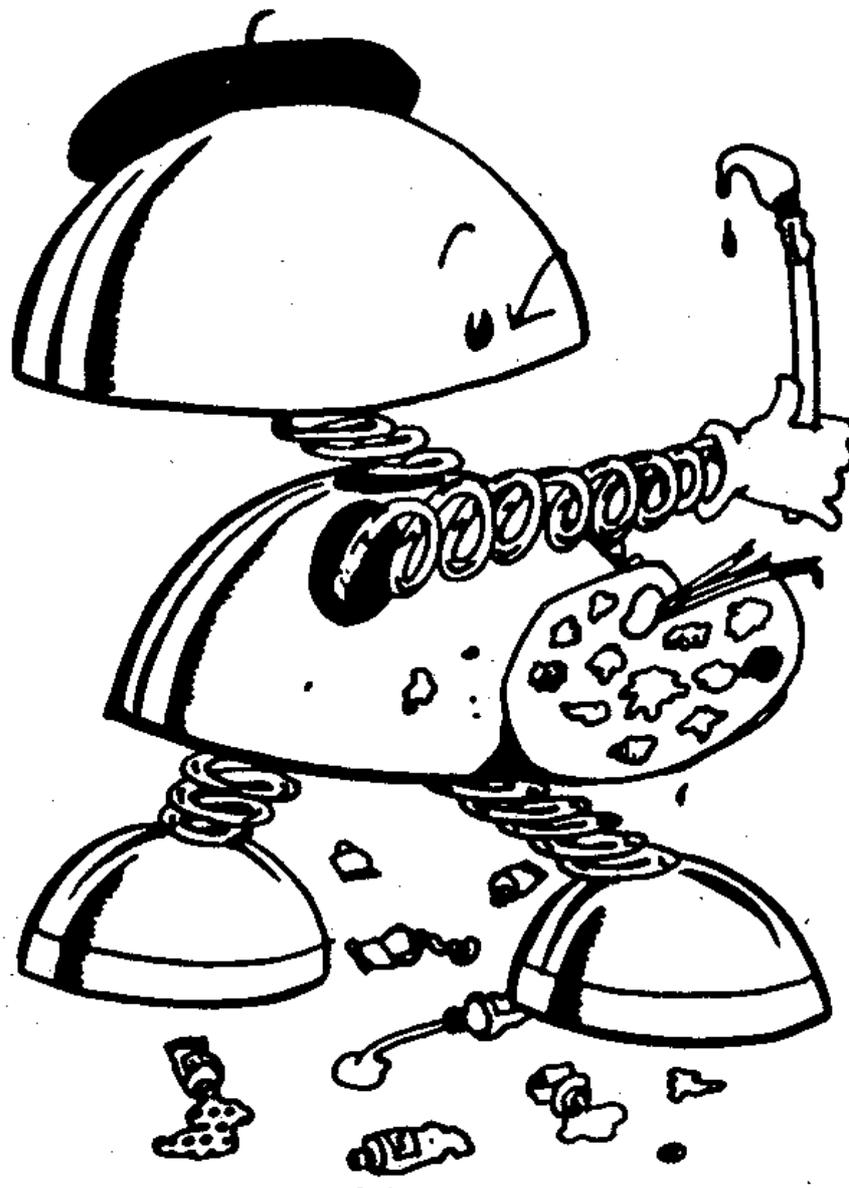


Vol 3 - No 5.

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FORMAT

FOR SPECTRUM AND SAM USERS



SAM Coupe - The Artistic Wonder

PCB DESIGNER

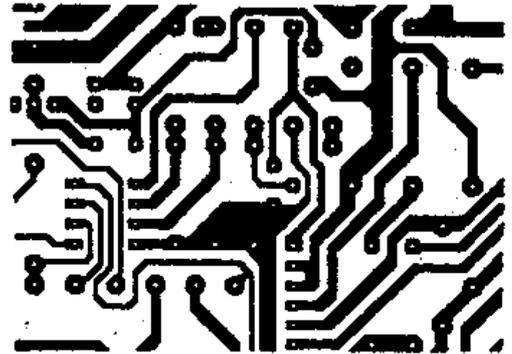
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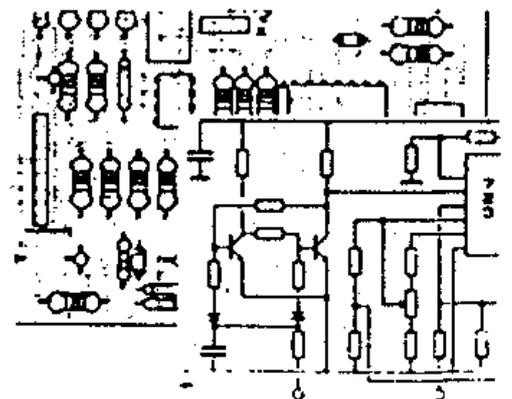
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NEWS ON 4

ALL FORMAT COMPUTER SHOW.

February the 10th is a date for all Spectrum and SAM Coupe users. This is the date set for the first of a new generation of computer shows to be held at the New Horticultural Hall in London, the same hall that hosted many ZX Microfairs in the past. The show opens its doors at 10.30am.

The new show, designed to attract all home computer users, will be dominated by the MGT SAM Coupe stand, which will take up the entire stage area. The show is backed by an advertising campaign in Computer Trade Weekly (the industry newspaper) which will ensure good support from a wide range of exhibitors. Extensive publicity will also be given in the London Area and in the high-street computer magazines. FORMAT will be taking a stand so see you there.

SILVERBIRD FLIES AGAIN.

Tudor Enterprises and Microprose have signed a deal that will allow Tudor to relaunch the SILVERBIRD label. Silverbird was the budget section of Firebird which Microprose bought from British Telecom earlier this year.

The first four releases, three new games and one compilation, will be launched in February. Tudor are keen to contact development and conversion programmers interested in writing for Silverbird. Contacted them on 0934-628219.

THE SAM COUPE ROADSHOW.

To support the change-over from mail-order to dealer sales of the SAM Coupe Miles Gordon Technology plan a series of one-day ROADSHOWs during the period 26th February to 8th March. The concept of the Roadshow is to train dealers on all aspects of the SAM

Coupe during the afternoon and to allow dealers to invite customers to demonstration sessions in the evening.

The venues include Glasgow, Newcastle, Haydock, Brighouse, Bristol, Southampton, Coventry and London. As invitations are only available through SAM Coupe dealers any FORMAT reader who would like to attend should contact MGT Customer Care on 0792 791100 for the address of their local dealers.

SAM HOTLINE CONTINUES.

Even though the SAM Coupe is now available MGT see a future for their 24 hour SAM HOTLINE (0792-791275). This service was introduced to keep people updated on the development of the SAM Coupe but will now be used to tell users about software developments and compatibility. The message will continue to be updated weekly.

NEW SPECTRUM ROM GUIDE.

Francis Miles, a regular contributor to FORMAT, has launched an extended study of the 48k Spectrum ROM. Called 'An Index to the Spectrum ROM' it looks at every subroutine, variable and flag in the system. Linked to the 'Complete Spectrum ROM Disassembly' by Ian Logan (published by Melbourne House in 1983) the publication takes the form of 450 page loose-leaf work supplied in a ring binder. While useful to have Ian Logan's book it is not essential as the Index is full of detailed explanations.

It is available direct from F.G.Miles, 'Windrush', Rabley Heath, Welwyn, Herts, AL6 9UF. Price £25. It's also available as five 5.25" discs (Disciple/PLUS D format) with a version of 'Word Manager' so you can print it out. Please contact Mr Miles for price of disc version.



The Editor Speaks

I would like to start off by wishing all FORMAT readers a really HAPPY NEW YEAR. I hope 1990 sees you all Healthier and Wealthier (and Wiser from reading FORMAT). My personal thanks to everyone who sent me a Christmas card, I'm sorry that I sent out so few this year but I was very short of time before Christmas.

This is a very special issue of FORMAT, I make no apology for devoting so much space to the SAM Coupe. It is an honour to print the first review of the final version of SAM - no other magazine has one yet. Even if you intend to keep your Spectrum, SAM is still an important milestone and from your letters and phone calls I know lots of you are really keen to find out more about the machine. It provides an upgrade path that hasn't existed since Sinclair sold out. FORMAT has supported the MGT disc systems and the Spectrum since 1987. We will now expand to cover SAM and support SAM users as well as our existing Spectrum readership. 1990 is going to be an exciting year so keep reading.

December was an eventful month for me, I spent the first three weeks in Swansea with MGT working on the SAM project. Sorry I was not available to answer your telephone calls for so long but they kept me chained to a desk for an average 16 hour day and only fed me once in a while (thanks Lena, your home cooking saved me from starvation). What with the Flu epidemic (which started in that area) and the bad weather I wondered if I would ever get home for Christmas. I was first called in to help with debugging the ROM but ended up building SAMs.

It was a miracle MGT managed to ship any SAMs before Christmas. At the start of December everything seemed set for 3,000 machines to roll off the production lines at A&A (the factory making the SAM Coupe) but that was before the flu bug hit. With just 10 days to go, before the last day MGT could dispatch to people in time for Christmas, A&A said that they could only produce 200 machines in the time. Flu had laid waste to their production staff and important jobs like flow-soldering could not be done without the skilled workers.

The entire staff of MGT swung into action and met the emergency head on. The in-house production lines were cleared to build SAM power supplies and Sales and Customer Care staff were press-ganged into soldering. In the last few days even desks in the sales area were covered and turned into assembly lines as real SAM computers were made. In the end, between A&A and MGT, 870 SAM Coupe computers rolled off the production lines and were dispatched before Christmas. A 36 hour shift on the 20th/21st left everyone exhausted but it is thanks to this dedication that so many happy SAM buyers had their machine for Christmas.

Any readers who have sent in articles or programs for publication over the last few months should have heard by now if we are going to use them. If you haven't heard could you please give me a ring.

This issue is missing many regular features due to lack of space. Normal service will be resumed next month. See you then.

Bob Brenchley. Editor.

SAM Coupé

THE FIRST REVIEW

By:- John Wase and Bob Brenchley.

SAM'S HERE - JUST!!! Yes, I mean that. I went down to MGT just a week before Christmas in the hope that they would be ready. Sure enough, there were rows of active people, building power packs. The production SAMs were being made somewhere up the valleys, a two hour truck run. And the news was that perhaps the first truckload would arrive that night...

Alas, it was not to be and I returned with a model fitted with a pre-production keyboard made up of individual key switches, rather than the production thing. The finished circuit board and ROM were in place so it was only a real keyboard that was missing.

So this is therefore the VERY FIRST real review of a SAM Coupe ANYWHERE.

