesn't give me time to redo large numbers of copies if only minor hiccups occur, so apologies to those readers who didn't get totally "clean" issues! If the machine decides to play up, and if I am running three weeks late, there is not a great deal I can do about it, I'm afraid.

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DATA PROTECTION ACT

How to request details of any information about you which may be held in computer-readable form by ITUG.

You must make your enquiry IN WRITING, giving your FULL DETAILS - i.e., your FULL name, your present address, and ANY PREVIOUS ADDRESSES dating back to 1982. The reason for this odd request is that ITUG may hold more than one address for you, perhaps in archived files.

TO SAVE YOU FROM UNNECESSARY ENQUIRIES, you should note that the ONLY details held by ITUG in computer-readable form will be the initial of your FIRST or COMMON NAME (where a common name is not necessarily your first name), your SURNAME (which, if you changed it - perhaps by marrying, or by deed poll, - you might advise when you enquire), and your POSTAL ADDRESS.

NO OTHER DETAILS ARE STORED IN COMPUTER-READABLE FORM, not even your telephone number, subscription payments, or equipment details.

ALL your details must be provided in a CLEARLY LEGIBLE handwriting or typewritten (preferably) form, and a cheque or postal order for £5 MUST ACCOMPANY YOUR REQUEST. Make it payable to PETER BROOKS. CASH WILL NOT BE ACCEPTED UNDER ANY CIRCUMSTANCES.

YOU MAY NOT ENQUIRE ON BEHALF OF ANY OTHER PERSON. I cannot divulge ANY details to any other person - that is the agreement under which ITUG has been registered.

You should address your enquiries to ITUG at 96, Banbury Road, OXFORD, OX2 6JT.

WHAT YOU WILL RECEIVE: a direct printout of the information as it is held on disk (the only computer-readable medium which ITUG uses for personal details).

If you do not receive a satisfactory reply within 40 days, you may then contact the DATA PROTECTION REGISTRAR and lodge a complaint which he will then pursue.

To be honest, I find it highly unlikely that any current subscriber will need to know what data is held, but I am required by law to provide the facility, and the information. Note that the MAXIMUM permitted charge is £10, and also that an exhaustive search will take a considerable amount of time.

It will be interesting to see, in the light of my recent experiences, which Data Users the Registrar will decide to require to register having previously allowed them an exemption. It would appear that the Office of the Registrar is not infallible when it comes to giving advice, and the responsibility for making sure the correct advice is given rests on the enquirer, not on the Office (i.e., if they gave the wrong advice, it is because you weren't clear enough in your explanations, get it ?).

ITUG is registered under the Act until 11th December 1989.

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December's issue marks the beginning of the Season of Goodwill, which means that I'd probably better warn you that the next couple of issues may be delayed by the postal strike which looks certain to put in an appearance...

That aside, I would like to take this opportunity to wish one and all a very Merry Christmas, and a Happy and Prosperous New Year. I will be dashing around more than usual over the festive period, so callers will have to put up with the dreaded answering machine more than of late. I can't be in two places at once, and the machine does at least let me know that folks have been trying to contact me - when they leave a brief message, that is.

Anyway, have a good Christmas, and make your New Year Resolution one which includes writing an article or two for TI-LINES and its readers, who would like to hear from you!

CHIP AHOY! Been at sea with your PIO output not being Centronics compatible ? ITUG has the answer, and then some. AVAILABLE NOW: a replacement DSR ROM for your TI RS232/PIO card, to circumvent the lack of true Centronics (parallel) compatibility. If you are desperate to use PIO rather than RS232, but couldn't before, because your printer's idea of parallel, and TI's idea of parallel, are not the same, then now is your chance!

And that's not all! How would you like to be able to specify SPLIT BAUD RATES for your RS232 ? Not only split baud rates, but virtually ANY baud rate, not just the usual handful ?

Well, now you can do that as well!

The facts: PIO. The new PIO output routine assumes that there will be no "acknowledge" for each character sent. Output will only halt when the BUSY line goes high - normally when the receiving buffer is full.

This allows "true" Centronics communication.

RS232. The RS232 BAUD command can now be used to set up ANY baud rate between 62 baud and 65,000 baud. The accuracy of the set rate is within 2% at 2400, 9600, 19200, and 38400, and ALL rates below 2400. DEFAULT is still 300 baud.

WARNING: make sure that you set the right baud rate - if you get it wrong, you will still get what you asked for!

SPLIT BAUD RATE. There are TWO NEW BAUD COMMANDS: ".RX" and ".TX".

These are used in the same way (but NOT as well as) the ".BA" command and allow the Transmit (.TX) and Receive (.RX) rates to be independently set. For example, OPEN £1: "RS232.TX=75.RX=1200" will set up transmit at 75 baud, and receive at 1200 baud. [2022: Use OPEN #1 INSTEAD OF £1]

This DSR ROM replaces U1 on your RS232 card. It costs £10 including post and packing. Cheques/Postal Orders payable to "ITUG" please.

A fitting service is available if you need it. Apply for details.

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A NOTE TO AUTHORS: If you are thinking of writing an article for publication in TI-LINES, and you might use special graphics not available on MY printer, you may like to avail yourself of some sheets of outlined paper as used in current issues of TI-LINES, on which to print your material (and special graphics) yourself. Note that (a) you MUST use a new (or re-inked) ribbon to produce as dark an original as possible, and (b) you must be prepared to reprint an edited version if it becomes necessary. Take note of the way in which current articles in TI-LINES are laid out: 58 lines of text including title line, with a footer of one blank line, and one chevron line containing the words "MORE>" or "END" as appropriate.

If you would like to make use of the facility, contact me and advise me how large the article will be (in terms of published pages) so that I can supply you with the necessary paper - FREE, of course.

There is a strong possibility that I will be able to offer HALF-HEIGHT double-sided drives in the near future. Prices are uncertain, but I hope to be able to offer about a dozen drives. These are likely to be a mixture of 40 and 80 track, so we should be able to suit most tastes.

If you have been looking for half-heights (perhaps to set up a pair within your PEB) then contact me early in January.

I am fixing to publish just a simple list of the Public Domain Disk Library titles shortly (perhaps even in this issue if I can get the work done), in response to demand for even such an uninformative list. I have still yet to prepare the detailed reviews of each package, but if you already know roughly what each does, then the bare list will suffice until I can find more time.

THE NEXT BLOXWICH WORKSHOP: SATURDAY, MARCH 26TH 1988. Further details will follow in due course. Make sure you clear that weekend for action, and look forward to an actual demo of the MYARC 9640 among many other wonderful things (well, interesting things, anyway!).

Elsewhere in this issue you will find the first list of software which has been made available for ROMOX programming. The DI list consists of around 27 titles, each costing £5 if obtained through ITUG. The price includes post and packing plus a fee to the programmer. Whether you buy a programmed ROMOX or send one (or more) in for programming, the fee is fixed at £5. This breaks down into £3 fee for the programmer, £1 to try and cover postage and packing, and £1 to try and cover the purchase of the ROMOX including my fuel costs in collecting the finished items (needless to say, all costs are not covered!).

The maximum number of ROMOX which may be purchased by any one ITUGer at present is FOUR, but if you are sending in previously purchased items, you may have as many of your ROMOX programmed as you wish. Please provide payment by cheque or postal order, and make out to PETER BROOKS

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(although "ITUG" is acceptable, I would prefer it if you use my name).

Just to keep you in the picture, researchers at the Royal Signals and Radar Establishment are reported in MicroComputer Mart to have developed an erasable optical disk, using a laser-only technique. The disks are supposed to have a lifetime of several thousand rewrites. The news was originally reported by an industry paper, Computer News, which also stated that the RSRE are looking for support from private firms to make the disks commercially viable. How long now to a domestic laser disk system for the TI ???

Elsewhere in this issue you should find an advertisement for products supplied through RICHARD SIERAKOWSKI, who trades as R.S.T.S., and who will be bringing in the new MYARC 9640 PC for those wishing to take their computing a quantum leap further.

Thanks to Richard, I have had a couple of opportunities to see the 9640 card in operation, although as yet without the final version of its Operating System. Reports from overseas newsletters (notably that of the OTTAWA TI-99/4A USERS GROUP) indicate that MYARC are developing a formidable list of cloned popular software - for example, MyNumber, a Lotus 1-2-3 clone; MyData, a DBase III clone; - along with updated versions of the existing packages like MyWord and MyArt, the word processor and graphics package, respectively.

Also near to readiness is MyBasic, a compiler for guess which language, and I understand that versions of the hard disk controller (and maybe also some of the above software ?) should be available for both the 9640 AND the 99/4A...

The HORIZONS RAMDISK (my apologies to all and sundry for insisting on calling it the NEW HORIZONS... New Horizons is the name of the User Group associated with the Horizon company - oops!) has had its construction details altered to enable it to be built with 32K RAM rather than 8K RAM chips - providing we can get hold of them cheaply enough!

In addition, the MIAMI USER GROUP has updated its remarkable RAMDISK Operating System (available through GORDON PITT) to V7.1, which I am told will run with ANY RAMDISK, not just the Horizons unit. This excellent piece of software will be demonstrated at the BLOXWICH WORKSHOP at the end of March next year.

