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GEMINI & NASCOM USERS

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EDITORIAL

Questionnaire

Well, I hope that it all went to plan, or else I'm about to make a fool of myself - but then that's nothing new! The theory is that with the last magazine a Questionnaire went to all of the subscribers to 80-BUS News. (The reason for my uncertainty is that this is being written before the other mag. has come back from the printers.) Now, the purpose of the Questionnaire (from now on referred to as `Q') is many-fold. Firstly it is to find out what equipment you are using - this will then let us know whether an article about, for example, the Polydos operating system, will be read with interest by the 25 per cent (say) of the readership that runs Polydos, or just by the author! Secondly there is a section asking what type of articles you like - this will influence whether we write more about hardware, software or more reviews etc. Thirdly, the section on your likely expansion and product desires will give us an indication of what general direction we should be heading in with you. Fourthly, depending on how modest you are (or aren't) in answering the `knowledge' part, we can establish the average level of competence, which will let us know how simple or complex we should get. And finally it will keep someone here (yes Dave, you've been volunteered!) out of mischief for a considerable time - assuming we actually get some response.

The Prize

When the `Q' went to press we decided that, as we usually get a pitifully low response to requests for input, we needed to offer a prize as an incentive. At the time of writing the `Q' we didn't know what this should reasonably be. Since then Gemini has stepped in and offered a prize of £100 (inc. VAT) of Gemini `Goodies' in the form of a voucher that can be redeemed at any Gemini dealer. In addition to this we will give 10 lucky people a free years subscription to 80-BUS News. So now you have 12 amazing reasons for sending in that `Q' that is still sitting next to your computer:

1 - the chance of £100 worth of goodies,
2-11 - the chance of a free sub.,
and 12 - the opportunity of being able to influence the contents of the mag. (Yes **YOUR** opinion really does count.)

Being the eternal pessimist what I am, I personally doubt that we'll receive more than a 20 per cent return rate, so PROOVE ME WRONG. After all, what weight will "70 per cent (of the 3 per cent of the readership that actually replied) wants the entire mag. to be about Comal" carry? Anyway....

This Issue

Somewhere in this issue you will find one of David Hunt's ramblings. Now the layout used is an experiment, and we would like your reaction to it. Please just scribble a note on your still un-returned `Q', on your re-subscription, on an article, or on a post-card, saying what you think. The cost of printing this mag. has slowly been creeping up and up, and we need to cover this. There are several choices: a) put up the subs (never a very popular idea), b) get the magazine typeset and thus smaller (difficult to justify for the relatively low number of magazines produced and for the additional cost, delays and loss of control incurred), or c) reduce the number of pages. I favour the latter, but one way of keeping the actual quantity of material the same would be to treat most of the magazine the same way as Dave Hunt's article (i.e. fit two pages onto one). Now even I don't know exactly what it'll look like until the magazines are returned from the printer, so I hope it is legible - please let us know what you think. Be seeing you.

P.S. For those of you puzzled by this issue's front cover, the answer is really quite simple. Read David Parkinson's article and think about one of the new features of the SVC!! Your answers with the next article you submit please.....

GEMPEN/DISKPEN – A Review of the New, Improved Version — By C. Bowden

A short while after I got my NASCOM 2, I saw NASPEN advertised, and I bought a copy. Having no Disks or Printer at that time, I really did not need a Text editor/formatter and NASPEN remained largely unused. The built in editors of ZEAP and BASIC fufilled all of my needs. When I upgraded my system to IMP Printer, Disks and CP/M though, I required an editor to write Assembly Language source files. I had to learn to use ED for this. ED is very powerful, but also very clumsy to use, after cursor type editing. (At least both the Gemini CP/M and SYS allowed me to screen edit MBASIC source code.) Then DISKPEN, a revised NASPEN running under CP/M, became available. I bought one, and soon learned to use it to write my Source files, and odd letters, and also started to do some real Text editing. After a while I added an IVC card to my system, and upgraded to GEMPEN at a very reasonable cost, to take full advantage of the 80 wide screen.