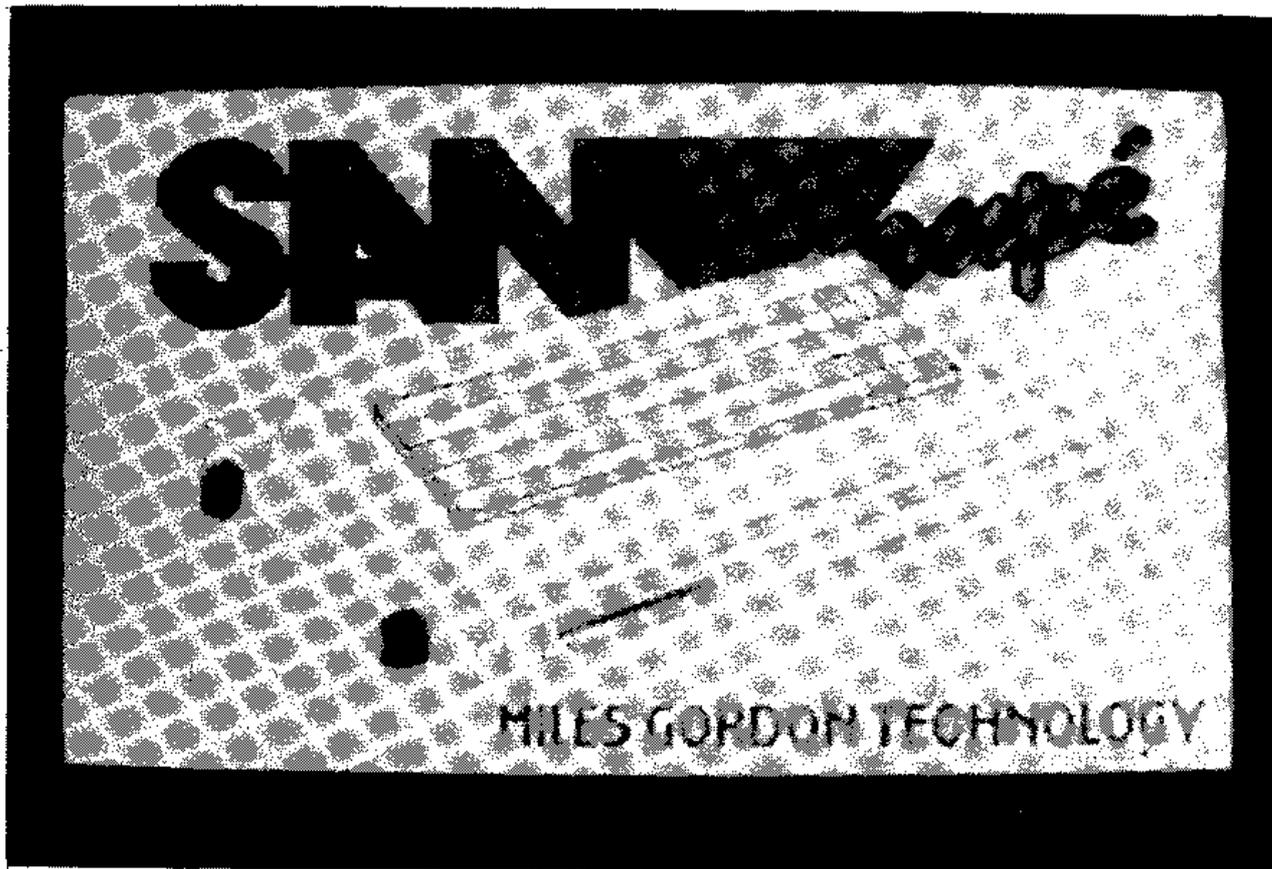
He's telling lies I hear you say. Sams' really here, lots of people have played with it. We've seen it all in the glossy mags, many times. Well, the fact is, you've not. The only thing that anyone has had to play with is an early pre-production SAM, shown at shows, together with selected software to show off any 'finished' ROM routines and and lots of photos of Bruce Gordon holding a specially shaped piece of wood. More recently, folks who've been invited (or pushed themselves) in to MGT have been allowed to play for an hour or two with more advanced (but still pre-production) machines. I think this is the first SAM they've actually let out, except to a handful of programmers like Bob Brenchley and Nev Young who were working on the ROM and other software. After all, they've only just finished the ROM.

Everyone down at MGT seemed well versed with the capabilities of the machine. Except me, that is. Being your average Bear Brain, I was rather

taken aback when I switched it on. I mean, usually when you switch a computer on, it's quiet and well mannered. A little copyright notice, perhaps, like the one from Clive (with an amendment by Alan on later models) on the Spectrum or the genteel announcement on the BBC, or even the restrained use of colour on the QL (F1 or F2?). The sixteen Brilliant Horizontal Stripes on the black screen above a Miles Gordon Technology copy-right sign quite took me by surprise.

So, I type in a number. Like 10. Everyone starts writing Basic on line 10. Up it comes on a black screen with, at the bottom, the good old Speccy editing area. So, this looks rather familiar. Except that the screen is black and the letters brilliant white. Hold on a moment, though. The screen's much wider than the old Speccy screen: I mean the border's a lot narrower. Anyway, type in a statement. 10 PRINT "Oranges and Lemons. That ought to give it something to chew on. Up it comes, in rather less brilliant white on the main screen when you press "Enter". Except it's labelled "Return". Dammit, there's going to be a lot to get used to. Interesting, it's a bit like the Spectrum +3; if you type in complete keywords at the bottom in lower case, the editor puts them in upper case as the syntax checker does its job.

Wase gets confident. PRUNT "Oranges and lemons". Sam accepts this with alacrity, puts it through the syntax checker, pushes it on the screen. Press on, run it, error message "12 Missing DEF PROC 0:1". Unlike the Spectrum +3, it doesn't rewrite the screen each time, so that it will enter lines as quickly as you can type them, like the Beeb. However, again like the Beeb (which doesn't really check syntax at all, until it tries to



run the program) it will accept odd words, because it thinks they're procedures, and a procedure can be called in SAM Basic merely by entering its name, without the necessity of preceding it with PROC. Astute programmers will notice that after tokenisation by the syntax checker, and insertion in the listing, the keywords are in capitals, the procedures being still left in lower case, so it's not too difficult to tell something funny is going on. But Junior School Teachers are likely to get rather familiar with error message 12, I guess.

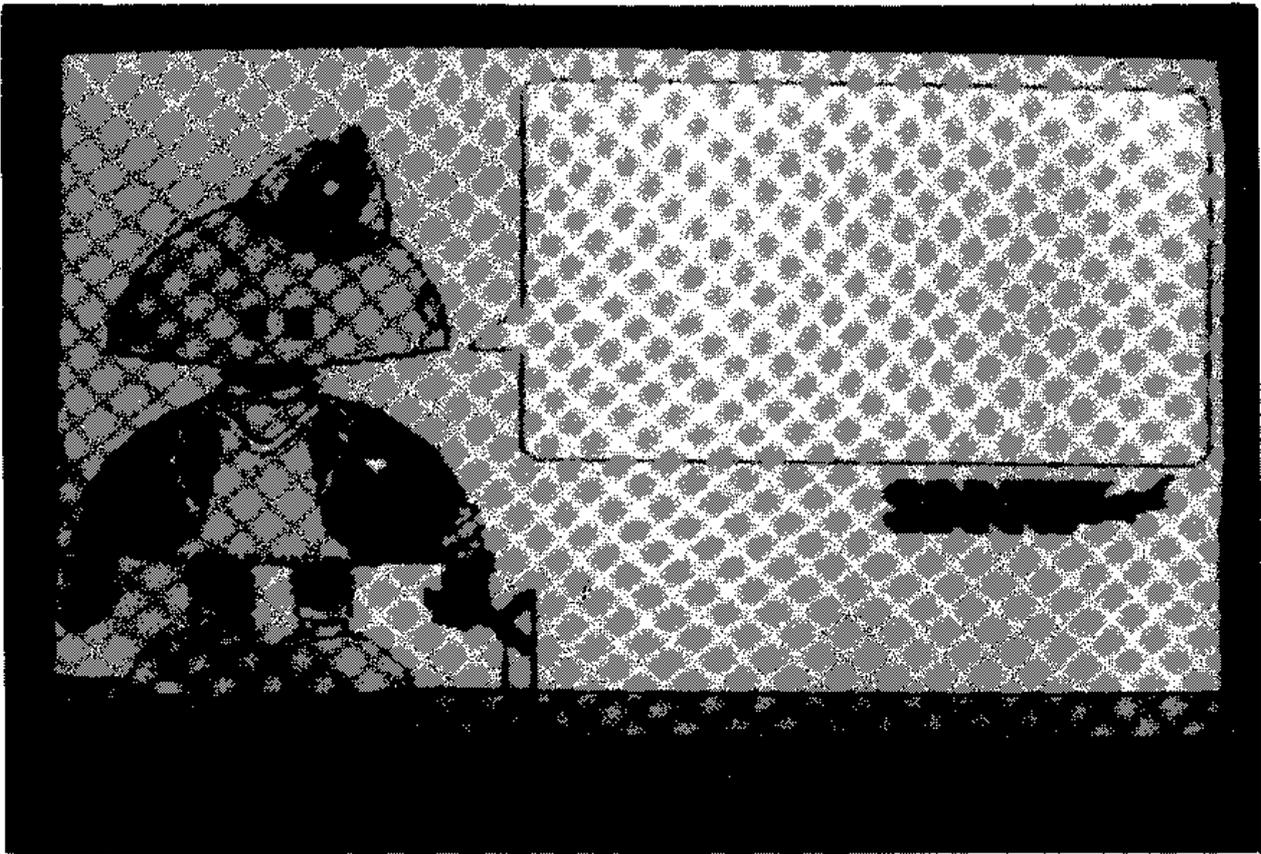
Although it doesn't really have full-screen editing, lines are much easier to edit than on the old Spectrum, (and infinitely easier than the Beeb's) - just type the line number and press Edit - down it comes... Must have made arranging the RAM paging pretty difficult - if the statement's in a page of RAM miles away from the memory bank the ROM's addressing at the time. Now that's a thought. And what about these 500K programs (yes, this one's a 512K job -

with the quarter megabyte memory extension card costing only £39.95, I guess that most SAMs will end up expanded). Just think of a FOR - NEXT loop with the FOR statement in one page of RAM, the line being executed in another and NEXT in another. The mind boggles.

Enough of this. Whilst talking to you, I've been looking at the screen of a pretty rough television. I chose a pretty rough one on purpose. Well, the colours on the demo tape supplied with the machine aren't too bad at all - there's still a little dot crawl, but it's by no means as pronounced as that on even a good Spectrum. And on one of my Monitor Tellies with a Scart plug, it's super. No dot crawl at all. Many modern tellies have a Scart socket on the back - if yours has one it's well worth paying the little bit extra for the connecting cable.

Now, how good is SAM'S Basic?

I dragged down from the door my Personal Computer World Benchmarks chart. The first test was for Integer



mathematics - and strictly there's no integer maths on this one - not like, say the Beeb, where you mark integers with a % sign. On to real maths. My version of the RealMath program went like this.....

```

100 REM RealMath
110 PRINT "Start"
120 LET X=0.0
130 LET Y=9.9
140 FOR I=1 TO 1000
150 LET X=X+(Y*Y-Y)/Y
160 NEXT I
170 PRINT "Finish",X
180 STOP

```

.....and I tested it on the latest version of a Spectrum - my Amstrad Spectrum +3 and on SAM. The results were pretty good - for SAM, that is. Spectrum, 20.5 seconds, SAM 7.0 seconds (I did it 10 times with a FOR NEXT loop and divided by 10). The data published by PCW showed that the +3 was a little slower than the old 48K rubberkey 17.5 seconds and the SAM a little slower than the BBC'B' (5.8 seconds). And as the Beeb is renowned for its fast Basic, that was pretty

good. Incidentally, that was using mode 4: mode 3 (the 85 column screen) was virtually unreadable on a rough telly, pretty good as white on black with the Scart, and even better as green on black (colour 68) Since the amount of screen manipulation was negligible, timings were virtually the same.