The modified RAMDISK construction enables up to 16 megabytes of RAM to be bolted on, although the Horizons company quite rightly say that this is not really regarded as a practical proposition (anyone for a four foot wide RAMDISK ???) and so have designed the modification with only 1 megabyte in mind. Further details will become available as we go on, but Bloxwich will be your best bet for a visual feast.

Out of space, out of time, and probably out of mind!! Have a good Xmas!
>>END

MATHEMATICAL RABBITS

By Trevor Taberner

I recently re-read FRANCESCO LAMA's excellent article in V4.2 TI-LINES on equation solving, and remembered that I have a program designed to give the numbers in the FIBONACCI SERIES which may be of use to some readers.

The series, you may recall, is obtained by adding two consecutive numbers in the series to give the value of the next number. Taking the first two numbers as 1 and 2 the third number would be 3, the fourth number 5, the fifth number 8, the sixth number 13 etc. In other words the series is :- 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, etc., and the following short program will generate the series in convenient screens of 20 numbers.

```
1 REM **********************
2 REM *                    *
3 REM *  FIBONACCI SERIES  *
4 REM *                    *
5 REM *    listing from    *
6 REM *       DORTIG       *
7 REM *                    *
8 REM *       ~~~~~~       *
9 REM *  psst!             *
10 REM *     Multiply     *
11 REM *     a number     *
12 REM *      in the      *
13 REM *      series      *
14 REM *      by the      *
15 REM *      number      *
16 REM *    1.618033989   *
17 REM *     to obtain    *
18 REM *      a close     *
19 REM *   approximation  *
20 REM *    of the next   *
21 REM *   higher number  *
22 REM *   in the series  *
23 REM *  and ignore the  *
24 REM *  program if you  *
25 REM *       wish       *
26 REM ********************
100 CALL CLEAR
110 A=1
120 B=1
130 INPUT "HOW MANY NUMBERS?":N
140 FOR I=1 TO N
```

(continued overleaf)

>>>MORE>

```
150 IF INT(I/21) * 21 <> I THEN 170
160 INPUT F$
170 C=A+B
180 PRINT C
190 A=B
200 B=C
210 NEXT I
220 STOP
```

If you want to alter the program to generate more than 20 numbers at a time please remember that the computer will eventually go into scientific notation.

In case you are wondering to what possible practical use this series can be put, why not consider the famous rabbit problem which, simply stated, says, "How many pairs of rabbits will you have each month if you begin with one breeding pair and let them accomplish what rabbits are noted for, assuming that none die, that they take one month to mature and that each adult pair will produce one new pair each month ?"

Alternatively you could start a rabbit farm and buy a note-book and pencil but don't send your surplus rabbits to me; just send a proportion of the profits.

Another interesting aspect is that if you multiply a number in the series by 1.618033989 you get a close approximation of the next number in the series. E.g., 3*1.618033989 = 4.854101967. 'Not a very close approximation' you might say, 'only 97.08203934% accuracy'. However the higher the number in the series the greater the accuracy. Take for example the nineteenth number, 10946, and multiply it by the 'magic' number. The answer is 17711.00004 which compares very well with the twentieth number in the series which is 17711. How about that for accuracy! Where did this 'magic' number 1.618033989 appear from ? In fact it is the solution to the simple equation which states the proportions of the "Golden Section" known to Euclid and artists ever since. The equation is 1/X = 1+X, and its solution is GS = 0.5(1 + square root of 5), where GS = 1 + X.

The pukka definition of the Golden Section is "A line which is divided in such a way that the smaller part is to the larger as the larger is to the whole (AB cut at C, so that CB:AC=AC:AB)". In other words a rectangle of two numbers in the series say 8 by 13 may be divided into an 8 by 8 square and a new rectangle of 5 by 8. The second rectangle can be divided into a 5 by 5 square and a 3 by 5 rectangle etc. This Golden Section is the proportion by which most artists knowingly or unknowingly composed their pictures. The proportion is aesthetically pleasing, it looks 'right' and has often been thought to possess some hidden harmonic virtue in tune with the Universe. What greater justification is there for the proclivities of the rabbit's lifestyle.

PS The largest FIBONACCI number which I have obtained is 9.21685E99. If you experiment with this series please let me know your results. My address and phone number appeared in Vol 4 Issue 4. As for me I am about to pair FIBONACCI WITH A CELLULAR AUTOMATON and give Peter Brooks a little vicarious pleasure if I discover an interesting offspring.

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ROMOX SOFTWARE: The following items are to be made available through ITUG to existing subscribers ONLY.

This is NOT a commercial operation, and vast quantities of profit are not anticipated (nor are even small quantities!!!).

You may submit ROMOX previously purchased, or order up to FOUR ROMOX already programmed with software of your choice from this list.

If you submit ROMOX previously purchased, there is no limit to the number which you may have programmed.

There is a fixed fee of £5 per cartridge programmed, whether one or several ROMOX are submitted for programming, or are ordered (subject to current limitations).

Further lists may appear in due course, and the fee for programming may vary from list to list. Due to the "soft" nature of this service, all titles should always be available, unless withdrawn for whatever reason.

Further projects based upon the ROMOX cartridge are anticipated, and details will appear as appropriate in due course.

DI CODE	FIRMWARE TITLE
0001	ST NICK
0002	ASTROBLITZ
0003	MIDNITE MASON
0004	TOPPER
0005	HOPPER
0006	AMBULANCE
0007	FACE CHASE
0008	LOG JUMP
0009	BEYOND PARSEC
0010	ANT EATER
0011	CROSSFIRE
0012	DRIVING DEMON
0013	DEFENDER
0014	SHAMUS
0015	RABBIT TRAIL
0016	CAVE CREATURES
0017	CENTIPEDE
0018	EDITOR/ASSEMBLER
0019	STARTRAP
0020	STARGAZER 1
0021	STARGAZER 2
0022	STARGAZER 3
0023	D STATION 1
0024	D STATION 2
0025	TILE BREAKER
0026	KING OF THE CASTLE
0027	BOXER

>>END

RAMDISK RECOVERY

By HAL TONKIN, OTTAWA TI-99/4A USER GROUP, published in the V6.10 issue of their newsletter.

If you back up your RAMDISK (RD) before turning off the power every time you use it, then read no further.

If, however, you are like the rest of us mortals, who take a backup copy only once a month or so, then this article may help.

Every now and then, when I turn on my system, I find that the Operating System (ROS) for the RD has been corrupted. If the system will still come up and I can get Extended BASIC to run, then it is a simple matter just to reload the ROS. Usually the files are still OK, and at this point I breathe a sigh of relief, and THEN take a backup.

However, the other week, when I turned on the power, there was nothing - no TI banner, no menu, no response on the keyboard, just a little red light in the RD slot indicating that it was looping somewhere in its power-up routine.

PANIC!!! I had just finished entering a C program, and did not want to have to type it all in again. The RD instructions say that when this happens, the only way out is to power down, remove the RD card from the system, remove the batteries, wait, re-install the batteries, re-insert the card, and reload the ROS. However, this will also destroy the contents of the rest of the memory - that is, all my precious files.

There had to be another way of resolving the problem, and it turned out that there is - this time, anyway. If this ever happens to you, perhaps the following procedure may also save your bacon.

1. Turn off the PEB and the console.

2. Put a MiniMemory cartridge in the console.

3. Turn on the console ONLY. At this point the TI banner should come up, and after pressing a key, the MiniMemory menu should appear.

4. Select Option 2: EASY BUG

5. NOW turn on the PEB. Since the console was already switched on, it did not try to execute any of the power-up routines located in the cards in the PEB.

6. Select CRU single bit I/O by typing "C", then type "C1000" and press ENTER, and then "1" and then press ENTER, to enable your RAMDISK. CRU address >1000 is where my RAMDISK is set. If your RD is at a DIFFERENT address, then enter the appropriate address instead of >1000.

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When you turn on the CRU bit, the red light in the RD slot should come on, indicating that the RD has been selected. IF IT DOES NOT THEN THIS RECOVERY PROCEDURE WILL NOT WORK.

7. Exit CRU single bit I/O by typing a period (full stop).

8. Examine memory address >4000 by typing "M4000" and press ENTER. This is the address of the first byte of the RAMDISK memory and should contain the value >AA, indicating that there is a device present.

9. Alter the byte at memory address >4000 to become >00 to indicate that there is NO device present, by typing "00" and pressing ENTER.

10. Exit CPU memory addressing by typing a period (full stop).

11. Turn off the CRU bit >1000 by typing "C1000" and pressing ENTER, then type "0" and press ENTER. The red light in the RAMDISK slot should go out.

12. Turn off the PEB, then turn off the console.

13. Remove the MiniMemory cartridge, and re-insert Extended BASIC.

14. Turn on the console, and then the PEB.

15. Reset the system by pressing and holding down the FCTN key, and then pressing "=" - the QUIT operation. All the cards in your PEB except your RAMDISK should reset themselves, and the system should not hang up, since the RAMDISK will not try to execute its corrupted power-up routine.