This situation continued until a few months ago when a new improved GEMPEN/DISKPEN was advertised. (From now on I will call it 'PEN'.) The cost of upgrading was again very reasonable, so I got the new version. The improvements are certainly worth while. Whilst previous versions will do most of the things that the average user needs, there were certain bad points. For example use of "D" instead of "d" could have fairly disastrous consequences. Such 'CASE' related commands have now been removed. Another big improvement has been in the provision of a 'HELP' command. Customization information is also provided. Another feature that greatly increases the scope and power of PEN is that it is also possible to load and run 'Overlay' files.

In 80BUS NEWS Vol 2. Iss.5 the Editor refers to WORDSTAR which is a very well known text processor program that runs under CP/M. I have used WORDSTAR, and it is a VERY powerful program. It can deal with Files longer than RAM Memory, which PEN cannot. Due to its power and complexity, there is quite a lot to learn if one is to become reasonably proficient, and I have not really devoted that much time to this, probably because PEN can do just about all that I require anyway, and is much more suited to system hardware, unless a lot of customizing is done to Wordstar. It is really a case of 'Horses for Courses'. If one needed to write anything longer than about 30-40K, or do something really 'Fancy', then WORDSTAR would be the better choice. The real 'Clincher' for most users would be the price, which is in favour of PEN by about 5 to 1.

PEN is available in a number of versions, but those to suit GEMINI or NASCOM Hybrid systems are the same. Minor differences can be patched as required. The PEN module is supplied on disk together with a number of other files. These are:

1) GEMPEN.COM or DISKPEN.COM	(10K)	Main Module.
2) PEN1.DOC, PEN2.DOC & PEN3.DOC	(98K)	Program Documentation.
3) CONFIG.DOC	(22K)	System Configuration Docs.
4) SPOOL/MAXIFILE/.DOC; etc.	(26K)	DOC's on OVERLAYS.
5) EPSON/CENT/NEC.LST	(8K ea)	.PRN's for Printer Config.
6) HELP.OVL	(14K)	HELP Overlay.
7) OVERD/MENU.OVL	(2K ea)	More overlays.

It will be seen from the above that extensive .DOC files are provided. Persons experienced in assembly language will be able to alter and Patch the main module to support other printers, or to change other system defaults. These may be patched using a debugging tool such as ZSID/DDT/GEMDEBUG. For example, I quickly altered my main module to support a GM827 keyboard, attached to my IVC Card. This is supported by PEN, but is not 'switched on' in PEN when supplied. I have also altered the default 'lines per page' to 20, and 'Line width' to 76 as I find 20 line pages ideal for 'skipping through' [Ed. - Mr. Bowden hasn't found the ^B and ^C commands.] and 76 wide does not seem to stop for Hyphenation so often. At the time of writing this, I have just bought an EPSON FX80 Printer, and I hope to change a few things in the printer tables. PEN contains tables for Proportional Printers but like the option for the GM827 keyboard, this is also switched off when supplied, also the tables are for Centronics and NEC printers, which will probably turn out different to those used by the FX80. To fully support reconfiguration though, it is necessary to alter HELP.OVL, and this is not easy, as the small bits of machine code in the file prevent it loading with an Editor. To make the support 'suite' complete, I feel that the source for HELP.OVL ought to have been supplied, since all of the other 'tools' to make alterations are supplied.

PEN can be entered in several ways. If the command PEN (Enter) is given, then it is assumed that a new file is being started and a default name $$$.PEN will be allocated. If a name is given, e.g. PEN STD.MAC - then the named file will be loaded if found on the logged in disk. If not found then the question NEW FILE ? Y/^C is asked. ^C allows recovery from a spelling mistake, whilst a "Y" will open a new file of the given name. Normal CP/M conventions are supported so that:

A>B:PEN A:TEST.DOC   is quite legal.