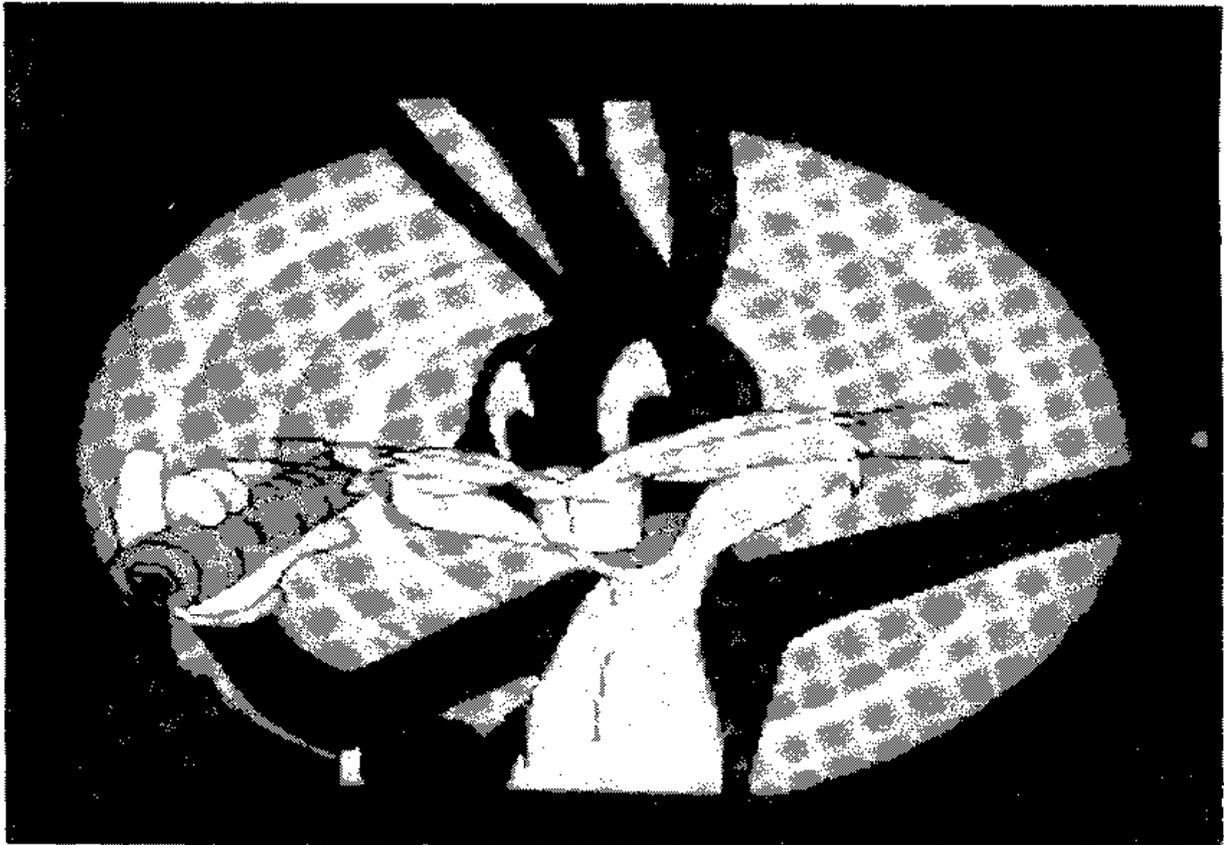
And now TextScreen. Essentially, this tests the scrolling, printing a line at a time a thousand times.

```

100 REM TextScrn
110 Print "Start"
120 FOR I=1 TO 1000
125 POKE 23692,255
130 PRINT "1234567890qwertyuiop ";I
140 NEXT I
150 PRINT "Finish"
160 STOP

```

Line 125 of course enables the Spectrum screen to continue scrolling without the prompt Scroll? coming up. The command 'SCROLL CLEAR' does the same thing on SAM. It said run it on an 80 column screen if possible; my first version had a comma instead of a



colon on line 130. The +3 took 197 seconds - way out from the 48K result quoted of 84 seconds. Of course - it needed 2 lines to print out - had to scroll twice as much screen. Changing to the comma gave 82.5 seconds. SAM in mode 4 (the start-up, full colour mode) took 117 seconds, as it did in mode 3 (the hi-res 80 column screen). Of course this is running to the Marquis of Queensbury's rules - the Spectrum has no 80 column mode. But it's a bit hard on SAM, making comparisons when the Spectrum's shifting only 6.75k of screen, whereas poor SAM has 24K to shift in either modes 4 or 3. Changing to mode 1, really a fairer comparison, resulted in 57 seconds for SAM - appreciably faster than the Speccy.

TrigLog tests the computer's ability to deal with trigonometric functions.

```
100 REM TrigLog
110 PRINT "Start"
120 LET X=0.0
130 LET Y=9.9
140 FOR I=1 TO 1000
150 LET X=X+SIN (ATN (COS (LN (Y))))
```

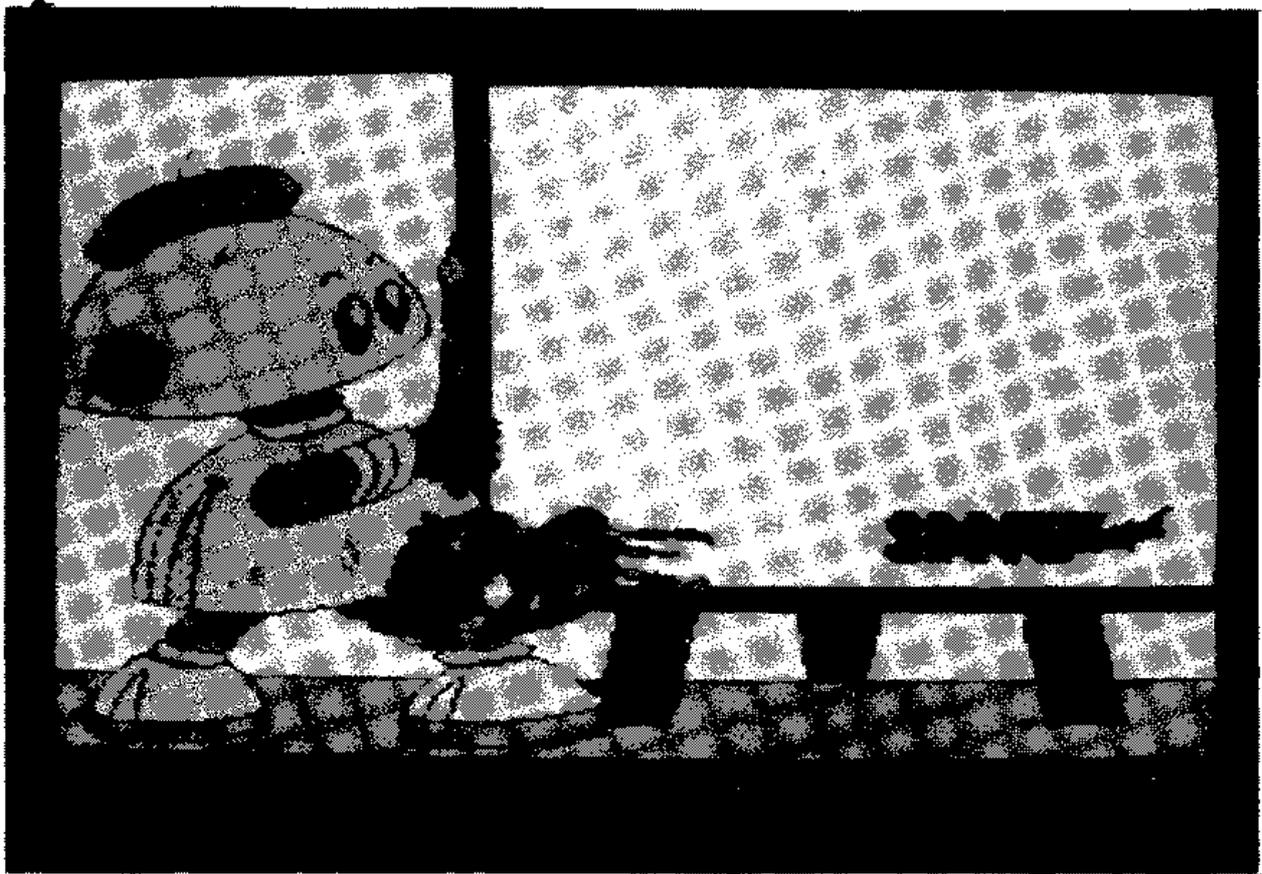
```
160 NEXT I
170 PRINT "Finish",X
180 STOP
```

The +3 took 227 seconds, compared with the published figure for the rubberkey of 226.5 seconds and SAM's 89 seconds. Not bad, SAM.

GrafScreen compares the rates at which pixels are plotted on screen. Using this program....

```
100 REM Grafscrn
110 PRINT "Start"
120 CLS
130 FOR I=1 TO 100
140 FOR J=1 TO 100
150 PLOT I,J
160 NEXT J
170 NEXT I
180 PRINT "Finish"
190 STOP
```

.....the Spectrum plotted a solid square of black pixels in the bottom left hand corner of the screen, line by vertical line. SAM obliged also, but in white on black, in modes 1, 3 and 4. The Spectrum took 117 seconds.



SAM took 31.0 seconds in mode 4 (start-up), 32.5 in mode 1 (32 column) and 28.5 in mode 3 (thinner pixels to plot, perhaps). So again, it won hands down. Of course, all these numbers need a little interpretation - like grafscrn on the Atari ST takes 92.7 seconds (due to a Basic which is not good at screen handling and a complex screen), wherea's Triglog takes only 7.9 seconds, no slower than in its Megamax C language. So far, though, the indications are that the Coupe's Basic is nearly as fast as the Beeb's and screen handling is very slick. And this tallies with the gut feeling one has when one uses the machine.

Although neither the Spectrum nor SAM has integer arithmetic available, the calculations in PCW's example are actually integer except for one point, in line 150. So I tested the following program....

```
100 REM IntMath
110 PRINT "Start"
120 LET X=0
130 LET Y=9
140 FOR I=1 TO 1000
```

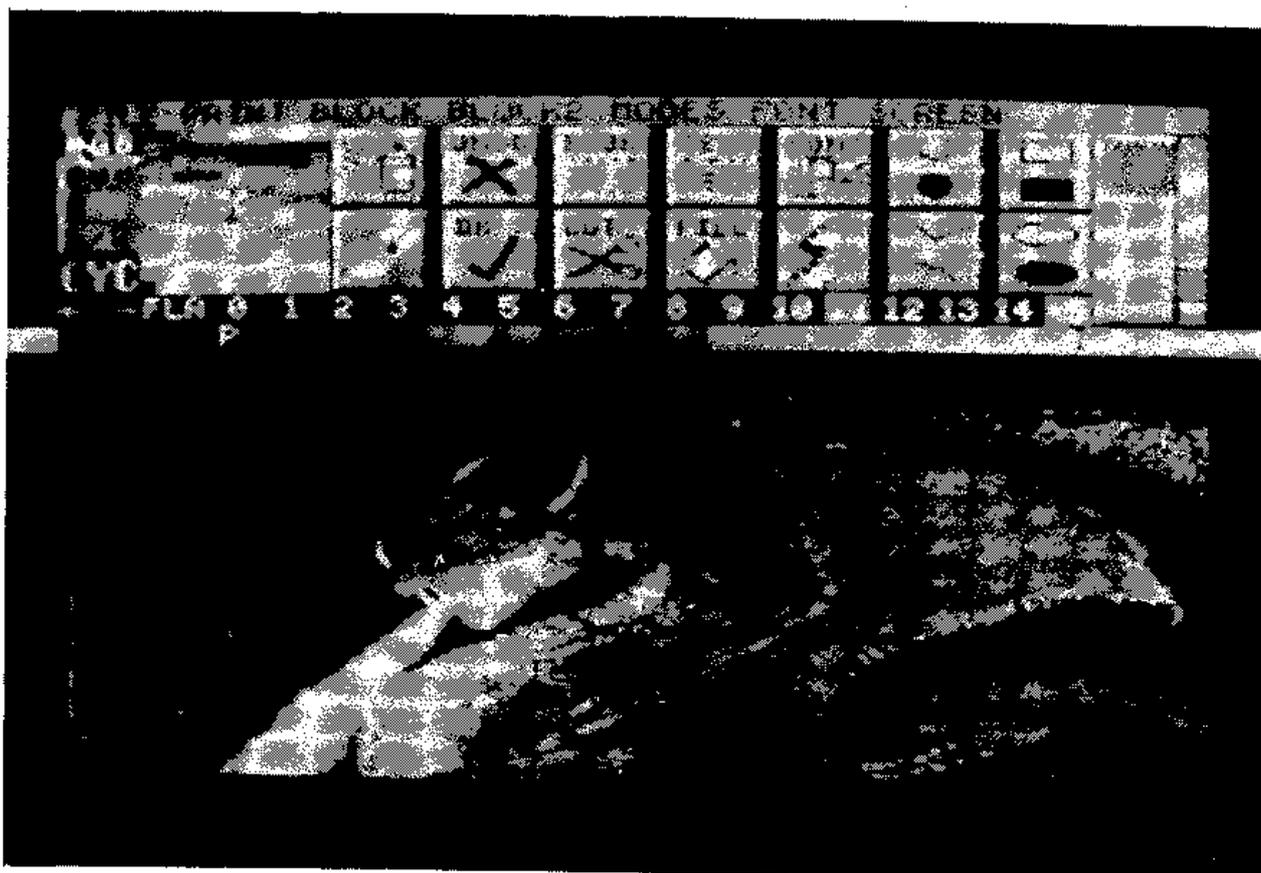
```
150 LET X=X+INT ((Y*Y-Y)/Y)
160 NEXT I
170 PRINT "Finish",X
180 STOP
```