16. Put your ROS disk in drive 1, and select Extended BASIC.

17. Reload the ROS, and with luck, your files will still be present.

18. Take a backup NOW, before anything else goes wrong!!!

This procedure may not work all the time, but it did for me, and may be worth trying before taking the irrevocable step of removing those batteries.

{Having "road-tested" a few Horizons RAMDISKs, and having experienced the lockout described above more than a few times (due probably to my heavy-handed use of the module-insertion-as-system-reset), I thought that this simple, elegant solution offered by Hal Tonkin would be of use to the increasing numbers of Horizon RD owners. I ought perhaps to emphasize that the propensity to lock out or up is not a feature of the Horizons ROS, but rather that familiar old adversary experienced by virtually all TI owners at one time or another. Those who possess issues of TIDINGS may recall much discussion of the tendency of simple (but frequent) editing of BASIC programs to cause similar problems. PB}

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DISK CONTROLLERS: FROM TI TO MYARC

This article appeared in the April 1987 (V5.4) issue of NORTHWEST OHIO 99'ER NEWS, a joint publication produced by OH-MI-TI and NEW HORIZONS USER GROUPS. It was originally written by JERRY COFFEY in January 1987

The views expressed in this article reflect the author's personal experience with TI, Corcomp, and Myarc disk controllers. Technical data has been verified wherever possible, but is not publicly documented in some instances. Please bring any errors to the attention of the author, (in this case, please notify ITUG and corrections will be duly published and automatically will be relayed to OH-MI-TI and NEW HORIZONS since these groups receive an exchange copy of TI-LINES).

The published article has been edited to conform to standard English where necessary, and to elucidate any difficult points.

The total disk capacity of the TI-99/4A has increased in just a few years from less than 80K (a lone, single-sided, single density, 35 track drive) to almost 2.9 megabytes (four double-sided, double density, 80 track drives). The early standalone was replaced by the Peripheral Expansion Box (PEB) system which would support three double-sided single density 40 track drives (540K). Corcomp introduced their four drive double density system (1440K) followed by Myarc's similar system with two double density formats (1280K and 1440K).

{It is a little confusing, but the author is discussing TOTAL disk capacity - i.e., the total amount of storage available if you place blank, initialised disks in ALL the available on-line drives! PB }

Then, in 1986, Myarc offered its 80 track upgrade, which doubled capacity again. Even as capacity was increasing rapidly, the TI and Corcomp controllers differed only modestly in I/O speed. When Myarc introduced its fast DSDD controller, few reviewers did justice to its speed advantage. Early comparisons were done at the standard TI or Corcomp interlace, but the big speed gains required taking advantage of the much tighter sector interlace possible with the high speed Myarc card. To understand how this works, we need to take a look at the way a disk drive performs.

DISK DRIVE FUNDAMENTALS

A floppy disk drive writes information in concentric rings called "tracks" on a thin plastic disk coated with a film of magnetisable particles. Each track in turn is divided into blocks of information called "sectors". A blank disk has one (or more) index holes used to synchronise the processes of writing to and reading from the disk. The type of disk with many index holes is called "hard sectored" since each sector has its position fixed by an index hole. The type of disk used by most computers has only one such index hole, and is called "soft

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sectored". Under this system, the computer must write magnetic "signposts" on the disk to mark out each sector, in a process called "formatting" or "initialising" a disk. These signposts take up a substantial fraction of the space on a track, since they include not only sector numbers but also buffers (filler bytes) which allow the computer to achieve synchrony in order to read or write sectors of data and to prevent the sector identifier from being overwritten by a drive operating at a speed slightly different from that of the drive which originally formatted the disk.

The typical 5.25 inch disk drive has a "stepper motor" capable of moving the drive's read/write head(s) in or out along a radius of the disk in steps 1/48th of an inch (thus the description "48tpi", or 48 tracks per inch). Since the inner tracks have a smaller circumference, they crowd the bits of information together. Magnetisable coatings on a floppy disk are rated by their capacity in bits per inch at standard magnetic flux for the write head. This figure is usually over 5000bpi for modern floppies, but was somewhat lower a few years ago.

The circumference of the inner track of a 40 or 80 track disk is about 10 inches - which allows about 6250 bytes to be written on the track without exceeding 5000bpi. For comparison, the Corcomp double density format requires over 6400 bytes per track. Media limitations were the reason that some early 5.25 disk drives only used the outer 35 tracks. The 16 sector (by 256 bytes per sector) format recommended by most drive makers requires only 6250 bytes per track and includes several hundred additional buffer bytes to compensate for differences in drive timing.

TIMING IS EVERYTHING

With soft-sectored disks, the integrity of the read/write processes requires critical timing. The disk rotates at 300 rpm within a small margin. This means that there are about 250,000 magnetic pulses (bits) passing beneath the head each second. In single density format, the majority of these pulses are timing or filler bits - in double density, many of the timing bits are suppressed in order to double the rate of data bits. In a typical sector read, the drive must bring the disk up to speed, recognise the index hole, step out to track zero (to get its bearings), determine single or double density, verify its position, step in to the target track, verify the track number (written in the format operation), detect the sector identifier as it flies past, then immediately read the 256 data bytes into memory. Five of these operations require accurate reading of the magnetic pulses whizzing by at over 250Kbits per second.

If you do some quick arithmetic (256 bytes per sector = 2048 bits per sector, into 250Kbits per second...hmmm...Why can't the drive read a 125 sector file in one second ?

Well, firstly, many of those bits are not data bits, they are overhead to keep things synchronised and allow for timing variations between drives. Secondly, some time is used up in moving the head from one track to the next when more than one track must be read. Thirdly, 250Kbits per second is the instantaneous read rate, and the computer must take time to do other things like move the last sector out of

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its buffer to make room for the next one. In the standard TI protocol for reading a disk, the data is moved into VDP RAM (so the drive can be used without requiring the memory expansion) before it goes to the memory expansion. All this thrashing eats up huge chunks of the time available for reading data. By the time one sector is safely tucked away in the 32K card, several sectors have already passed by the drive's read/write head. If the sectors were written consecutively on the disk, we would have to wait a full revolution (0.2 seconds) before the next sector would pass under the head.

To avoid this inefficiency, the consecutively numbered sectors are spaced out around the disk so that they are separated by just enough time to take care of other business. The actual pattern in which the sectors are scattered is called the "interlace". The idea of the interlace is to spread the sectors out to meet the timing needs of the hardware - both the time needed to stash each sector away and the time needed to step from one track to the next and get the head settled down for some serious (250Kbps) reading.

INTERLACE AND HEAD STEP TIMES

Life was simple with the TI disk controller. Both the interlace and the head step time were locked into the controller's PROM (that's the programmed chip which contains the control programs for the card). The head step time is the inbuilt delay between step signals to allow the stepper motor to move the head one "click" in or out. The TI settings are very conservative (for conservative, read "slow") to allow for slow drives. The step time is 20ms - if you step from track 0 to track 39, it takes 20x39=780ms, almost four revolutions of the drive (200ms is one revolution). The TI interlace lays the sectors down on a track in the order 0-7-5-3-1-8-6-4-2. This allows all sectors to be read in four revolutions of the disk though the slow head step rate lets another revolution go by between tracks. Thus the maximum read rate is about 9 sectors per five revolutions (= 1 second) or 2304 bytes per second.

When Corcomp designed its double density disk controller, allowances were made for the increased speed of later drives by permitting the step rate to be set with DIP switches for each drive. The step rates available are 30, 20, 12, and 6ms (the faster values quoted in the CC manual are referenced to the wrong clock speed). Corcomp also provided a choice of interlace options, though only a couple of them are practical. The default interlaces are labelled "7" for single density, and "10" for double density. The single density interlace is the same as for TI, but with a faster step setting the head can be moved without losing a revolution and thus can read 20% faster than the TI controller.

The double density interlace allows 18 sectors to be read in 5 revolutions, but it doesn't leave enough margin to stash the last sector away, and step the head in time to catch the zero sector of the next track (which is why the sector number "hangs" for 0.2 seconds every 18 sectors while verifying a formatted disk - you are seeing the extra revolution needed to acquire the first sector of the next track).

Thus the maximum read rate is 18/1.2 or 15 sectors per second, about 67% faster than the TI controller. Users of the CC controller have probably noticed that it loads its own MANAGER program faster than this.

>>MORE>

In this case a special loader bypasses VDP RAM and loads directly into CPU RAM - this faster handling of the data allows the stepper motor to be activated sooner and thus saves one revolution per track (so the 98 sector file can be read in about 5.5 seconds). This provided a foretaste of the speed that MYARC would achieve with its double density controller.

The Myarc controller bypasses VDP RAM to load directly into CPU RAM. This technique, coupled with a buffer RAM chip on the controller card provides a quantum leap in disk I/O speed. The Myarc card reads the TI single density interlace at 11.25 sectors per second (the same as Corcomp) and reads the CC 18 sector per track interlace at 18 sectors per second (the same speed at which Corcomp reads its MANAGER program), but this is only the beginning. Since the hardware empties its sector buffer faster, consecutive sectors can be placed closer together allowing a track to be read in fewer revolutions - i.e., it supports a faster interlace. With fast drives, the 9 sector per track single density format can be read at interlace "2".