Note however that unless HELP.OVL is on B:, current USER or USER 0, or on A: USER 0, it cannot be loaded, so it is best to put PEN, and any .OVL files onto the default or A: disk before starting. Another good feature of PEN is that it much more forgiving than most Programs if a Disk suddenly 'fills up' since PEN allows one to change Disks without rebooting.

The top line of the screen displays the version number, current cursor line, and Bytes free. If the cursor is off the screen, an indicator shows whether it is before or after the displayed data. The bottom two screen lines are command status lines. This leaves 22 lines (IVC Version) free for text display.

In common with most text Editors, PEN operates in two modes - Command and Insert, and will be in Command mode when run up. Over 60 commands are available, although many are infrequently used. The commands fall into several groups, relating to specific functions such as Cursor movement, text formatting or disk access. The various groups may be displayed on the screen by calling up the HELP Overlay, by means of the "?" or ^E command. When this is done the lower part of the screen is cleared of text and a 'MASTER MENU' of 12 groups is displayed. Entry of the key letter will then call up a second, more detailed and specific display describing commands relevant to that group. It is thus possible to refresh one's memory on all commands at any time. When the HELP display is no longer needed, it may be removed from the screen.

The Insert mode is entered by either the I (i) - Insert, or A (a) - Append command. If I is used the cursor does not move within the text, wheras the 'A' command moves it to the 'end of text' position so is more suited to adding text at the end of an existing file. Either command causes the word 'Insert' to be displayed on the status lines at the bottom of the screen. The cursor is displayed as a flashing Left arrow in Inverted video and it is nondestructive. It is best to consider that ALL operations will occur at the place pointed to by the arrow. e.g. BS will delete the letter pointed to and characters under/after the cursor will move left/up. Any typed Characters will be inserted in the 'gap' pointed to, and text under/after the cursor will move right/down. This is different to editing in BASIC etc. where characters will 'overtype' unless space is created by shift/right arrow. The Insert mode is terminated by a ^Z.

A number of commands (also used in Insert mode) are available to move the cursor forwards or backwards through the text by units of one character/word/line/paragraph/Quarter page. The main cursor commands are Right and Left arrow, to move one character, Shift Right or Shift Left arrow to move one Word, Up or Down arrow to move one (logical) line, Shift Up or Shift Down arrow to move one Paragraph. In command mode, text can also be scanned in 'Pages'. The length of a page can be changed from the default value by using the '3' & '4' commands, to suit screen or Printer output. Page markers can then be inserted into the text, or removed at will, by simple commands. If Pages are marked forward and backward scanning is supported (8 or 9 commands). Any page may be printed (P command) and if the cursor is not moved, repeated printing of a Page is possible. More sophisticated printing is allowed under the Spool overlay.

It is important to realize that a line MAY NOT mean one line as seen on the screen. One normally enters text into a file by just typing words, spaces and punctuation, but WITHOUT pressing ENTER at the end of each screen line. The text will 'wrap around' onto the next line of the screen, etc., although some words may appear broken when the end of screen line is reached. In memory though, the text will be continuous. Thus a paragraph of say 200 words may be entered, and the cursor may be half way down the screen but the line counter will still say line 1, because the logical end of line is marked by a CR,LF sequence, which results from pressing ENTER, or from formatting. Half a dozen such paragraphs may occupy several K. of memory and take two or three screens to display fully, but may only register six lines on the status display.

When the text is formatted to the desired length however, the program will place a CR,LF at the end of every line of 76 (or whatever length set - N.B. These are .1" steps, NOT characters), and the line counter will display the correct count. Since the screen can only display 48 or 80 chars. on a line, any lines formatted longer than this will 'wrap around', and this will result in the line count indicator not agreeing with lines as counted on the screen.