The Spectrum did the job in 20.5 seconds (as before). SAM, in mode 3, took 7.4 seconds.

Overall, then, these results illustrate SAM's vastly improved Basic speed and handling.

Sam, of course comes with an instruction book by Mel Croucher with little quotations and pictures of Sam the robot - I liked it overall, though some of the Basic commands were not sufficiently well defined, and it was a bit short on examples. But it was a very nice little book, light and a good read - and quite funny in parts - I particularly liked the little quotations. FLASH! has a similar instruction book, and indeed gives one an indication of the superior screen handling capabilities of the machine.

I also liked the built-in sounds ZAP, BOOM, ZOOM and POW, which I



combined in a recursive procedure called ROW. Call up a ROW, and it sounded every bit as good as spectral machine code and, as the procedure was recursive (it called itself from within itself), it went on sounding like a professional fruit machine for ever!

Overall, I rate this machine as being pretty good, though I did worry about the lack of LED's to show it was on, particularly as it switched the screen off after 23 minutes or so if you haven't touched the keyboard.

Enough of me, though. I'll let Bob tell you about the graphics in more detail.... Now let's look at screen handling and colour.

Thanks John, I hope you didn't wear-out you stop-watch with all those timings.

Graphics make a computer, I remember well when computers had very poor block graphics or were forced to rely on over-printing letters and symbols to produce crude Space Invaders. Ah!

The good old days, when men were men and most ZX81s had only 1k of memory. Still things have moved on since then, colour came on the scene with the VIC20 and TI99 which both cost an arm and a leg when they first appeared (I remember seeing an advert for the first TI99 in the UK which cost £1199 including an NTSC standard TV to use it with). Then Uncle Clive started the real revolution in home computing - the rubber key 48K Spectrum was launched. 16k (or if you were rich 48k) of memory, 16 colours, sound, and pixel graphics. All for well under £200.

Since 1982 many colour computers have come onto the market, some have lasted - the C64; the BBC range; and various offerings from Atari - but others have failed - Lynks; Enterprise; Memotech; MSX. Only the C64 has rivalled the sales of the Spectrum in the UK and both machines have changed very little since their first launch in the early 80s.

The move towards 16 bit machines (Atari ST and Commodore Amiga) has



been hyped out of all proportion. Sales of both combined in the UK still only just top the 500,000 mark, against the Spectrum this is a mere drop in the ocean. What's important is not the number of bits of data a processor can handle at one go - but how well the hardware and software handle those bits when its got them. A bad basic on a machine (like the ST's) prevents the average home user from doing anything other than use other peoples software - very expensive on 16 bit machines. The SAM Coupe on the other hand uses the tried and tested 8 bit Z80B processor and gives users a very fast basic as John's benchmark timing have already pointed out.

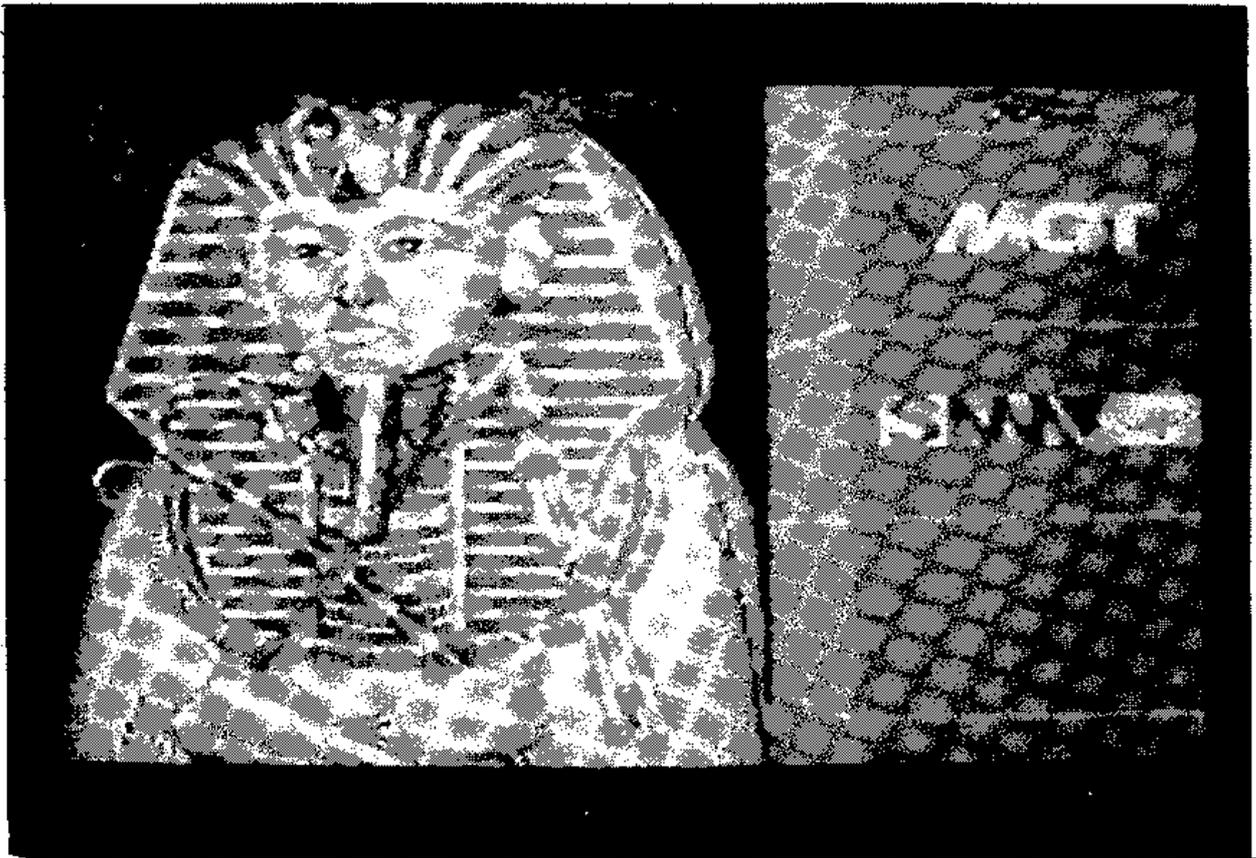
Before we go on to consider the graphic commands available to SAM users lets just look at the four screen modes available.

MODE 1:- This is the Spectrum compatible mode, the screen is laid out in exactly the same format as the Spectrum. With 8 colours, plus their BRIGHT versions and FLASH, the attribute file works just as you would

expect for Spectrum compatibility. There are however several extras.

First you can set up more than one screen and display the screen of your choice while printing to one of the others. This gives Basic programmers the opportunity to produce flicker free animation. Next, the 8 screen colours can be selected from SAMs 128k colour palette, so if you want all to set up all colours as shades of blue there is nothing to stop you.

MODE 2:- A 256x192 pixel screen, with an attribute file that allows you to set the colours on an 8x1 matrix, so you have 8 times the colour resolution as the Spectrum. Unlike mode 1 the memory map for the pixels is quite straight forward. Lets say our Mode 2 screen starts in the same place as a standard Spectrum screen. The top left-hand pixel is stored as the first bit of the byte at location 16384 (4000h). The right-hand pixel is the last bit of location 16417. OK thats just like the Spectrum, but if you have studied the Spectrum screen layout you will know that location



16418 contains the pixels for the top row of the character printed at 1,0 - in otherwords 8 pixels down from the first line. You can see it in action by doing a FOR-NEXT loop on your Spectrum to POKE 255 to locations 16384-22528.

Mode 2 on the otherhand uses a more logical (well to most of us anyway) method. Each line of 32 bytes (32x8=256) is laid out one after the other in memory. So the second row of the character at 0,0 is held at 16416, the third row is at location 16448 and so on. The screen therefore occupies the same space as a Mode 1 screen but the attribute file is 8 time the size. In Mode 2 the attribute file starts (in our example anyway) at 24576 and is the same size as the pixel screen area. This is because each byte in the pixel area (a horizontal line of 8 pixels on the screen) has its own attribute byte. Just add 8192 (2000h) to the pixel byte to get the address of the attribute byte.

The same INK/PAPER colours as mode 1 are available together with their

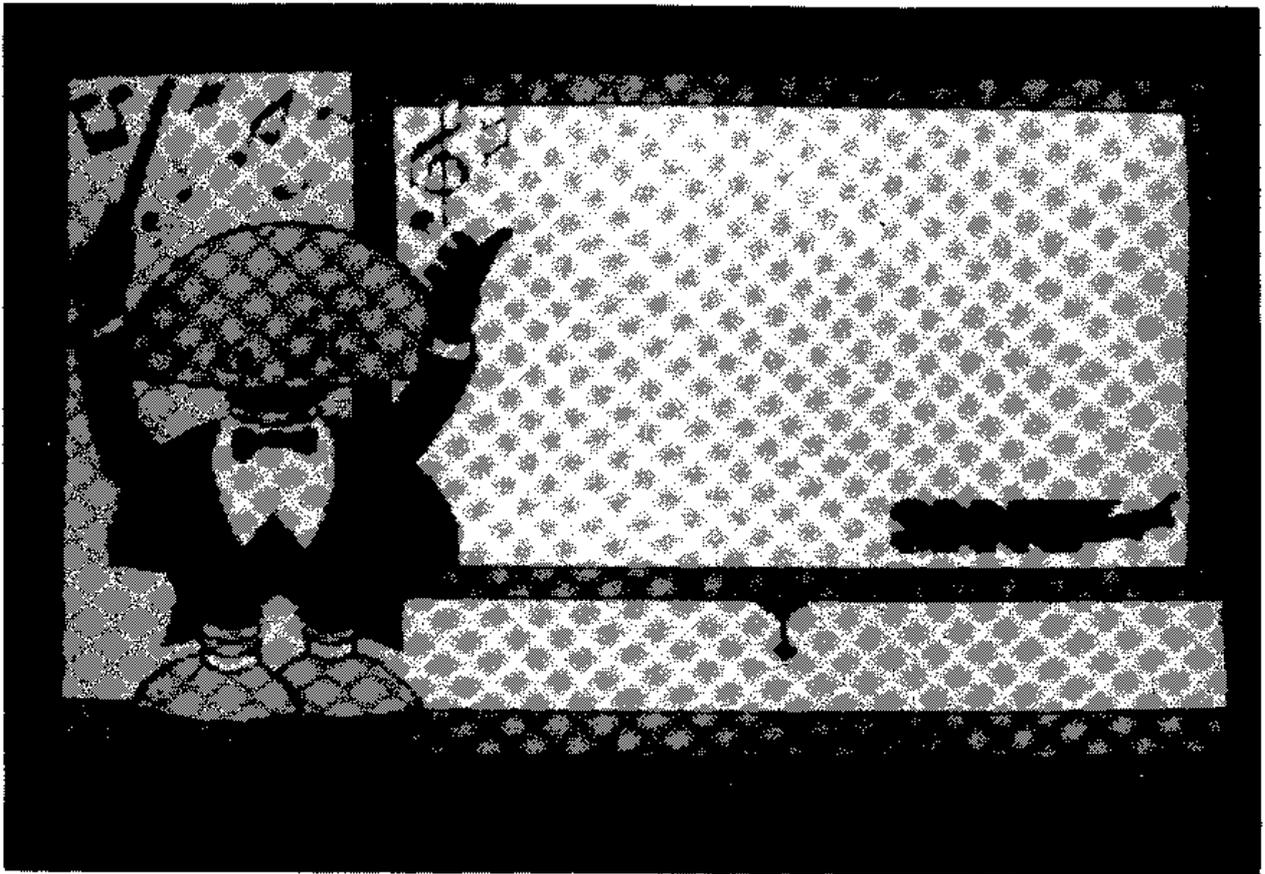
BRIGHT versions and FLASH. Again selected from SAM 128 colour palette.