NOTE: in Myarc terminology, the interlace number represents the number of disk revolutions required to read a track.

This works out to 22.5 sectors per second, compared with 9 for the TI, and 11.25 for the Corcomp controller. The Myarc 16 sector format can be read at interlace "3", 26.67 sectors per second - 3 times as fast as the TI controller and almost twice as fast as Corcomp double density. The Corcomp 18 sector format can be read at interlace "3" or "4", but the data rate is the same in either case: 22.5 sectors per second. Interlace "4" is smooth but requires a very quick head step, while interlace "3" reads the track in 3 revolutions but forces an extra revolution for the step from track to track because sectors 17 and 0 are adjacent on the disk. Though both interlaces have the same data rate, interlace "3" is safer if you are uncertain about the speed of your stepper motor.

In order to read and write both types of double density format, the Myarc system must insert an additional step in some I/O operations - sector 0 must be read to determine whether a double density disk has 16 or 18 sectors per track. This datum is needed to convert the logical sector numbers used by the TI Operating System into track and sector-within-track addresses for the floppy disk controller chip. The TI and Corcomp controllers do not need this step because they do not use the full potential of the TI disk I/O protocol. Once this step, accessing sector 0, is added to the various disk operations, it opens up the system for using more than two formats - including 80 track formats.

BEYOND DOUBLE DENSITY

A two-format system can be managed using only the floppy disk controller's inherent ability to sense single and double density recording patterns. To go beyond this limitation, the additional data stored in sector 0 must read, stored, and used to modify the special binary commands sent to the FDC (floppy disk controller) chip.

Fortunately, the TI-99/4A system design already provides for such innovations through the Device Service Routine concept, and standard

>>>MORE>

"GPL" calls. The system doesn't care what hardware is attached as long as it plays by the rules - an interface program stored in a memory chip (PROM) on the peripheral device does the trick. This program handles calls for I/O operations from other programs such as TI-Writer or the BASIC interpreters. Another set of rules controls the way disk and file information is saved on a disk. Disk parameters are stored in sector 0, while sector 1 must have a two byte "pointer" (a hexadecimal sector address) for each block (one sector) containing the housekeeping data for a file. It is these blocks which are scanned in order to display a disk directory.

{Interested readers are advised to read COLIN HINSON's detailed presentation on the TI Disk Operating System, and perhaps to also look at the excellent DSR disassembly produced independantly by Colin and by TIM MacEACHERN of TINS, published by ITUG as a booklet (£2). PB}

Since the Myarc controller must read sector 0 to determine the number of sectors per track, the other parameters in that sector are available to control other variables such as the number of tracks. But there are other limitations to overcome. The number of files on a disk is limited by the space available for pointers. 256 bytes at 2 bytes per pointer would give 128 files - except the pointer list must end with a "null" word (>0000) so that directory routines know where to stop - so we get 127 files per disk. The pointer itself can address sector numbers as high as 65535, so this is no problem. The real limitation is the sector bit map in sector 0. It begins at byte 56 leaving only 200 bytes or 1600 bits available to map the disk. Since a bit must be turned on for each sector in use, the 1440 sector DSDD 40 track disk is already near the limit. The answer devised for the 80 track DSDD system is to map two consecutive sectors with each bit in the bit map. It wastes some space but no more than systems which use a standard 512 byte sector.

{It is useful to note that an SSDD 80 track format with 1440 sectors available could be applied to a (reliable) flippy, resulting in 254 files per disk, and 2880 sectors without resorting to the doubling-up of bits in the bitmap. PB}

MAKING THE QUAD SYSTEM WORK

So now let's say we have new code in the disk controller EPROM (an "erasable" version of the PROM chip used by TI) that does all the proper tricks with the bit map and has the FDC commands to control the new 80 track drives we have added to the system. We still have to tell the controller which drives are 80 track, and find a disk manager program which can use the new commands. The selection problem can be taken care of using the DIP switches on the card (but in the process you lose their original function - setting the head step speed). Since the EPROM responds to standard GPL calls, most functions can be handled by the TI Disk Manager 2 cartridge. The exception is the disk formatting process; the formatting works OK, but the initial data written into sector 0 is for the standard bit map. (This can be fixed by changing byte 56 from >03 to >01 with a sector editor program like DISKO/DPATCH/DPKE.)

Read/write operations from Extended BASIC or TI-Writer work fine since

>>>MORE>

they use the GPL protocols. Myarc has an excellent disk manager program which works beautifully with 40 track drives, but it has suffered from a number of subtle bugs in 80 track mode. This program, like many others designed for high speed I/O, uses machine code to handle the FDC - bypassing some of the routines in the EPROM. Differences in bit map handling, even slight differences in execution times, can affect the performance of 80 track drives. The code in the 80 track EPROM has had a lot of attention to the proper timing - the price you pay for higher performance.

FINE TUNING THE MYARC DISK SYSTEM

Before you start using the Myarc system routinely, there are some experiments which can help you to obtain maximum performance from your drives. Use the Myarc disk manager to try different interlace settings, first with your 40 track drives, then with any 80 track drives. Watch for hesitations as each formatted disk is verified, then use the TEST option to read the sectors you have laid down. Look and listen for "retries" - when the sector number pauses with a head seek noise. Use the best disks you have and note the combinations which test smoothly. With fast drives in good condition, you should be able to run 9 sector (single density) format at interlace 2, and 16 or 18 sector, double density format at interlace 3. Don't worry if 18/3 pauses at the end of each track - this is just the extra revolution forced by having sectors 17 and 0 adjacent on the disk.

When you try this with 80 track drives, don't be surprised if the results are different. The time required for the head to settle into a wide standard track may not be adequate to get it reading properly from the narrow tracks on a quad drive. Such subtleties as erase delays and disk quality are also more critical on the skinny, low power tracks. My Mitsubishi 4853s (96tpi) will support both 16/3 and 18/3 but are unreliable at 18/4, while my TEAC 55Bs support all three at 48tpi.

Don't take chances with any setup that is marginal. The error rate may be low, but it always seems to happen to a file which isn't backed up.

HOT RODDING

If you want to try for a little more speed, there are two more tricks you can employ. The faster WD1772 FDC chip is pin compatible with the standard WD1770 supplied by Myarc. It will try to step the head at 2ms rather than the 6ms setting of the standard chip. (The 80 track EPROM automatically uses the fastest step speed available.) Many of the latest drives can step at 2ms or 3ms even though they are conservatively rated at 4ms or 5ms. The change is noticeable, but may not be worth the high price of the WD1772 (it is not a commonly-used chip and is rarely discounted). The second fix is cheap and very useful for the production of large quantities of copies. The FDC chip's automatic "write verify" function can be disabled by shorting a pin on the controller to ground.

This is best done with a switch so the verify can be re-enabled for normal operations. The effect of this modification is equivalent to the "turbo" option on the Corcomp controller and should be used only after

>>MORE>

testing.

INTERLACE PATTERNS

Note: the configurations marked * and ** are the standard interlace patterns for TI and Corcomp formats. The end-of-track intervals are only approximate since the 9 and 16 sector formats include more buffer space than the 18 sector format.

```
+-------+-------+-------------------------------------------------------------+
|Sector |Inter- |Pattern                                                      |
|/track |lace   |(dotted line is time available for head step)                |
+-------+-------+-------------------------------------------------------------+
|   9   | *   4 |0      7       5       3       1       8       6       4       2     |
|       |       |                                               ....................|
+-------+-------+-------------------------------------------------------------+
|   9   |     2 |0      5       1       6       2       7       3       8       4     |
|       |       |                                                       ........|
+-------+-------+-------------------------------------------------------------+
|  18   | ** 5  |0  11 4  8  15 1  12 5  9  16 2  13 6  10 17 3  14 7   |
|       |       |                                                ...........|
+-------+-------+-------------------------------------------------------------+
|  18   |     4 |0  9  5  14 1  10 6  15 2  11 7  16 3  12 8  17 4  13   |
|       |       |                                                    ........|
+-------+-------+-------------------------------------------------------------+
|  18   |     3 |0  6  12 1  7  13 2  8  14 3  9  15 4  10 16 5  11 17   |
|       |       |                                                       none|
+-------+-------+-------------------------------------------------------------+
|  16   |     5 |0  13  10  7  4  1  14  11  8  5  2  15  12  9  6  5   |
|       |       |                                         ................|
+-------+-------+-------------------------------------------------------------+
|  16   |     3 |0  11  6  1  12  7  2  13  8  3  14  9  4  15  10  5   |
|       |       |                                                 .........|
+-------+-------+-------------------------------------------------------------+
```

Note that 16-sector patterns are not precisely to scale

DETAILS OF "TURBO" MODIFICATION

As always, you proceed at your own risk (one person has told me that this did not work on his 40 track system, but I have not yet verified that). You can tell when it works if your controller writes as fast as it reads (normally the write time takes twice as long as the read).