Another consequence of the lack of CR,LF before formatting is that the UP/DOWN arrow keys will cause the cursor to jump the whole length of the logical line. This makes reaching the middle of a paragraph by cursor character or word commands tedious. The answer is to format frequently, or to press ENTER or RETURN fairly often when near the Right hand side of the screen. Formatting takes longer as the ammount of text grows, and it is not necessary to put the cursor to the start of the text each time a format is done. It can be placed at the end of the previous formatted part. If formatting is done on the last one or two paragraphs entered, it is very quick. The whole text only need be reformatted if changes are made near the start, or some other change is needed such as a different line length.

A minor criticism of PEN as far as I am concerned is that after formatting the cursor always moves to the start of the text. I would have preferred it to display from the position at which the format command was given. This is usually what I want to see after formatting so I have to step through the text until I find the required position again, which is a little annoying, although use of '*' and '=' commands (which are cursor position markers) would probably help. Source Code files are not formatted of course, and normally ENTER would be pressed at the end of each line.

In Insert mode anything typed except cursor commands and BS will be placed into the file. This includes a number of non Alpha-Numeric characters, which have a special meaning, and are 'embedded' commands to control formatting or printing. It is thus possible to indent, exclude from formatting, cause a printer to change character set or print mode and so on. PEN has around 16 commands to control printing.

A nice feature of PEN is that TAB characters show on the screen as a row of little dots. Since 'TABs' can upset formatting, it is useful to be able to 'see' them. (A formattable TAB character (^A) is available as an alternative.) Any area of text may be marked (^U) to exclude it from formatting, so that tables or lists that would be destroyed by normal formatting may be included. The ^U command is cancelled by a ^F command, to allow formatting to recommence. PEN also supports an Indent command (^R), which indents in steps of 4 spaces, and appears on the screen as (different) dots. This can help in building tables or lists, or just to indent the whole text. The Indent is reduced by the ^X command. If the commands are placed into the text in insert mode, variable ammounts of indent are possible. In command mode, the ^R and ^X commands operate on the whole text, so could be used to set a print margin, for example.

<u>Some Other Commands</u>

It is impossible to describe all of the commands in a review, so only a few will be described in any detail. Many commands are straightforward, no option commands. Potentially fatal commands are protected by 'Are you sure?'.

<u>Block Move/Delete</u>

Any block of text may be marked with a 'backslash' character at start and end. If the cursor is then moved to another place, the 'M' command will cause the marked block to be inserted at the cursor position. The origional block is not deleted. The markers may be removed by the 'N' command. Alternatively a '^D' command will allow block(s) to be deleted, but PEN first checks that it has the right block, as there could be several marked blocks throughout the text. Using backslash for the move markers can be inconvient to the C programmer as these are used as remark delimters within C. The information supplied with PEN makes it an easy task to choose some other less used character instead.

<u>Change Keyboard Case</u>

The 'U' command will reverse the Keyboard case, which is very useful since this saves much operation of the Shift key, depending on the type of file being edited. With the GM827 keyboard, which has a 'CAPS LOCK' key, it is possible to permanently set Upper case or Lower case, or to have Lower case/Shift upper or Upper case/shift lower. With a NASCOM and GEMINI keyboard in use together, a number of parallel options are possible!!

Kill Text

'B' will kill all text from cursor to the start of text, while 'K' will kill from cursor to the end of text. Smaller ammounts may be removed by using the Block Delete command. The 'D' command will kill text from cursor back to the previous 'New line', and so could kill several displayed lines. (See comment on lines above.)

Disk Commands

At any time a copy of the text in memory can be saved to disk by use of the 'W' command. Control returns to PEN. When the edit session is finished, the 'E' command will write the file to disk, and exit to CP/M. Editing can be terminated without writing to disk, by use of the 'Q' Quit command, but in this case the question 'Are you sure' is posed. In common with most programs of this type, two disk copies of a file are maintained, the most recent always becoming the Named file, whilst the other becomes the .BAK - Backup file. When the next edit is completed, the old .BAK will be deleted, and the previous master file will be renamed FILENAME.BAK. The newly edited file will saved as the new master, under the correct FILENAME.TYP. If the user wishes to retain the .BAK file on the disk before an edit, then it can be renamed. i.e. -
REN MYFILE1.DOC=MYFILE.BAK.
An unusual and very useful feature is the 'O' command, which change the name of the output file from within PEN. very useful for breaking bits of source code up into constituent parts, etc.