As a mode 2 screen is 12k long it can be held within one of SAMs 16k pages so this mode will be of special interest to programmers who want to pack a lot into the 256k (512k) available.

MODE 3:- This is a mode aimed more at the serious user. Mode 3 is the 80 column mode (the ROM prints 85 characters to be exact). The pixel resolution is 512x192 so you have twice the horizontal resolution as other modes. Each pixel can be set to one of 4 colours, selected from the SAM colour palette.

There is no attribute file in this mode. Instead 4 pixels are stored in each byte of screen memory (2 bits per pixel). This means that 24576 bytes are needed to store a screen, but you don't have to cross a page boundary just to access an attribute.

In Mode 3 characters are printed on a 6 wide matrix, hence 85 characters



per line. There is no hardware FLASH or BRIGHT, but use of palette switching by interrupts will enable you to have flashing characters if you really want. Of course with no attributes there can be no colour clash problems so, even with only 4 colours, I can see some programmers using this mode for games. However it's word processing, spreadsheets and graph plotting that Mode 3 will be the ideal choice for even though you need a monitor or Scart television to see this mode at its best.

MODE 4:- This is the mode SAM starts up in and the star attraction for graphics. 256x192 pixels each of which can be set to any one of 16 colours, selected from the 128 available. The screen is laid out in contiguous memory with each byte representing 2 pixels (4 bits per pixel) hence 16 colours. Again 24576 bytes are required to hold a screen so two 16k pages are needed for each screen. This is without doubt the mode that most games programmers will use. It will be easy to give programs fast moving sprites and, without clashing

problems, games should be fast and smooth. It's the mode FLASH! (SAM's bundled art package) uses most.

Right, that's the screen modes, now let's look at the graphic commands you can use. In all cases I will work with screen mode 4 unless otherwise stated.

It is in things like circles that the speed of the Coupe really stands out. Try this short routine:-

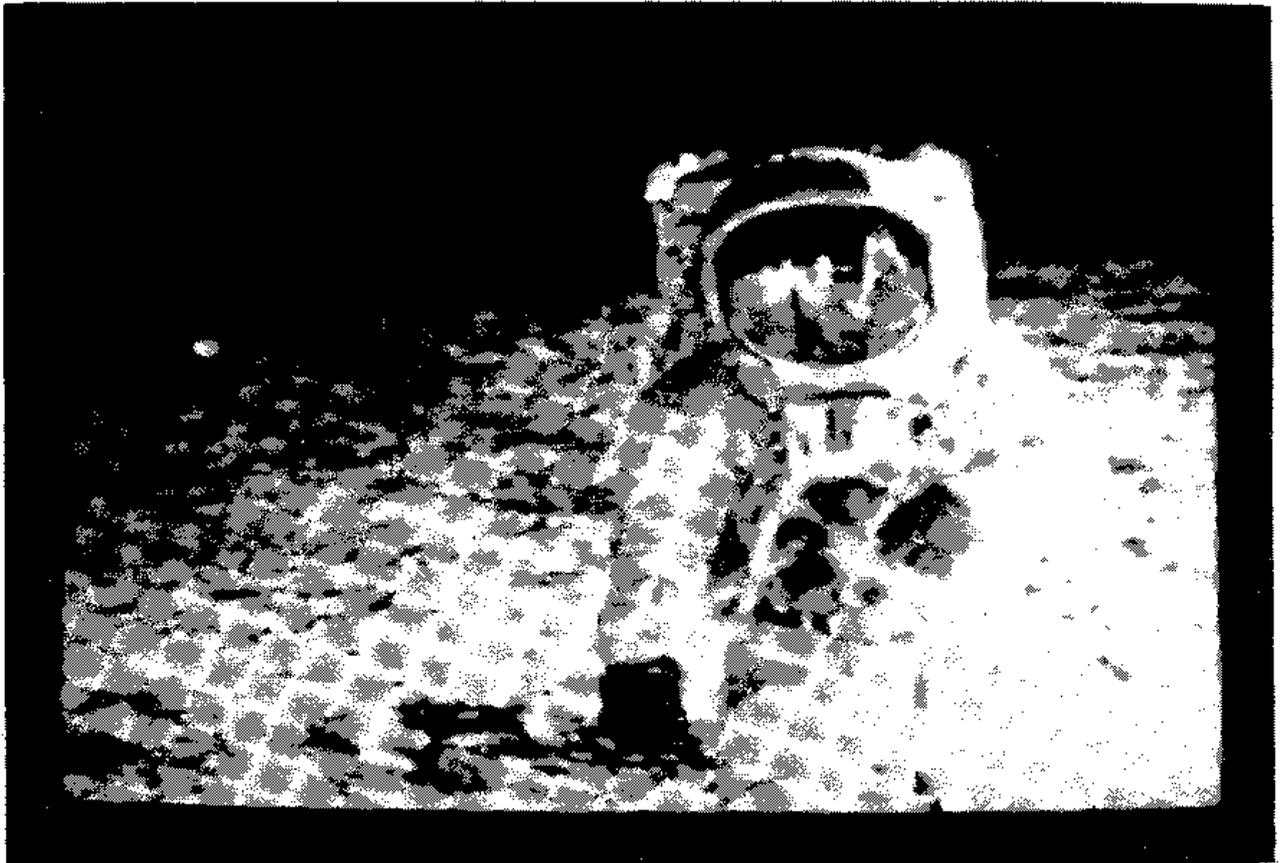
```

10 REM Circles.
20 PRINT "START."
30 FOR I=10 TO 80
40 CIRCLE 120,85,I
50 NEXT I
60 PRINT "STOP."
70 STOP

```

This will print an expanding circle on your screen. On the SAM Coupe (in mode 1 - the Spectrum mode) this took just 2.75 seconds as against 55 seconds on the Spectrum. In mode 4 it took only 0.95 seconds 'a fantastic speed'.

Not bad, but try altering line 30 to be FOR I=10 TO 90 and the Spectrum



will stop with an error message - B Integer out of range - when 'I' gets to 86. The Spectrum requires all circles to be on screen, they can't go over the edges. Well SAM circles can, they even wrap-round onto the other edge of the screen in some cases.

The Spectrum has a DRAW command but SAM has two versions:- DRAW which is just like the Speccy and draws relative to the last plot position, and DRAW TO which does exactly what its name suggests and draws to an absolute X,Y co-ordinate. PLOT works exactly the same as the Spectrum version and there is also a FILL command which will fill even the most complicated shape.

In mode 4 the graphic co-ordinate go from 0,0 (the bottom left corner of the main screen area) to 255,173 not 255,175 as on the Spectrum. This is because an extra two pixel lines are used in the editing area so only 174 are left for the main screen. However PLOT 0,-18 is allowed. To make things even easier you can reset the origin for all graphic commands using the XOS

and YOS options. LET YOS=-18 will set the 0,0 position to the bottom left corner of the editing area so you could now plot up to 255,191. In mode 3 you have double the horizontal pixels so the X range is 0 to 511.

All the graphic commands can be BLITZed. This is a very flexible feature. Lets try the following:-

```
10 REM Squares.
20 FOR I=10 TO 200 STEP 5
30 PLOT I,20
40 BOX
50 NEXT I
60 STOP
100 DEF PROC BOX
110 DRAW 0,20: DRAW 20,0: DRAW 0,-20:
DRAW -20,0
120 ENDPROC
```

This will draw a series of squares across the screen. Now add the following lines:-

```
15 RECORD TO A$
55 RECORD STOP
```

Then rerun the program. When it stops



type CLS as a direct command and press Return. Now type BLITZ A\$ and press Return. The squares are now redrawn very fast. What has happened is that A\$ now hold a shorthand form of the commands that were recorded to it. The BLITZ command executed this shorthand and redraws the boxes without the overheads of each line of basic being interpreted. XOS and YOS, together with XRG and YRG which give a scaling factor, can be used to alter the position and size of BLITZed items.

As space is now running out I will just list a few of the remaining graphic commands, most deserve whole pages to themselves, which I am sure they will get in future issues of FORMAT so keep reading.

SCREEN and DISPLAY are used to set-up more than one screen in memory and select which on is shown on your TV.

CSIZE has a limited effect on the size of printed characters.

GRAB and PUT can be used from basic

to create sprite type graphics complete with masking and logical ANDing/ORing.

WINDOW sets up screen windows. The SAM demo program makes extensive use of these.

The SAM Coupe is a fantastic machine for the price. Software support is already underway which will guarantee it a place in the market. With its graphic and sound abilities it out-performs all other 8 bit machines and even puts some aspects of 16 bit computers in the shade. It must be considered the logical upgrade for Spectrum users and an ideal computer for the first-time buyer.

The pictures in this article are actual photos of SAM screens taken from the demo tape and FLASH! program. The demo was written by Garry Thomas with SAM cartoons by Dave (Betterbytes) Hood. It is a real pity we couldn't print them in colour to really show them at their best.

NEV'S HELP PAGE

By: Nev Young.

This month I'm going to blitz all the printer help letters. I've been sitting on some of these for quite some time as for many of them I just can't do anything. The reason in most cases is that I do not have the manual for the printer or that I don't have a copy of the program involved. But I didn't give up and when I went to visit MGT the other day I made a nuisance of myself and got ALL the answers. Or to put it another way if the answer is wrong then it's somebody else's fault.

T.G.Potter of Livingston, your Panasonic KX-P1081 works on the default codes so just don't change any when you set up your system file.

D.W.Stokes of Cornwall, to make your Brother HR5 do a large size print (I hope you mean a screen dump) you need to get LCOPY 2 from the reader services. The disc check program from the introductory issue has checked the disc when it finishes without an error.

D.Morgan of Northumberland, to make your Brother HR5 work with Tasword set up the interface control 1 to 0, CR=13 LF=0 . This should cure the ? at the start of each line.

C.Adams of Dyfed, to get your Picturesque Monitor & assembler to work I suggest you read issues 1/4 on printer drivers and the articles on command codes in issues 2/3, 2/4, 2/6 and 3/2.