Find the 74LS251 chip at the top centre of the controller board, above the DIP switches and beside the large FDC chip (marked WD1770). Solder a wire from the number 2 pin of the 74LS251 through a switch to ground (e.g., the wide trace of the DIP switches or any trace connected to that wide trace). It looks like this from the bottom (non-component side) of the board:

(see overleaf)

>>>MORE>

```
                 |
                 |
                 |     +-------------------switch-----------to ground
                 |      .|......                  \
  too            |   +---------+  +-------+        \
  of             |   |         |  | DIP   |         location of the switch
  Myarc          |   > 74LS251|  |switch|         is up to you
  controller     |   |         |  |       |
  board------>   |   +---------+  +-------+
                 |
                 |
                 |  +---------------------+
                 |  |                     |
                 |  |                     |
                 |  |  WD1770             |
                 |  |                     |
                 |  >                     |
                 |  |     (or 1772)       |
                 |  |                     |
                 |  |                     |
                 |  |                     |
                 |  +---------------------+
                 |
                 |
                 |
```

EPILOGUE

Since I wrote the article on disk controllers, I have discovered some surprising facts about my own system. All of the Myarc timings in the article were done on an 80 track system with the fast WD1772 controller chip (stepping at 2ms). With some help from PAUL CHARLTON and RICHARD ROSEEN, I recently customised Paul's EPROM to step at 3ms using the WD1772. (Richard's drives were making errors at the faster speed.)

I used a MECHATRONIC EPROM programmer to download the EPROM code to disk, changed the FDC commands with a sector editor, and wrote the altered code back to a fresh EPROM. The process is simple (and cheap) once you decide what code you need in the EPROM.

The slower step speed made it possible to observe slight differences in the performance of the WD1772. The first thing I noticed was that interlace 4 on 18 sector tracks was no longer smooth - it was missing the first sector after a track seek, and forcing an extra revolution of the disk. This was the first clear indication of just how close this format is to the "ragged edge". The reaction to the small change in step speed implies that this interlace comes within 5% of the minimum time required to step and settle the head. Thus the likelihood of read/write errors is relatively high with this interlace. It will sometimes detect the sector ID and begin a read or write before the head has settled completely.

This interlace should definitely be avoided - 18/3 is both faster and more reliable.

>>END

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MACHINE CODE SPECIALS

A rendering of the MiniMemory LINES program by JAMES STRINGFELLOW

(in various formats)

```
************************
*                      *
*  LINES EXBASIC       *
*                      *
*       START          *
*                      *
************************

       DEF   START

VWTR   EQU   >2030
VSBW   EQU   >2020
VSBR   EQU   >2028
KSCAN  EQU   >201C

KEYVAL EQU   >8375
KEYDEV EQU   >8374
STATUS EQU   >837C
MYWS   EQU   >8330

SAVE   EQU   >8C00
JIM1   BSS   >20
JIM2   BSS   >2
JIM3   BSS   >2
JIM4   BSS   >2
JIM5   BSS   >2
JIM6   BSS   >2

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

N2     MOV   *R2+,R0
       JLT   N1
       BLWP  @VWTR
       JMP   N2
N1     B     *R11

************************
N20    BLWP  @VSBW
       JMP   N3
N4     MOVB  R1,@SAVE
N3     DEC   R2
       JNE   N4
       B     *R11
************************
N35    MOV   @JIM1,R1
N5     AI    R1,>1D6B
       JEQ   N5
       MOV   R1,@JIM1
       B     *R11
************************
N13    MOV   R1,R4
       SLA   R4,5
N16    SOC   R1,R4
       ANDI  R4,>FF07
       A     R0,R4
       ANDI  R0,>0007
       S     R0,R4
       LI    R3,>8000
       SRC   R3,0
       MOV   R4,R0
       BLWP  @VSBR
       SOC   R3,R1
       BLWP  @VSBW
       AI    R0,>2000
       BLWP  @VSBR
       MOVB  R1,R1
       JNE   N6
       SRC   R2,4
       SOC   R2,R1
       BLWP  @VSBW
N6     B     *R11
************************
TRY    DATA  >8300,N7
N7     CLR   R12
       LI    R5,1
       LI    R6,1
       MOV   @16(R13),R7
       MOV   @12(R13),R9
       S     R9,R7
       JLT   N8
       JMP   N9
N8     NEG   R5
       NEG   R7
N9     MOV   R7,R7
       JNE   N10
       SETO  R12
N10    MOV   @18(R13),R8
       MOV   @14(R13),R10
       S     R10,R8
       JLT   N11
       JMP   N12
```

>>MORE>

```
N11     NEG   R6
        NEG   R8
N12     MOV   R9,R0
        MOV   R10,R1
        MOV   @10(R13),R2
        BL    @N13
        C     R9,@16(R13)
        JNE   N14
        C     R10,@18(R13)
        JNE   N14
        RTWP
N14     MOV   R12,R12
        JLT   N15
        A     R5,R9
        S     R8,R12
        JMP   N12
N15     A     R6,R10
        A     R7,R12
        JMP   N12
************************
START   LWPI  >8320
        LI    R2,N50
        BL    @N2
        LI    R0,>1B00
        LI    R1,>D000
        BLWP  @VSBW
        LI    R0,>1800
        CLR   R2
N19     CLR   R1
N18     SWPB  R1
        BLWP  @VSBW
        SWPB  R1
        INC   R1
        INC   R0
        CI    R1,>0100
        JLT   N18
        INC   R2
        CI    R2,3
        JLT   N19
        CLR   R0
        CLR   R1
        LI    R2,>1800
        BL    @N20
        LI    R0,>2000
        LI    R1,0
        LI    R2,>1800
        BL    @N20
        LI    R0,>0711
        BLWP  @VWTR
************************
        CLR   @JIM2
        CLR   R3
        LI    R6,>80
        LI    R7,>60
        LI    R8,>D3
        LI    R9,>A3
        CLR   R0
        INCT  R0
        MOV   R0,@JIM3
        INCT  R0
        MOV   R0,@JIM4
        INCT  R0
        MOV   R0,@JIM5
        INCT  R0
        MOV   R0,@JIM6
************************
N33     MOV   @JIM2,R0
        JNE   N21
        BL    @N35
        ANDI  R1,>000F
        MOV   R1,R5
        CI    R5,2
        JHE   N21
        ORI   R5,2
************************
N21     A     @JIM3,R6
        A     @JIM4,R7
        A     @JIM5,R8
        A     @JIM6,R9
        MOV   R6,R6
        JLT   N22
        CI    R6,>0100
        JLT   N23
N22     NEG   @JIM3
        A     @JIM3,R6
N23     MOV   R8,R8
        JLT   N24
        CI    R8,>0100
        JLT   N25
N24     NEG   @JIM5
        A     @JIM5,R8
N25     MOV   R7,R7
        JLT   N26
        CI    R7,>C0
        JLT   N27
N26     NEG   @JIM4
        A     @JIM4,R7
N27     MOV   R9,R9
        JLT   N28
        CI    R9,>C0
        JLT   N29
N28     NEG   @JIM6
        A     @JIM6,R9
N29     BLWP  @TRY
************************
N32     CLR   R0
        MOVB  R0,@KEYDEV
        BLWP  @KSCAN
        MOVB  @KEYVAL,R0
        MOVB  @STATUS,R1
        JEQ   N30
        CI    R0,>0500
        JNE   N31
        B     @N60
N31     CI    R0,>4300
        JNE   N32
```

>>MORE>

```
       INV   @JIM2
N30    CI    R0,>FF00
       JNE   N32
       INC   R3
       CI    R3,>50
       JNE   N33
       CLR   R3
       LI    R2,>000A
       LI    R4,>FFFF
N34    DEC   R4
       JNE   N34
       DEC   R2
       JNE   N34
************************
       BL    @N35
       MOV   R1,R1
       JLT   N43
       ANDI  R1,>0007
       JMP   N36
N43    ORI   R1,>FFF8
N36    MOV   R1,@JIM3
       BL    @N35
       MOV   R1,R1
       JLT   N37
       ANDI  R1,>0007
       JMP   N38
N37    ORI   R1,>FFF8
N38    MOV   R1,@JIM5
       BL    @N35
       MOV   R1,R1
       JLT   N39
       ANDI  R1,>0007
       JMP   N40
N39    ORI   R1,>FFF8
N40    MOV   R1,@JIM4
       BL    @N35
       MOV   R1,R1
       JLT   N41
       ANDI  R1,>0007
       JMP   N42
N41    ORI   R1,>FFF8
N42    MOV   R1,@JIM6
************************
       CLR   R0
       CLR   R1
       CLR   R3
       LI    R2,>1800
       BL    @N20
       LI    R0,>2000
       LI    R1,>0000
       LI    R2,>1800
       BL    @N20
       B     @N33
************************
N60    LI    R2,D1
       BL    @N2
       LIMI  2
       BLWP  @>0000
************************
N50    DATA  >0002,>01E0,>0206
       DATA  >03FF
       DATA  >0403,>0536,>0717
       DATA  >FFFF
D1     DATA  >0000,>01F0,>0200
       DATA  >03FF
       DATA  >0401,>0560,>FFFF
       END
************************
```

```
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>END
```

{This marks the end of the assembly language source code version of the MiniMemory LINES program, converted by James to run under Extended BASIC but other versions appear over the next few pages. The object code file obtained from the above file is presented (albeit sideways, since it violates the 72 column width maximum of TI-LINES pages!), followed by the poke-it-in-byte-by-byte version so that ITUGers who possess only Extended BASIC and the 32K RAM Expansion may experience LINES without the need to invest in a disk system!