Another very useful command is the 'R' command. This will read another file from disk, and insert it into the file currently in memory, at the Cursor position. This is useful for things like Letter Heads, or EQUATES Source file listings.

Find Commands (with Replace option)

When activated, PEN prompts for the 'Find' string on the status lines. The required string should then be entered, and terminated with ^Z or ^C. A ^Z causes PEN to immediately start searching. If ^C is used, a second String is expected, and should be entered, terminated by ^Z. If a second string is entered, it can be used as the replacement string as described below.

The 'F' command will search the entire file, ('f' from current cursor position) and display any text that matches the 'Find String'. It will then stop. If 'ENTER' is pressed the next occurence is found. If the 'Replace' option is active, then pressing 'ENTER' will cause the String to be changed for the replacement option, and a further 'ENTER' will find the next occurence. Whenever a match is found, if 'SPACE' is pressed instead of 'ENTER' the substitution is NOT made, and the next match is sought. The last entered Find command can be re-activated, even after further editing, by use of the '^F' command. Appart from changing spelling mistakes, or replacing abbreviations, one nice use of this command is to rewrite 8080 Source files to Z80 Mnemonics.

Overlays

Overlays are a new feature of PEN. I am unable to comment on these in much detail because I have only had experience of the two supplied with PEN. The idea is good though, and it adds greatly to the power and versatility of PEN. The OVERLAY 'Menu' is activated by the '&' command, which displays a list of overlays that may be available and used. The 'OVERD' overlay for example, will display the Directory of a Disk, or allow deletion of files.

Some Other Commands

'1','2'	- Alter line length - .lin steps (for formatting).
'V','v'	- Change screen format (48/80 col)/Remove 'Menu'.
'*'	- Place a marker in text.
'='	- move cursor to marker and delete it.
'O'	- Allows renaming of the output file.
'J'	- Insert single Character. Avoids 'I','^Z' sequence.
'P'	- Print File. (To next Page marker, if any exist.)
'G','^G'	- Insert (Remove) Page Markers.
'Z',('Y')	- Move to Start (End) of text.

N.B. A few commands do not apply to all Versions of PEN, due to possible Hardware differences, particularly Screens and Keyboards.

Formatting

Although only a few commands relate to formatting, this is one of the main features of PEN. With a Formatter, one can type away without attempting to regulate the Right hand edge of the display, or relating to Compressed Print on a 15 inch Printer. One simply continues typing until say, a paragraph has been entered. At this stage, the screen display will be 'ragged' with some words broken at end of (screen) line. If the formatter is now invoked, the text will be adjusted so that all lines are of the same (preset) length, without any broken words. To achieve this PEN will add some extra 'space' characters to the line, at positions where a single space already exists, until the total count is correct. The net result is a very pleasing display. Occasionally PEN cannot continue because a word at end of line is too long, and there are not enough single spaces in the line for formatting. The text is displayed with the cursor pointing to the offending word, and one can hypenate ('-' command), or edit to get around the problem. PEN is not permitted to automatically hypenate as this could result in some odd effects. Three or more adjacent spaces are not adjusted, as these could be Indents, Tabs or similar required gaps. Two adjacent ENTER characters are not altered as this is taken to indicate end of paragraph.

The commands associated with formatting are 'S', 'L' and 'X', and they are protected by 'Are you sure' to avoid making a mistake such as formatting Source Code. The use of these commands is fully described in the .DOC's and there is little point in going into the differences here. Normally it is only necessary to place the cursor before the part of the text to be formatted and to issue the 'S' command, and confirm with 'Y'.