H.Connel of Cleveland, to get your Tandy DMP 106 to work just change line 60 to read POKE @6,1 in the Tas-Sign program and use the PLUS D printer lead.

M.R.Perry thinks he has found a problem with the DISCiPLE (and the

PLUS D). They do not set the left margin correctly. The very first line is printed with no left margin. Following lines have the margin. The first line of a screen dump has a margin but the rest do not. The first line after a screen dump has no margin.

Sorry you've not found a bug. It wasn't lost! You are, of course, quite right. This is a fault in the operating system. It is caused by the DISCiPLE setting the left margin by sending the number of space characters held in POKE @9 after a CR. That's why the first line doesn't have a margin. Also no margin is sent during a screen dump. That is why it moves back.

You can avoid the problems by a little work. To avoid the first line being wrong always print a blank line first. Also do POKE @9,0 and send CHR\$ 13 before doing a screen dump.

A neater way, if your printer can do it, is to set a margin on the printer. EPSON compatibles allow this by a control code. The basic command would be LPRINT CHR\$ 27; CHR\$ 108 ;CHR\$ margin. Where margin is a number equal to what you would normally POKE into @9. (Remember to do POKE @6,1 first). Also check that your printer will do it as not all so-called Epson compatibles have the command.

Another way to mix text and screen dumps is to use the 'Small is beautiful' program printed in issue 2/5.

And talking of that program P.R.Morgalla. You get a row of dots down the left side because you have missed the ; from the end of line 200 in the basic.

P.R.Morgalla has also found a

problem with the scroller program in issue 3/2. It crashes after the message has scrolled across the screen twice. The problem is with the machine code. Two extra instructions are needed. At the end of the program it needs to be:-

```

1110      LD HL,(STBC)
1111      LD B,H
1112      LD C,L
1120      JP (HL)

```

For the poker program line 170 should finish ,92,68,77,233,17888.

The reason it crashes is that after the JP (HL) the BC register is saved in (STBC) but on line 1090 you will see it has just been tested for zero. So zero is saved into STBC. This means that at the end of the second pass HL = zero and so the code jumps to address zero. This resets the machine.

The two new instructions reset BC to the correct value.

A nice multi coloured letter from Desmond Anglin of London. A DISCiPLE user like myself, he is having lots of problems getting TASWORD +2 to work. Buy the TASCAN +2 program from Reader Services and all should be well. If you want a colour screen dump you should read Villy Feltman's article in issue 3/3.

And the next letter is from James Lindsay who also has a STAR LC10 printer and wants to know how to print in colour from basic. I am tempted to say write to Desmond cos he can do it. The only practical way is to use embedded codes in your data as you send it to the printer. It could also be done by using the INK command but this would need the printer routines rewriting. As you have a PLUS D they are in ROM and can't be changed so would be a long and difficult task.

As for printing from Artist II. Yes you can print without the snapshot effect. No not in colour. Read about printer drivers in issue 1/4. I can't say more as I don't have a copy of Artist II to work with.

P.Sneddon of Bolton wants to know how to get the OCP +80 Finance Manager to print with the PLUS D. It looks like the same driver I use for the OCP +80 Editor/Assembler for which I use:-

```

                ORG OFFD3H
START          EQU $ ; = OFFD3H
                DEFW START
                DEFW INIT
                DEFW BUSY
                DEFW PRINT
                DEFW LENGTH
PRINT          RST 08H
                DEFB 39H
INIT           RET; BOTH INIT AND BUSY
                ARE JUST RETURNS
BUSY           RET
LENGTH        $ - START ; = 13

```

Follow the instructions in the Finance Manager manual for inserting the driver routine.

A few people are having problems setting up and using their Lifetime disc drives from MGT. The correct set up is:-

- A. With PLUS D/DISCiPLE set switches 1,2,3,4,5,6 on drive to on,off,off,off,off,off for drive 1 and off,on,off,off,off,off for drive 2
- B. With Spectrum +3 set switches as for drive 2 above.
- C. With Spectrum +2A or +3 and PLUS D/DISCiPLE install a 'Fixer' between the Spectrum and PLUS D/DISCiPLE and set up as for A.

J.Murphy of Surrey is confused about manuals. In issue 3/1 I said to check your disc manual before adjusting your drive. John tells me he didn't get a manual when he got his drive. The problem is you should always get a user manual with something like a printer but you don't need a user manual with a disc drive. The manual I referred to was not a user manual but the service manual which you would have to buy separately from the manufacturers. Often the place that sold you the unit will also sell you the service manual. But beware they

can be expensive. If you really want one then find out the address of the manufacturer or their local agent and then write to them.

Finally thanks to all of you who sent me info about video titling programs. I have copied them and sent them on to P.Clough. Strangley they were all about ProTitley by Hall Video Productions of 147 Gladstone Street, Winsford, Cheshire. CW7 4AU. Phone 0606-551925. (if you contact them mention FORMAT please).

I am glad to be getting some feedback it lets me know that I'm not wasting my time doing this.

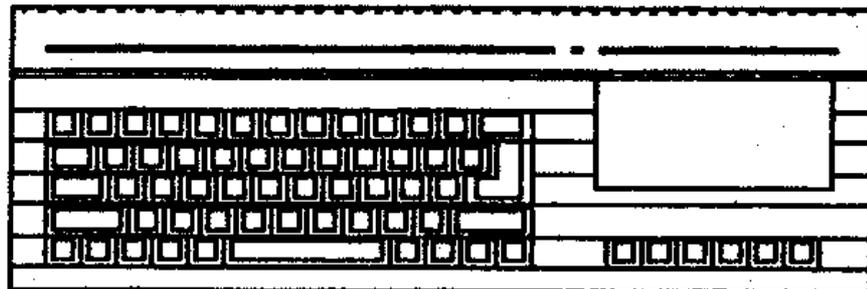
Thats all for this month. Remember

If you don't write to me I can't write this page. I also have to point out that I can not answer questions personally so DO NOT send me return postage etc. I will attempt to answer as many queries as possible but only through the magazine. Try an give full details of your problem and include a listing if it is a programming problem.

Write to FORMAT or directly to me at:-

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nb. dos 3d required for Disciple

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- + - + - + -

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SHORT • SPOT

By: John Wase.

Happy New Year to you all, and here's the usual miscellaneous crop of assorted goodies to help you all on your ways.

In November 1989's "Format", Francis Miles made mention of the tedious calculations necessary to determine pitch and duration of the BEEP command when used in machine code. Anything like this usually gets a response, and this one's from Malcolm Goodman of Leeds, who provides a short program which should solve the problem. Here it is:-

```
1 REM .....(10 DOTS)
2 CLS : PRINT "THIS SHORT PROGRAM W
  ILL ALLOW YOU TO SPECIFY THE FREQ
  UENCY AND DURATION OF A NOTE, AND
  THE VALUES THAT ARE NEEDED IN TH
  E DE AND HL REGISTERS PAIRS WHEN
  CALLING THE ROM BEEPER WILL BE PR
  INTED ON-SCREEN."
3 PRINT #0;AT 0,9;"PRESS A KEY": PA
  USE 0: CLS
9 RESTORE 100
10 INPUT "PITCH (hertz) ";P: PRINT "
  PITCH = ";P;" HERTZ"
20 INPUT "DURATION (seconds) " ;D: P
  RINT "DURATION = ";D;" SECONDS"
30 LET DE=P*D
40 LET START=PEEK 23635+256*PEEK 236
  36+5
50 LET HL=INT ((437500/P)-30.125)
60 RANDOMIZE DE: LET A=PEEK 23670: L
  ET B=PEEK 23671
70 RANDOMIZE HL
80 LET C=PEEK 23670: LET D=PEEK 2367
  1
90 FOR X=START TO START+9: READ DATA
  : POKE X,DATA: NEXT X
100 DATA 17,A,B,33,C,D,205,181,3,201
110 PRINT "DEL";INT DE;: PRINT "HL=";
  INT HL
120 RANDOMIZE USR START
130 PRINT GOTO 3
999 SAVE CHR$ 215+"CALCULATE" LINE 2
```

The shortcomings of our machines

irritate us all and give me material every month. Here's Daniel Neidle's solution to interference with the television sound and picture on the Spectrum+2. He doesn't say which model it is, so I assume it is the old grey one, since he mentions the PLUS D in connection with his solution. Daniel writes that the interference patterns and noise bars on the TV display can almost prevent programming, and the situation is worsened by the extra power drawn by the +D. His solution is to open up, remove all cables and solder a thick (1A+) insulated wire from the case of the silver metal modulator in the top of the left hand corner to the metal tip at the rear of the DC-in socket: keep the wire as short as possible and away from any components. This shorts out any interference picked up on the ground bus from regulators and "noisy" ICs, giving both clearer vision and audible sound. I have not tested this: you do it at your own risk!

In return, Daniel asks if any reader has found a way to change the colours of the 128 Editor from white on black to black on white.

The +2 is notorious for its defective keyboard reading, and it is worth mentioning again that the fault in 48K mode (comma, stop, cap M, N and "STOP" all fail to work when the machine is cold) can often be rectified by soldering a one thousand picafarad capacitor across diode 35. Tasword +2 (128K mode) has to have a special patch because of ineffective keys which spoils the insert mode: anyone know of a hardware fix for this one?

All my problems with Daniel Neidle started off because of the defective renumbering routine in the +2. Peter Morgalla from Hemel Hempstead writes

that he often wishes to start renumbering from a particular line; say 1000, when writing modular parts of a program before merging them into the main routine. System variables 23444/5 and 23447/7 hold the start line number and the renumber step size respectively. The following short program, merged with your magnum opus which is being developed will let you poke these variables as necessary:-

```
9994 CLS : INPUT "START LINE ",START
9995 INPUT "STEP SIZE ",STEPS
9996 POKE @23444-8192,START
9997 POKE @23446-8192,STEPS
9998 PRINT ;"PRESS <EDIT> THEN RENUMBER": STOP
```

Peter mentions that 8192 is the PLUS D POKE @ offset, and should be replaced with 664 for DISCiPLE users. Oh, and he also points out that this program is particularly useful in conjunction with Nev Young's line delete command "OUT" in Vol.2, No.4.

One of the ways of avoiding this problem is to use the toolkit commands in Andy Wright's Beta Basic. His RENUM works on everything except computed GOTOs or GOSUBs. (This of course means that VAL will not work, but you can always remove or replace the VALs easily with Beta Basic). I have checked and confirm that this function will also be available on SAM.

Last month, I reported on the +3's quirks with its Centronics port: you remember; it wouldn't work with my Silver Reed daisywheel printer. The solution is to use the serial port and a serial to parallel converter; it worked like a dream. If there is sufficient interest, Bob intends to run a project on such a converter in a future Format. (It is not, unfortunately, the answer to everything, for my MCP-40 plotter (also badged as a Tandy) which works splendidly on a PLUS D and +3, but not on a Discovery, fails to respond to this treatment).

And talking of that ignominious piece of hardware, the +3, which lacks proper access to the discs and

channels from Basic, does anyone know how to do:-

- (i) OPEN £4;D1;N\$ OUT
- (ii) PRINT £4;A\$;
- (iii) CLOSE £4 on it?

One of few virtues of the +3 is its high quality software which evades many of its tacky hardware difficulties. Amongst these is Tasprint +3 - 25 different fonts in a variety of sizes and styles, all on disc, and each automatically loaded with a control code in the text. I know that Tasword will be put on Sam - I hope that Tasprint is, too; perhaps with a 24 pin printer driver? Meanwhile, I was playing around last night with the patch which FORMAT supplies to transfer Tasword +2 to PLUS D/DISCiPLE, and noticed that it overwrites the Tasprint code area. Providentially, then, I've had a couple of little bits and pieces from Dick Guy, allowing the use of Tasprint on a DISCiPLE (should work with a PLUS D, too - I can't see why not, but if it doesn't I guess I'll hear pretty quickly).