You might like to note that pressing C during the LINES operation will "freeze" the current colour of the lines and continue using that colour until C is pressed again, whereupon LINES reverts to its multi-coloured mode. Exit is by pressing FCTN= (the usual QUIT sequence).

As a postscript, try and get to the Bloxwich Workshop in March and watch the MYARC 9640 doing its version of LINES. The speed is almost (but not quite) sickening... PB}

```
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>MORE>
```

LINES: OBJECT CODE FILE — JAMES STRINGFELLOW

```
0037C          A0000A0020A0040A0060A0080A00A0A00C0BC032B1103B04207F354F   0001
A00C6B2030B10FBB045BB0420B2020B1002BD801B8C00B0602B16FCB045B7F2B8F         0002
A00DCBC060C0000B0221B1D6BB13FDBC801C0000B045BBC101B0A54BE1017F293F         0003
A00F2B0244BFF07BA100B0240B0007B6100B0203B8000B0B03BC004B04207F2F8F         0004
A0108B2028BE043B0420B2020B0220B2000B0420B2028BD041B1604B0B427F323F         0005
A011EBE042B0420B2020B045BB8300C012AB04CCB0205B0001B0206B00017F300F         0006
A0134BC1EDB0010BC26DB000CB61C9B1101B1002B0505B0507BC1C7B16017F2B5F         0007
A014AB070CBC22DB0012BC2ADB000EB620AB1101B1002B0506B0508BC0097F2B2F         0008
A0160BC04ABC0ADB000AB06A0C00ECB8B49B0010B1604B8B4AB0012B16017F28DF         0009
A0176B0380BC30CB1103BA245B6308B10EEBA286BA307B10EBB02E0B83207F28BF         0010
A018CB0202C035EB06A0C00C0B0200B1B00B0201BD000B0420B2020B02007F311F         0011
A01A2B1800B04C2B04C1B06C1B0420B2020B06C1B0581B0580B0281B01007F2FFF         0012
A0188B11F7B0582B0282B0003B11F2B04C0B04C1B0202B1800B06A0C00CC7F2C6F         0013
A01CEB0200B2000B0201B0000B0202B1800B06A0C00CCB0200B0711B04207F326F         0014
A01E4B2030B04E0C0020B04C3B0206B0080B0207B0060B0208B00D3B02097F312F         0015
A01FAB00A3B04C0B05C0BC800C0040B05C0BC800C0060B05C0BC800C00807F2B1F         0016
A0210B05C0BC800C00A0BC020C0020B160AB06A0C00DCB0241B000FBC1417F2C5F         0017
A0226B0285B0002B1402B0265B0002BA1A0C0040BA1E0C0060BA220C00807F30DF         0018
A023CBA260C00A0BC186B1103B0286B0100B1104B0520C0040BA1A0C00407F2FDF         0019
A0252BC208B1103B0288B0100B1104B0520C0080BA220C0080BC1C7B11037F30DF         0020
A0268B0287B00C0B1104B0520C0060BA1E0C0060BC249B1103B0289B00C07F2EFF         0021
A027EB1104B0520C00A0BA260C00A0B0420C0126B04C0BD800B8374B04207F2EBF         0022
A0294B201CBD020B8375BD060B837CB130AB0280B0500B1602B0460C034E7F2CDF         0023
A02AAB0280B4300B16EEB0560C0020B0280BFF00B16E9B0583B0283B00507F2C1F         0024
A02C0B16AAB04C3B0202B000AB0204BFFFFB0604B16FEB0602B16FCB06A07F25CF         0025
A02D6C00DCBC041B1103B0241B0007B1002B0261BFFF8BC801C0040B06A07F2B5F         0026
A02ECC00DCBC041B1103B0241B0007B1002B0261BFFF8BC801C0080B06A07F2A3F         0027
A0302C00DCBC041B1103B0241B0007B1002B0261BFFF8BC801C0060B06A07F2CAF         0028
A0318C00DCBC041B1103B0241B0007B1002B0261BFFF8BC801C00A0B04C07F2B8F         0029
A032EB04C1B04C3B0202B1800B06A0C00CCB0200B2000B0201B0000B02027F310F         0030
A0344B1800B06A0C00CCB0460C0216B0202C036EB06A0C00C0B0300B00027F2F9F         0031
A035AB0420B0000B0002B01E0B0206B03FFB0403B0536B0717BFFFFB00007F2C8F         0032
A0370B01F0B0200B03FFB0401B0560BFFFF7F802F                                  0033
50188START 7FD15F                                                          0034
:         99/4 AS                                                          0035
```

```
100 !**********************
110 !*                    *
120 !*    LINES EXBASIC   *
130 !*                    *
140 !*  CALL LINK"START"  *
150 !*                    *
160 !*                    *
170 !**********************
180 !
190 CALL INIT
200 CALL LOAD(16376,83,84,65
,82,84,32,37,200,"",8194,39,
188,63,248)
210 DATA 0,0,0,0,0,0,0,0,0,0
,0,0,192,50,17,3,4,32,32,48,
16,251
220 DATA 4,91,4,32,32,32,16,
2,216,1,141,0,6,2,22,252,4,9
1,192,96,36,244
230 DATA 2,33,29,107,19,253,
200,1,36,244,4,91,193,1,10,8
4,225,1,2,68,255,7
240 DATA 161,0,2,64,0,7,97,0
,2,3,128,0,11,3,192,4,4,32,3
2,40,224,67
250 DATA 4,32,32,32,2,32,32,
0,4,32,32,40,208,65,22,4,11,
66,224,66,4,32
260 DATA 32,32,4,91,131,0,37
,106,4,204,2,5,0,1,2,6,0,1,1
93,237,0,16
270 DATA 194,109,0,12,97,201
,17,1,16,2,5,5,5,7,193,199,2
2,1,7,12,194,45
280 DATA 0,18,194,173,0,14,9
8,10,17,1,16,2,5,6,5,8,192,9
,192,74,192,173
290 DATA 0,10,6,160,37,44,13
9,73,0,16,22,4,139,74,0,18,2
2,1,3,128,195,12
300 DATA 17,3,162,69,99,8,16
,238,162,134,163,7,16,235,2,
224,131,32,2,2,39,158
310 DATA 6,160,37,0,2,0,27,0
,2,1,208,0,4,32,32,32,2,0,24
,0,4,194
320 DATA 4,193,6,193,4,32,32
,32,6,193,5,129,5,128,2,129,
1,0,17,247,5,130
330 DATA 2,130,0,3,17,242,4,
192,4,193,2,2,24,0,6,160,37,
12,2,0,32,0
340 DATA 2,1,0,0,2,2,24,0,6,
160,37,12,2,0,7,17,4,32,32,4
8,4,224
350 DATA 36,246,4,195,2,6,0,
128,2,7,0,96,2,8,0,211,2,9,0
,163,4,192
360 DATA 5,192,200,0,36,248,
5,192,200,0,36,250,5,192,200
,0,36,252,5,192,200,0
370 DATA 36,254,192,32,36,24
6,22,10,6,160,37,28,2,65,0,1
5,193,65,2,133,0,2
380 DATA 20,2,2,101,0,2,161,
160,36,248,161,224,36,250,16
2,32,36,252,162,96,36,254
390 DATA 193,134,17,3,2,134,
1,0,17,4,5,32,36,248,161,160
,36,248,194,8,17,3
400 DATA 2,136,1,0,17,4,5,32
,36,252,162,32,36,252,193,19
9,17,3,2,135,0,192
410 DATA 17,4,5,32,36,250,16
1,224,36,250,194,73,17,3,2,1
37,0,192,17,4,5,32
420 DATA 36,254,162,96,36,25
4,4,32,37,102,4,192,216,0,13
1,116,4,32,32,28,208,32
430 DATA 131,117,208,96,131,
124,19,10,2,128,5,0,22,2,4,9
6,39,142,2,128,67,0
440 DATA 22,238,5,96,36,246,
2,128,255,0,22,233,5,131,2,1
31,0,80,22,170,4,195
450 DATA 2,2,0,10,2,4,255,25
5,6,4,22,254,6,2,22,252,6,16
0,37,28,192,65
460 DATA 17,3,2,65,0,7,16,2,
2,97,255,248,200,1,36,248,6,
160,37,28,192,65
470 DATA 17,3,2,65,0,7,16,2,
2,97,255,248,200,1,36,252,6,
160,37,28,192,65
480 DATA 17,3,2,65,0,7,16,2,
2,97,255,248,200,1,36,250,6,
160,37,28,192,65
490 DATA 17,3,2,65,0,7,16,2,
2,97,255,248,200,1,36,254,4,
192,4,193,4,195
500 DATA 2,2,24,0,6,160,37,1
2,2,0,32,0,2,1,0,0,2,2,24,0,
6,160
510 DATA 37,12,4,96,38,86,2,
2,39,174,6,160,37,0,3,0,0,2,
4,32,0,0
520 DATA 0,2,1,224,2,6,3,255
,4,3,5,54,7,23,255,255,0,0,1
,240,2,0
530 DATA 3,255,4,1,5,96,255,
255,255
540 FOR I=9460 TO 10172 :: R
EAD N :: CALL LOAD(I,N):: NE
XT I
550 CALL LINK("START")
```