There are still a number of commands that have not been mentioned in this short review, largely concerned with setting up system parameters for screen display, formatting or printing, but it is hoped that what has been written will give the reader a good idea of the main features of the PEN family of text Editor/Formatter programs. While it is easy to criticise any Software, and I have mentioned a couple of things in this article, I think that the current issue of PEN will satisfy the Text Editing and Formatting needs of most Home and Small Buisness users in all but the most exacting of tasks, and is well worth the cost.

64k, or even 128k, on a RAM A Board?!

by P. A. Forrester

There are probably many Nascom owners who would like to have a full complement of RAM but who jib at paying over £100 for one of the 64k boards which can be purchased, and so most of us soldier on with our old RAM A boards. Some may have added another set of 8 4116s, using the `piggy-back' method described in INMC-80 (1). However, now that 4164 dynamic RAMs can be obtained for less than £5, I started to ponder whether a better solution might not be to abandon the 4116s and add a block of 8 4164s at a cost of about £35. After I had worked out how to do this, it seemed a shame to leave the other block of 8 sockets unfilled, so I splashed out yet again and added another set of 4164s to give me a total capacity of 128k. Since the Z80 can only address 64k at any given time, I had to find out how to page the additional memory in and out of the address space. This note describes how all this can be achieved. I will not attempt to give a detailed recipe of which tracks to cut where, but rather, will try to give sufficient information so that anyone with a bit of knowledge of digital logic should be able to follow what I have done. The conversion to 64k can be done without the addition of extra support chips, apart from a couple of inverters, and only requires simple mods to the circuitry, but the use of two 64k blocks imposes the need for some means of controlling which parts of the 128k of available RAM is coupled into the memory-map at any given time and this requires some additional chips; the way I have done it only takes 7 extra TTL parts costing in total under £2.

Let us start with a little background on dynamic RAM. This differs in several respects from static RAM, such as the 6116 discussed in 80-BUS News (2). Firstly, the chips we are interested in use address multiplexing; secondly, they have only two data pins, an input and an output; and, thirdly the data must be periodically refreshed. Also, because they are based on NMOS, rather than CMOS, the 4116 consumes rather more power than the equivalent-capacity 6116. Let us briefly consider the implications of these statements. Our understanding can be aided by Fig. 1, which gives the pin layout of the 4116 and 4164.