First make sure your version of your Tasprint code is set up for your printer. Load your version from cassette or microdrive.

Use Dick's modification of Francis Miles code-changing routine (Format, issue 4), entering it as follows:-

```
1 REM * Francis Mile's *
2 REM * Code Changer *
3 REM * Format Nov'87 *
4 REM * pp7-8 *
5 REM * Modified by Dick Guy *
6 REM
9 REM*PRINTER PROG FOR UTILITIES*
10 POKE 62309,201
20 FOR a=62327 TO 62346
30 READ n
40 POKE a,n
50 NEXT a
60 STOP
70 DATA 71,219,31,203,119,40,250,120
, 211,251,62,64,211,31,230,191,21
1,31,120,201
```

Run it and save the modified

THE SECRETS OF WORD MANAGER

SPECTRUM MACHINE CODE MADE EASY

Part 9.

By: Francis Miles.

SYSTEM VARIABLES AND FLAGS - Part 1.

System Variables can be defined as those variables that control the working of a program, as opposed to Data Variables which hold the transient data a program may be working on. The Spectrum also has its own System Variables, they control the operation of the computer. To avoid confusion I will use the term Program Variables when talking about

"Word Manager" has a subroutine called SCOL which changes the screen colours; it is entered with a code in the A register which codes the attributes required in the usual way, F B PAP INK; F and B (one bit each) control FLASH and BRIGHT respectively, PAP and INK (3 bits each) give the PAPER and INK colours. So LD A,00111000B would give BLACK (000) ink on WHITE (111=7) paper, without FLASH or BRIGHT.

```
1000 SCOL EQU $
1010 ;changes colours to codes in A
1020 ;ensure FLASH and BRIGHT off
1030 AND 00111111B
1040 ;move PAP 3 bits right into lo
1050 ;bits of B
1060 LD B,A
1070 SRL B
1080 SRL B
1090 SRL B
```

[This value in B will be used later for the border colour. Now the "Word Manager" flag program variable MISFL is checked; each of its eight bits is an independent flag, bit 3 being the signal for "insert mode". If insert mode is on, the screen display is shown with PAPER and INK colours reversed.]

```
1100 ;if MISFL 3 set,
1110 LD HL,MISFL
1120 BIT 3,(HL)
```

```
1130 JR Z,SC.B
1140 ;reverse colours
1150 ;stack INK
1160 AND 00000111B
1170 PUSH AF ; INK
```

[This colour will be used for the border later.]

```
1180 ;move INK 3 bits left to PAP
1190 ;position
1200 SLA A
1210 SLA A
1220 SLA A
1230 ;add PAP in INK position from B
1240 ADD B
1250 POP BC ; -
```

[Now the INK colour for the border is in B.]

```
1260 ;put attributes in sv ATTR.P
1270 SC.B LD (IY+83),A
```

[ATTR.P is a Spectrum system variable, one byte at 23693 holding the "permanent attributes" - ie those which are used to colour the whole screen, as opposed to the "temporary attributes" in 23695 ATTR.T. Like all the Spectrum system variables, although ATTR.P affects and is used by the ROM, it is not actually in ROM (which ends at 16383), and therefore it can be POKEd from BASIC or loaded from machine code. Also like the other system variables, it can be economically addressed by reference to IY, which is permanently set at 23610 (the system variable ERR.NR). Using IY often saves one or more bytes and never costs any bytes.]

```
1280 ;put PAP colour in A for border
1290 LD A,B
1300 ;if CAPS LOCK on,
1310 BIT 3,(IY+48)
1320 JR Z,SC.BC
```

[IY+48 addresses another Spectrum

system variable, FLAGS2 at 23658. Like MISFL this is a flag variable, with each bit carrying an independent signal. Only bit 3, which signals CAPS LOCK status, is of much practical use - the others are all rather transient, signalling things like "the key input channel is in use" or "there is something on the screen".]

```
1330 ;put border in contrasting
colour 1340 XOR 0000111B
```

[XORing a colour number with 111 gives the best contrast colour number.]

```
1350 ;colour border
1360 SC.BC CALL 8859 ;BORDER
1370      CALL CLRS
1380      RET
```

Any labelled location, in which a value can be parked, and from which it can be subsequently loaded into a register, is a program variable; it is good programming practice to keep them all together in a bunch at the start of the machine code or in some other suitable location - in that way you at least always know how much memory you are taking up with variables. It can be quite a lot! They can be classified in various ways:-

SPECTRUM SYSTEM VARIABLES and PROGRAM VARIABLES.

Sixty-odd system variables of the Spectrum's own system are listed in Chapter 25 of the old Spectrum handbook (Part 25 of the +2 handbook). About six of these are used by "Word Manager" in one way or another.

Some of those marked N ("no lasting effect") in Chapter 25 can be used in machine code programs as program system variables, to save space - and four of the five flag variables contain unused bits. (FLAGS bit 4, FLAGS2 bits 7, 6 and 5, FLAGX bits 4, 3 and 2, and TV.FLAG bits 7, 6, 2 and 1).

But beware! The programmers of peripherals (Bruce Gordon among them) know about these spare variables and

flags, and craftily use them to save space in their own programs. If you use the NMIADD system variable at 23728, or bit 4 of FLAGS, with the DISCiPLE connected, you will crash the system. Probably Bruce uses others of the "spares" as well, these are the only ones I have definitely identified.

"Word Manager" has fifty or sixty program variables of its own: several of them have been mentioned in previous articles, e.g. MSSP which stores the stack pointer address at the start of the "main sequence" and returns the stack pointer to it whenever a jump is made to ABORT; SO, the "screen zero"; and MISFL, a collection of miscellaneous flags (there are four flag program variables altogether). The two used most are:-

C1 - the current cursor address (a "text address", counted from zero at the start of the text), and

LO - the number of bytes used so far in the text buffer.

The simple subroutine C1LO, as its name suggests, handles both of these:-

```
6100 C1LO EQU $
6110 ;put the address HL in C1;
6120 ;if HL > LO, put in LO also
6130 ;HL > LO?
6140      PUSH BC
6150      PUSH DE
6160      EX DE,HL
6170      LD HL,(LO)
6180      AND A
6190      SBC HL,DE
6200      JR NC,C1.RET
6210 ;yes, LO must be increased
6220 ;is C1 out of range?
6230      EX DE,HL
6240      CALL OFLO
6250      EX DE,HL
```

[OFLO is a subroutine to check DE against yet another program variable, L1, which marks the limit of memory currently available for text; if it is excessive, it flashes a message and jumps out of this subroutine via ABORT.]

```

6260 ;new LO is in order
6270     LD (LO),HL
6280 ;put it in C1 anyway
6290 C1.RET LD (C1),HL
6300     POP DE
6310     POP BC
6320     RET

```

ONE-BYTE and TWO-BYTE (or longer) SYSTEM VARIABLES.

Flag program variables are usually only one byte, and so are some others such as COLS (the attribute codes currently used for the screen) and MICNO (the number of the Microdrive unit currently tuned in). But many program variables are addresses, which obviously need two bytes.

In a few cases two bytes are allocated to a particular program variable even though only the low byte is used and the high byte is kept permanently zero. A "Word Manager" example is the program variable LINEP, holding the number of bytes currently selected for the line length to be used in printouts; it is never more than 128, so one byte would be enough. But I found there were so many cases like:-

```

6030 PLUSL EQU $
6040 ;increment HL by one print line
6050     LD BC,(LINEP)
6060     LD B,0
6070     ADD HL,BC
6080     RET

```

and

```

0250 MINUSL EQU $
0260 ;decrement HL by one print line
0270     LD BC,(LINEP)
0280     LD B,0
0290     AND A
0300     SBC HL,BC
0310     RET

```

that it was well worth sparing the extra byte in the program variables, thus making it possible to delete the "LD B,0" line in each case (two bytes each time).

More about system variables and flags next month.

EDITORS NOTE:-

For those of you who missed the first instalment of this series (which appeared in *FORMAT* Vol 2 No 9 - May 1989) I would like to explain that these articles were written to show you how machine code is used within a commercial program like Word Manager. It is not necessary to have a copy of Word Manager to understand the series as Francis talks about techniques, some of which have evolved over a period of time, and only uses examples from Word Managers coding.

This series is not aimed at a total beginner, it requires an understanding of Z80 assembler level coding. A beginners course is being written and will be appearing in *FORMAT* later this year.

Meanwhile try getting a copy of 'Spectrum Machine Language For The Absolute Beginner' edited by William Tang and published by Melbourne House in 1983 (ISBN 0 86161 110 1). It's now out of print but you should be able to get it through your local library. It tends to get a little bogged-down with Hex (which is really only used by some advanced programmers) but it's still the best you will find.

* + * + * + *



"It's got 512k of paged memory but I can't remember which section I put my 48k game in."

SPECCYROM ON SAM

By:- Ken Elston.

Many early Sam Coupe computers will be purchased by 48k Spectrum users who want to upgrade. Most of these new users will want to run their Spectrum software on their SAM. Is it possible?

Well, MGT provide part of the answer in the SAM package, the SAM Coupe Utility Tape contains a Spectrum Emulator which works with about 60% of games in the Spectrum top-twenty over the last year. But it wont work with the majority of non-games software.

Why? Well most games written by professional programmers will be self contained, making a call to a ROM based routine is a real sign of bad programming. However utility programs are often different, many try to pack in as much as possible and as calls to ROM routines save space, and the time needed to write their own version of a routine, they are often used. This is all very good, if the ROM stays the same (which the Spectrum ROM has done - more or less) but I can remember that lots of programmers fell down when Sinclair changed his Interface. One ROM several times.

So some programs wont work with the SAM utility because they make direct calls to a Spectrum ROM routine. The utility program supports some calls like tape loading, some printing to the screen, the RST 8 instruction and a few others. But MGT couldn't put a complete copy of the Spectrum ROM in their machine or Sugar would have their guts for garters. Although why he should complain, when he seems hell-bent on killing the Spectrum, is beyond me.

But, I'm please to be able to tell all you lucky SAM owners, there is a way you can insert a Spectrum ROM in your machine - NO, DON'T UNSCREW SAM - it's not necessary to open up your

Coupe to do the job. It's not a hardware fix but a software one.

First take one 48k Spectrum, one cassette recorder, a cassette lead, and a pinch of salt.. No forget that last bit, wrong recipe. Connect up your computer and recorder then type SAVE "SPECCYROM" CODE 0,16384 and press Enter. Start your recorder and press a key and your 48k ROM is now saving a copy of itself to tape (nice friendly chap the 48k). It only takes about 2 minutes to save so it's not too much trouble.

Once saved to tape you now need to get it into your SAM Coupe, so switch off the Spectrum and plug in your SAM. Type in the following short program and save it to another tape. Now type RUN <RETURN> and play your SPECCYROM tape. The ROM copy is loaded into page 3 of SAM's RAM. Pages 0,1 & 2 are in memory starting at 16384 when you first switch SAM on so loading to 65536 (64k +1) gets the code into page 3.

OK. So the ROM image is now in place, what next? Well a little bit of machine code is needed to rearrange the pages so SAM looks like a 48k Spectrum - with a 16k ROM from 0 to 16383 and 48k of RAM from 16384 to 65535. The data in lines 200 & 210 is poked into memory to do this, I used location 50000 as this is in page 2 of RAM which will stay in the same place after the routine is executed. The CALL 50000 sets memory to be pages 3,4,1 & 2. It also write-protects page 3 (were your ROM image is) and jumps to location 0 to start up the Spectrum ROM. I've included a listing of the machine code source so you can see what is going on.