›››END

DV80 TO DV163 TRANSLATOR

Submitted by JAMES STRINGFELLOW

```
100 !**********************
110 ! TRANSLATES FROM
120 ! DIS/VAR 80 TO MERGE
130 ! FORMAT
140 !**********************
150 !
160 !USE A FULL SCREEN
170 !EDITOR TO CREATE
180 !EXTENDED BASIC PROGRAMS
190 !
200 !CREATE A FILE USING
210 !TI-WRITER - MAKE
220 !SURE YOU DISABLE THE
230 !WORD WRAP MODE AND
240 !LIMIT THE LENGTH
250 !TO 80 CHARACTERS
260 !
270 CALL CLEAR
280 !DISPLAY AT(3,7)BEEP ERA
SE ALL:"***TRANSLATE***"
290 DISPLAY AT(7,5):"DIS/VAR
 80 FILENAME:": :"DSK1"
300 ACCEPT AT(9,4)SIZE(-12):
IN$
310 DISPLAY AT(12,15)BEEP:"M
ERGED OUTPUT FILNAME:":"DSK1
."
320 ACCEPT AT(14,4)SIZE(-12)
:OUT$
330 OPEN #1:"DSK"&IN$
340 OPEN #2:"DSK"&OUT$,VARIA
BLE 163
350 LINPUT #1:L$
360 S=POS(L$," ",1)
370 A$=SEG$(L$,S+1,80)
380 ON ERROR 500
390 N=VAL(SEG$(L$,1,S))
400 ON ERROR 450
410 !
420 PRINT L$
430 PRINT #2:CHR$(INT(N/256)
)&CHR$(N-256*INT(N/256))&CHR
$(131)&A$&CHR$(0)
440 GOTO 350
450 PRINT #2:CHR$(255);CHR$(
255)
460 CLOSE #2
470 PRINT : :"ENTER""NEW"" A
ND THEN ""MERGE"" THE TRANSL
ATED FILENAME:":"        ";OU
T$: : :
480 PRINT "REMEMBER TO REMOV
E THE       LEADING ""!"" IN
EVERY LINE.": : : :
490 END
500 ON ERROR 450
510 RETURN 350
```

{I have seen a number of such programs kicking around the Public Domain and other distribution systems, but this is the first offered by a UK subscriber for publication in TI-LINES. The technique of using a text editor to produce a program listing (for BASIC as well as for many other languages) is one that is more common in the "professional" computing sphere, but has been used on other machines - notably the Sinclair QL.

It is a very useful method of producing a listing (either from scratch, or by LISTing an existing program to disk) which can then be processed just as any text file can be, to change variable names "at a stroke", to search for specific words/phrases for possible modification, and to simply and easily duplicate blocks of program code which would probably otherwise have to be entered slowly and laboriously by hand (complete no doubt with countless errors). PB}

>>END

N O T I C E B O A R D

WANTED / 4 SALE / WANTED / 4 SALE / WANTED / 4 SALE / WANTED / 4 SALE /

FOR SALE: packs of TEN disks, double-sided, double density, 96 tpi, but can be used at lower capacities: £7 inclusive of post and packing. If you want disk boxes, I can now supply those WITH packs of ten disks at £8.50 inclusive. If you just want an empty disk box (technically called a "library case"), I will supply them at £2.50 inclusive of post etc.

Contact ITUG (0865 510822 or write).

FOR SALE: TEII with manual. £20 including post and packing. Contact ITUG. Complete with TEII Protocol manual.

)))END

TI-WRITER FONT DESIGNER

By JAMES STRINGFELLOW

Here is a program which should be useful for people using graph paper to design graphics for TI-WRITER.

It is for use with the EPSON 80 printer and should be easy to convert. I have included at the end of the program some changes to be made if your printer head has the top wire numbered 64 instead of 1 as with the EPSON 80.

The screen is 14 dots high and 16 dot rows long which should make quite large characters.

You can invert your graph by pressing "M" for mirror.

After saving to a disk you can load into your TI-WRITER for printing with your letter.

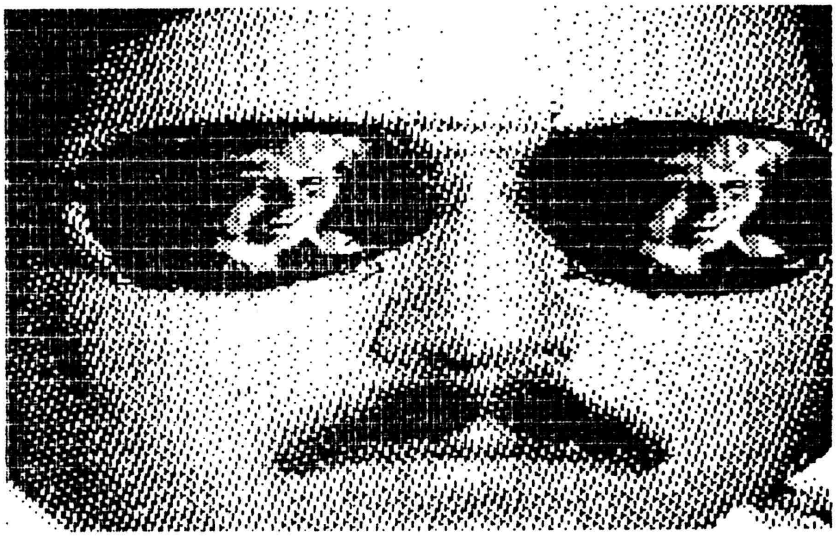
```
100 !************************
110 !*                      *
120 !* TIWRITER FONT MAKER *
130 !*                      *
140 !*  VERSION 1  1987     *
150 !*                      *
160 !* James Stringfellow  *
170 !*                      *
180 !************************
190 !
200 CALL CLEAR :: CALL SCREE
N(5):: CALL CHAR(128,"FF8181
81818181FF",122,RPT$("0",16)
,129,RPT$("F",16))
210 FOR I=5 TO 12 :: CALL CO
LOR(I,2,11):: NEXT I :: CALL
 COLOR(13,2,11,0,5,5,1,1,13,
3,2,13,4,2,13):: P$=RPT$(CHR
$(128),16)
220 X=64 :: CH=128 :: FOR R=
4 TO 17 :: DISPLAY AT(R,4):S
TR$(X);TAB(7);P$ :: X=X/2 ::
 IF X<1 THEN X=64
230 NEXT R :: CALL VCHAR(1,3
```

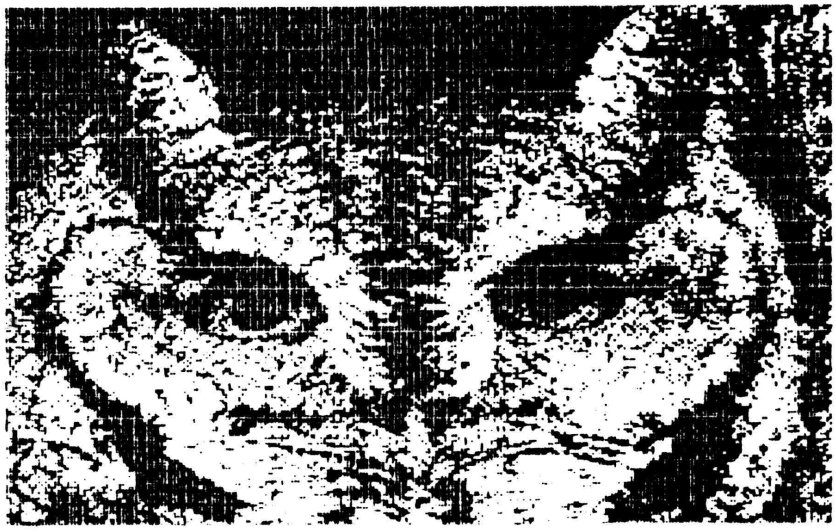
)))MORE)