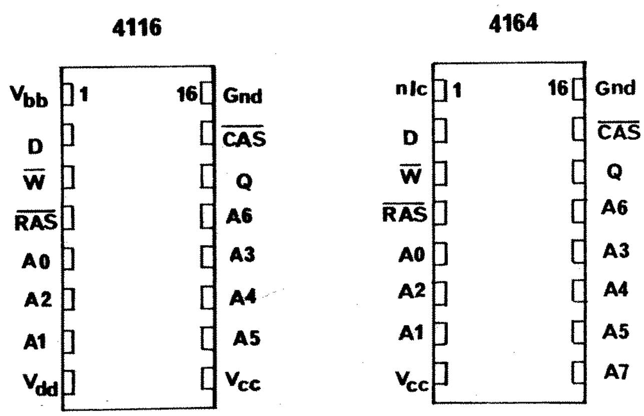


FIGURE 1

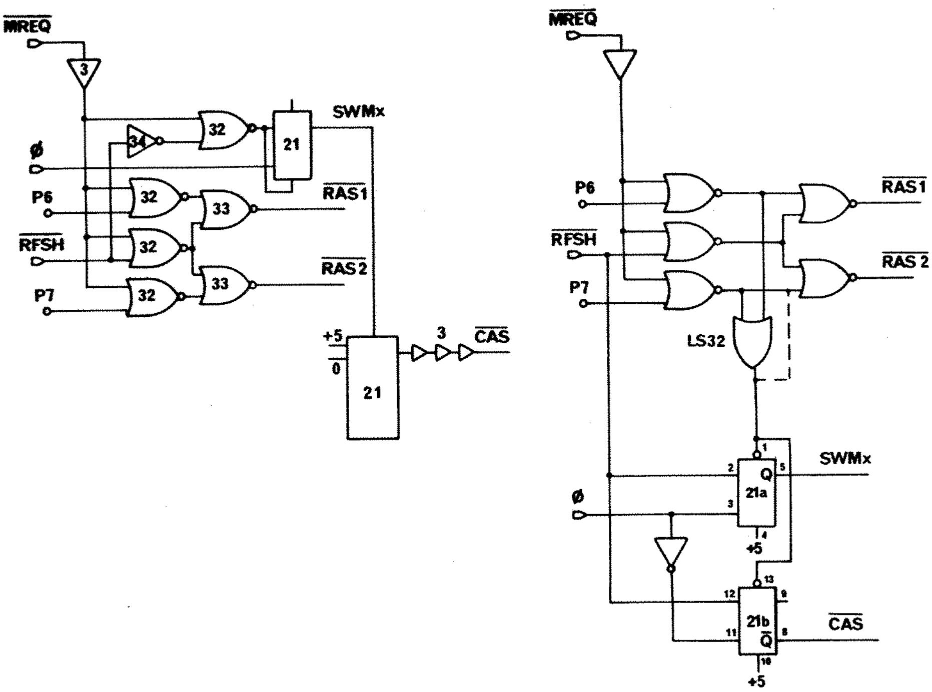
You see that the 4116 has only 7 address pins and the 4164 has 8. To address 16 kilobits, we need 14 address lines, and so these have to be fed to the chip in two parts. First the lowest 7 lines of the address bus are fed to the address pins of the chip and these are latched internally by applying a low on the /RAS (row address select) pin; then, the next 7 bits are fed to the chip and these are latched by pulling the /CAS (column address select) pin low. It is one of the functions of the board designer to ensure that the addresses and their appropriate latching signals are fed to the chip in the correct sequence. The 4164 operates in a similar manner but requires that all sixteen address lines are coupled in two groups A0 - A7, and A8 - A15. Setting up an address on the input latches gives access to one cell so that we can read or write one bit. When R/W goes low, the bit presented at the input pin D is latched provided /CAS is also low. The stored bit then appears at the output pin Q when R/W goes high. /CAS also acts as an output enable; when it is high, Q switches into the high-impedance state. Because only one bit is stored for each address pattern, 8 chips are needed to service the full data bus. Thus a block of 8 4116s give 16 kbytes and 8 4164s give a full 64 kbytes. This is in contrast to the byte-mapped 6116, where a single chip can be used to provide a block of 2 kbytes.

The other main feature of dynamic RAM is that the charge in the memory cells slowly leaks away and has to be replenished periodically by rewriting. Each cell has to be refreshed within a time less than 2 mSec for the 4116 and less than 4 mSec for the 4164. This is another feature which has to be provided by the memory board designer. Fortunately, the problem is not as complex as it first appears since cells in the same column can be refreshed in parallel by applying an address to the rows only which is strobed by /RAS. Provided all row addresses are strobed during the stated period, refresh is assured. During this process, /CAS is held high which minimises power consumption and ensures that no data is placed on the data bus during refresh cycles. The refresh process occurs during the second half of the opcode fetch cycle, and the Z80 provides a 7-bit refresh counter which makes this part of the memory board design fairly straight-forward. However, when selecting 64k chips a little care has to be taken since, for example, the Texas 4164 requires an 8-bit refresh cycle and therefore presents problems when used with the Z80. Also, some chips, such as the Motorola MCM6664, have an internal refresh counter but require a strobe pulse to be applied to pin 1 to clock the counter on. You should therefore use 7-bit refresh chips which do not utilise pin 1, such as the Mostek MK4564, the Fujitsu MB8264, the NEC uPD4164, etc. The ones I actually used were Motorola MCM6665AP20s.