SAM now thinks it is a 48k Spectrum, you should now have the Sinclair

copyright message at the bottom of the screen, and all 48k cassette software should load and run in the normal. Some games will run a little faster (up to 12%) and some music can sound a little distorted. If you find any programs that fail to work at all then I would like to hear about them. I'm sorry but there is no way that 128k software will run on a SAM Coupe due to the daft memory layout used by a 128k Spectrum.

By the way, you could insert PALETTE changes before the CALL 50000 if you want to change the Spectrums colours to your own selection from SAM's 128 variations.

If all this paging business is a bit difficult to understand then the article by Nev Young in this issue should help you.

SPECTRUM ROM LOADER PROGRAM

```

01 REM *****
02 REM * SPECTRUM ROM LOADER *
03 REM * for MGT SAM Coupe *
04 REM * (C)Copyright 1989 *
05 REM * FORMAT PUBLICATIONS.*
06 REM * *
07 REM * PUBLIC DOMAIN *
08 REM * RIGHTS APPLY. *
09 REM *FREE FOR PUBLICATION.*
10 REM *****
70 REM
100 REM first load Spectrum ROM
110 :
120 LOAD ""CODE 65536
130 :
140 REM now poke in m/c routine
150 :
160 FOR I=50000 TO 50008
170 READ N: POKE I,N
180 NEXT I
190 :
200 DATA 62,163,211,250,62,4
210 DATA 211,252,199
220 :
230 REM now call machine code
240 :
250 CALL 50000
260 :
270 REM SAM now thinks it is a
280 REM 48K Spectrum.

```

Now we come to the source listing

for the machine code paging routine. This was written using the OCP assembler on the Spectrum, you may need to make slight alterations for different assemblers. As you will see the source code is very simple and I have placed enough comments in the program to explain what is going on.

SOURCE CODE FOR PAGING ROUTINE

```

010 ;*****
020 ;* SROMLOAD V1.1 December 1989 *
030 ;* (C)1989 FORMAT PUBLICATIONS *
040 ;* *
050 ;* Spectrum ROM loader routine *
060 ;* for M.G.T. SAM Coupe. *
070 ;* *
080 ;* PUBLIC DOMAIN RIGHTS APPLY. *
090 ;* FREE FOR PUBLICATION. *
100 ;*****
110 ;
120 ;ORG program to be in top 32k
130 ;of memory (SAM slots CD).
140 ;
150         ORG 50000
160 ;
170 ;First bank RAM pages 3&4 into
180 ;slot AB and write-protect RAM
190 ;in slot A this will be Spectrum
200 ;ROM image.
210 ;
220         LD  A,163
230         OUT (250),A
240 ;
250 ;Then set video page to 4.
260 ;This also sets screen MODE 1.
270 ;
280         LD  A,4
290         OUT (252),A
300 ;
310 ;Now jump to start Spectrum ROM.
320 ;
330         RST 0
340 ;

```

It should be possible, although I think it may be hard work, to get other Z80 ROM images running in the same way. The Spectrum ROM works without alteration because the port addresses it uses are the same as the SAM Coupe port addresses. However, armed with the SAM Coupe Technical Manual and a disassemble of the ROM you are trying to port it will just be a matter of hard slog to get things working.



By: Nev Young.

Trying to explain how the Coupe memory works is a bit like trying to explain why water is wet. The explanation is either far too complex or far too simple. It is very difficult to find a middle ground.

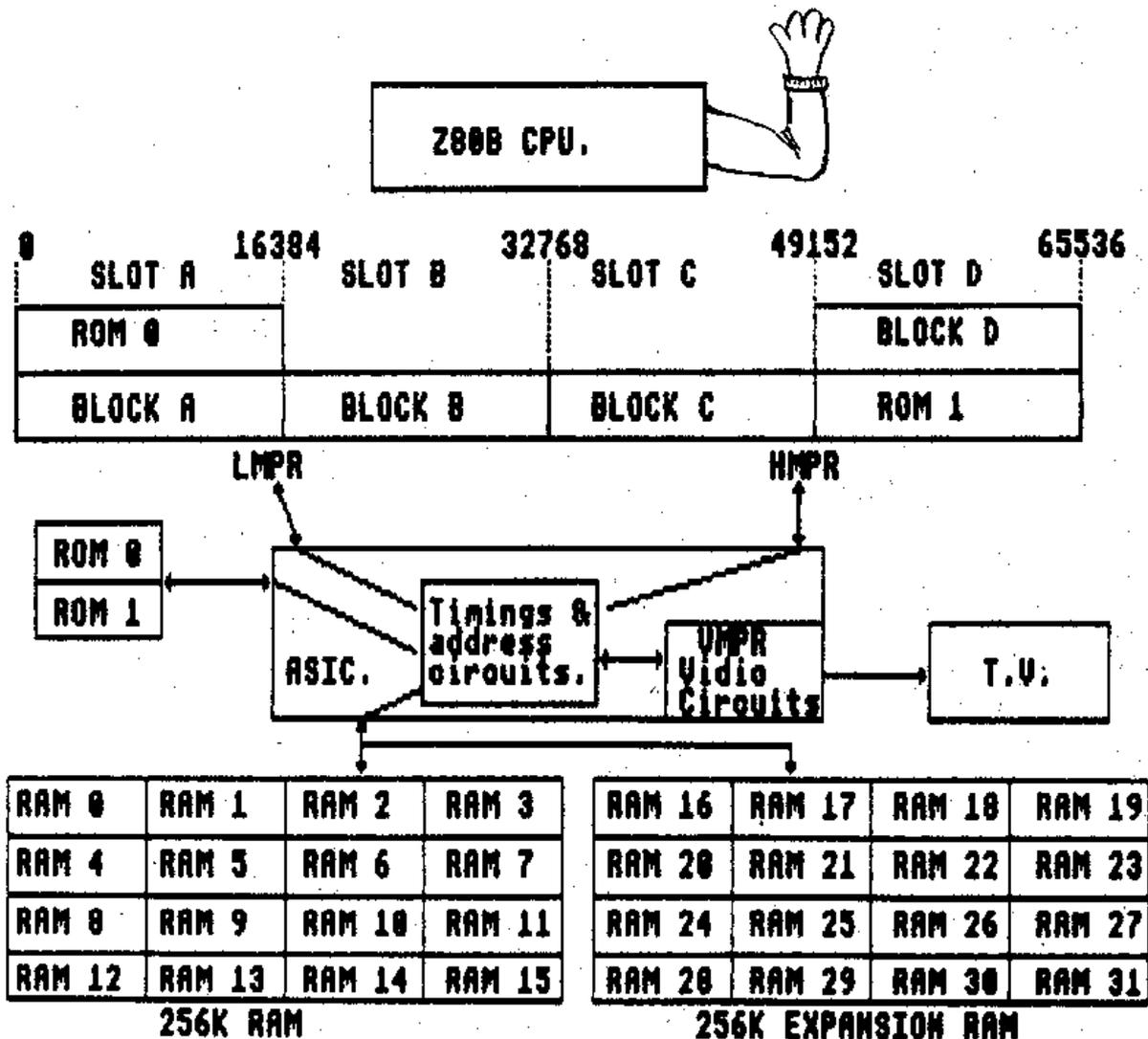
So instead I will give two explanations. Both true, but one is technical and the other is not.

Non technical explanation.

The Z80B is like a one handed blind man. In front of it there is a box with four slots. Inside each slot there is a block of data, written in

Braille of course, He is told the first slot is called slot A and holds addresses 0 to 16383, the next slot is called slot B and holds addresses 16384 to 32767, the third is called slot C and holds addresses 32768 to 49151 and the last is called slot D and holds addresses 49152 to 65535. As he has only one hand he can only have that hand in one slot at a time but because he is blind he can not see that the slots have trap doors in the bottom. One trap door for slots A and B and one trap door for slots C and D.

When the Z80B does an OUT instruction to port 250 (LMPR) or port



251 (HMPR) on the SAM Coupe the ASIC opens one of the trap doors and the two 16K blocks of memory fall out. The ASIC then puts two more 16K blocks into the slot and closes the trap door. But because the ASIC is a tidy beast the two blocks it puts through the trap door are always next to each other. For example if block 19 is put through trapdoor HMPR under slot C then block 20 will be put in slot D.

Any of the thirty-two 16K blocks can be put under any slot in this way. Obviously if the Z80B has its hand in slot A then it is safe to change the blocks in slots C and D and the same is true the other way around. There is nothing to stop the Z80B telling the ASIC to change the blocks that the Z80B has it hand on, But unless the memory has been programmed very carefully the Z80B will get lost.

Now by a clever trick when the Z80B tells the ASIC to change the blocks in the LMPR it is possible to put two blocks under slot A. One of these is normal RAM the other is the first 16K of the SAM ROM. The Z80B can only feel whichever is on top of the other, and exactly the same trick is used in slot D for the other 16K ROM. Whether the ROM or RAM is on top depends on the setting of bits 5 and 6 in the LMPR.

Now this is all very nice for the one handed blind Z80B but how do you get a picture on the TV screen? It may surprise some of you but the Z80B has got nothing to do with getting a picture onto the screen. The ASIC has a register at port 252 (VMPR) which selects which of the 16K blocks the screen starts in (in mode 3 and 4 the screen is 24K long and needs two 16K blocks the first of which is always an even number). Once this has been set the ASIC reads the memory and puts a picture onto the screen. The only time the Z80B can get at this memory is when it is put through one of the trap doors.

I can't think of any good reason for it but it is possible to have the same two blocks in both LMPR and HMPR and also in VMPR.

As you should expect, if the Coupe only has 256K of memory then there are only sixteen blocks of memory numbered 0 to 15. If you try and put any of the other blocks into the slots there will be NOTHING there.

The diagram on the previous page should help you to understand things.

In theory extram memory can be added on an external board, but this is not under the control of the ASIC so it could not be used for screen memory.

Techie description

Address line A15 from the Z80B chip is used to select the LMPR or HMPR register. The lower 5 bits of the selected register are used to provide address lines A14 to A18 that are combined with the Z80B address lines A0 to A14 to allow addressing the full 512K of memory.

The ASIC's video circuitry provides its own 15 bit address that, when combined with the lower 5 bits of the VMPR, provide a full 19 bit address to access the video pages.

Bits 5 and 6 of the LMPR are used to select the ROM in the first or last 16K of the Z80B memory map (slots A and D) as follows:-

LMPR bit 5 = 0 and
Z80B A14 & A15 = 0 - ROM 0 is active.

LMPR bit 5 = 1 and
Z80B A14 & A15 = 0 - RAM is active.

LMPR bit 6 = 0 and
Z80B A14 & A15 = 1 - ROM 1 is active.

LMPR bit 6 = 1 and
Z80B A14 & A15 = 1 - RAM is active.

With all other combinations - RAM is active.

Strange, but the techie description is quicker!

Next month - how to build your own nuclear power generator from everyday objects found in the kitchen.

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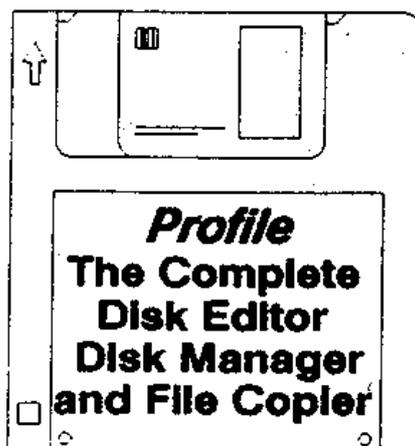
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