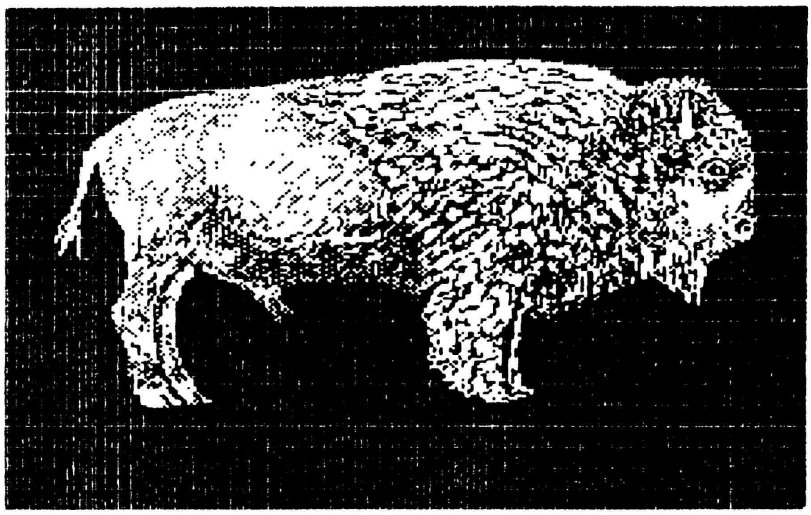
```
1,28,96):: Z$=RPT$(CHR$(32),
28)
240 DISPLAY AT(21,1):"zMovez
withzzWzEzRzSzDzZzXzCz":"zQz
Togglezonzoffzzz@zstopzzz":"
zKzclearzzPzprintzzMzmirrorz
":"zzzzzzzzzzzzzzzzzzzzzzzzz
zzz" :: M$,M2$=""
250 DISPLAY AT(1,7):"zTIWRIT
ERzFONTSz":Z$:Z$ :: DISPLAY
AT(18,1):Z$:Z$:Z$ :: R=4 ::
C=9 :: K=75 :: CALL SPRITE(#
1,128,16,25,65)
260 REM
270 CALL KEY(3,K,S):: Y=(K=6
9 OR K=82 OR K=87)-(K=88 OR
K=90 OR K=67):: X=(K=83
OR K=87 OR K=90)-(K=68 OR K=
82 OR K=67):: IF K=81 THEN 2
90 :: IF K=80 THEN 300 :: IF
 K=75 THEN 220
280 IF K=64 THEN 480 :: IF K
=77 THEN 440 :: R=R+Y :: C=C
+X :: R=R-(R<4)+(R>17):: C=C
-(C<9)+(C>24):: CALL HCHAR(R
,C,CH):: CALL LOCATE(#1,R*8-
7,C*8-7):: GOTO 270
290 CH=CH+1+(CH=129)*2 :: CA
LL HCHAR(R,C,CH):: FOR I=1 T
O 30 :: NEXT I :: GOTO 270
300 GOSUB 460 :: FOR C=9 TO
24 :: X=64 :: FOR R=4 TO 10
:: CALL GCHAR(R,C,G):: IF G=
129 THEN A=A+X
310 X=X/2 :: NEXT R :: FOR J
=1 TO LEN(STR$(A)):: CALL VC
HAR(J,C,ASC(SEG$(STR$(A),J,1
))):: NEXT J :: M2$=M2$&CHR$
(A):: A=0 :: NEXT C
320 FOR C=9 TO 24 :: X=64 ::
 FOR R=11 TO 17 :: CALL GCHA
R(R,C,G):: IF G=129 THEN A=A
+X
330 X=X/2 :: NEXT R :: FOR J
=1 TO LEN(STR$(A)):: CALL VC
HAR(17+J,C,ASC(SEG$(STR$(A),
J,1))):: NEXT J :: M$=M$&CHR
$(A):: A=0 :: NEXT C :: CALL
 DELSPRITE(ALL):: CALL MAGNI
FY(1)
340 CALL SPRITE(#1,128,16,18
5,233):: DISPLAY AT(24,6):"z
zzzzzzDoublezDensityzN"
:: ACCEPT AT(24,28)VALIDATE(
"YN")SIZE(-1):Q$ :: K=75 ::
IF Q$="Y" THEN K=K+1
350 OPEN #1:"RS232.BA=4800"
360 PRINT #1:CHR$(27)&"A"&CH
R$(7)
370 PRINT #1:CHR$(27)&CHR$(K
)&CHR$(16)&CHR$(0)&M2$&CHR$(
13)
380 PRINT #1:CHR$(27)&CHR$(K
)&CHR$(16)&CHR$(0)&M$ :: CLO
SE #1
390 DISPLAY AT(24,6)SIZE(23)
:"Printzagainzyeszorznozn" :
: ACCEPT AT(24,28)VALIDATE("
YN")SIZE(-1):Q$ :: IF Q$="Y"
 THEN 340
400 DISPLAY AT(24,6):"zzzzzz
zzzzSavezyesznozN" :: ACCEPT
 AT(24,28)VALIDATE("YN")SIZE
(-1):Q$ :: IF Q$="N" THEN 24
0
410 CALL LOCATE(#1,185,145):
: DISPLAY AT(24,2):"zzzFilen
amezDSK" :: ACCEPT AT(24,17)
SIZE(-12):F$ :: IF F$="" THE
N 240 :: OPEN #2:"DSK"&F$,FI
XED 80
420 PRINT #2:CHR$(27)&"K"&CH
R$(16)&CHR$(0)&M2$
430 PRINT #2:CHR$(27)&"K"&CH
R$(16)&CHR$(0)&M$ :: CLOSE #
2 :: GOTO 240
440 FOR R=4 TO 17 :: X=64 ::
 FOR C=9 TO 24 :: CALL GCHAR
(R,C,CH):: IF CH=128 THEN CA
LL HCHAR(R,C,129,1)ELSE IF C
H=129 THEN CALL HCHAR(R,C,12
8,1)
450 NEXT C :: NEXT R :: CH=C
H+1+(CH=129)*2 :: GOTO 240
460 DATA 80,76,69,65,83,69,3
2,87,65,73,84
470 CALL DELSPRITE(#1):: CAL
L MAGNIFY(2):: FOR I=2 TO 22
 STEP 2 :: READ Y :: CALL SP
RITE(#I,Y,16,I*8-7,I+I*8-7+1
6):: NEXT I :: RESTORE :: RE
TURN
480 END
```

>>>END

some sample RLE IMAGES







THE TIHOME SOFTWARE COLLECTION

Pricing for TSC disks has been reorganised, although the full Collection is still offered at £35 inclusive.

Check the TSC Catalogue (available free to ITUG subscribers on request) to find out what the TSC entries stand for. Make sure that you indicate clearly what your choice is, specifying the name of the disk/s you want.

GAMES:	TSC ENTRIES:
TSC_DSK_A	GA0001 - GA0011
TSC_DSK_B	GA0012 - GA0022
TSC_DSK_C	GA0023 - GA0032
TSC_DSK_D	GA0033 - GA0043
TSC_DSK_E	GA0044 - GA0055
TSC_DSK_F	GA0056 - GA0066
EDUCATIONAL:	
TSC_DSK_G	ED0001 - ED0009
TSC_DSK_H	ED0010 - ED0017
DEMONSTRATION:	
TSC_DSK_I	DE0001 - DE0006
MUSIC:	
TSC_DSK_J	MU0001 - MU0009
TSC_DSK_K	MU0010 - MU0017
TSC_DSK_L	MU0018 - MU0026
UTILITIES:	
TSC_DSK_M	UT0001 - UT0011
TSC_DSK_N	UT0012 - UT0022
TSC_DSK_O	UT0023 - UT0033
TSC_DSK_P	UT0034 - UT0044

PRICING

The number of programs on a disk can vary between about 7 and 11, dependent upon the sizes of the programs in terms of sectors used.

The exception is the DEMONSTRATION disk, which alone is offered at £2.95 inclusive of post and packing

The rest are priced as follows:

£ 3.95	for ANY 1 DISK	
£ 6.90	for ANY 2 DISKS	(SAVE £ 1)
£ 9.85	for ANY 3 DISKS	(SAVE £ 2)
£12.80	for ANY 4 DISKS	(SAVE £ 3)
£14.75	for ANY 5 DISKS	(SAVE £ 5)
£16.70	for ANY 6 DISKS	(SAVE £ 7)
£18.65	for ANY 7 DISKS	(SAVE £ 9)
£20.60	for ANY 8 DISKS	(SAVE £11)
£22.55	for ANY 9 DISKS	(SAVE £13)
£24.50	for ANY 10 DISKS	(SAVE £15)
£26.45	for ANY 11 DISKS	(SAVE £17)
£28.40	for ANY 12 DISKS	(SAVE £19)
£30.35	for ANY 13 DISKS	(SAVE £21)
£32.30	for ANY 14 DISKS	(SAVE £23)
£34.25	for ANY 15 DISKS	(SAVE £25)
£35.00	ENTIRE	(SAVE £27.20)

All programs are recorded on Single-sided disks.

You may elect to be supplied with software on Double-sided disks, when you should deduct £1 from the prices shown above.

If you prefer, you may send in your own disks, in which case deduct 50p for each disk from the prices shown above.

For example, 8 disks supplied by you would work out at £20.60 - (8 x 50p = £4) = £16.60 nett.

All the above prices are inclusive of post and packing.

The pricing for programs recorded on cassette remains £1 per program, with an overall charge of 65p for post and packing.

PLEASE MAKE ALL CHEQUES PAYABLE TO "PETER BROOKS"