The 4164 is simpler than the 4116 in that it can operate from a single 5 volt supply, so the -5 and -12 volt supplies will not be required in the new layout. A further advantage of the 4164 is that it actually consumes less power than the 4116; the 4116 typically consumes only 125 mW when running and 17 mW on standby, whereas the correponding figures for the 4116 are 460 and 20 mW respectively. Let us turn now to the circuit modifications required to add a single set of 8 4116s to the RAM A board, and after that we will go into the additional circuitry to achieve paging for the 128k RAM. Incidentally, if your copy of the circuit diagram is an minute as mine, you will probably find the use of a magnifying glass helpful to see the fine details of the circuit.

The first item which must be attended to is the address multiplexing. For the 4116s, A0 to A6 are multiplexed with A7 to A13 by IC20 and IC21, which are 74157 quad 2-to-1 line data selectors. The two remaining lines, A14 and A15, are decoded by IC24 to produce 4 16k decodes - we will utilise these for paging the 128k RAM. For the 4164s, A0 to A7 must be multiplexed with A8 to A15. It does not actually matter which lines are multiplexed together as long as the components of each pair come from the two different groupings, and that A0 to A6 are coupled as a unit to the RAM chips and latched by /RAS so that refreshing is performed correctly. Unfortunately, in the original design, A0 is switched with A7 which is not allowed, so A7 must be disconnected and replaced by A14, which can be picked up from pin 15 of the 74LS75 address latch IC25. All the remaining pairs can be left unaltered, which leaves A7 and A15 to be dealt with. As currently configured, the remaining inputs on IC21 toggle between 0 and +5 volts to provide the /CAS signal via three buffers in IC 3 which provide a short delay to allow the address lines to settle. It seemed to me to be more straightforward to use these inputs to toggle between

A7 and A15 to provide the additional RAM address line A7′, and find some other means of generating /CAS. Therefore A7 is removed from IC20-pin3 and taken to IC21-pin 13 and the connection to earth removed; A15 is picked up from IC25-pin 16 and taken to IC21-pin 14, and the 4K7 resistor removed. The complete set of 16 address lines are then multiplexed by IC20 and IC21.



(a) FIGURE 2 (b)

Now we have to produce a /CAS signal with an appropriate delay to replace the one generated by the multiplexer. There are various ways in which this could be done but an elegant solution, using only a single 74LS74, was shown recently by D. Allen (3). His circuit is shown in Fig. 2(b), and the relevant part of the original RAM A circuitry in Fig. 2(a). The latter uses only one half of the 74LS74, but by rewiring IC21 to the form of Fig. 2(b) both /CAS and the switch signal SWMx for the multiplexer can be generated. This works as follows: when /MREQ and /CS go low, /RAS is generated, thus latching the row address A0 to A7. At the same time, the reset line of both flip-flops goes high. The D input is /REF, which is high during memory access cycles, and so on the first positive edge of the system clock after /MREQ, IC21(b) flips, which switches the A8-A15 to the RAMs. On the next negative going clock edge, IC 21(a) flips /CAS low, latching the column addresses. During refresh cycles, the D input to both flip-flops is low and so neither switches and /CAS remains high, although /RAS goes low to strobe the row addresses providing refresh.

Fig. 3 shows waveforms derived from my modified board using the shortest program I know which is xx: JR xx in assembler, or 18 FE in hex. When loaded anywhere in memory, this program repeatedly accesses that address. The waveforms were obtained with an 8-channel Tektronix 7D01 Logic Analyser with a time resolution of 20 nSec. Two complete cycles are shown; note the sequence of the /RAS, SWMx and /CAS signals and how the A0 line toggles during each refresh period. In this arrangement, /CS, which is applied to either P6 or P7 depending upon which block of sockets is used, can, in principle, be tied to earth; however, see below. Also, the 74LS32 OR gate, which drives the 74LS74 flip-flop reset-pin high when either P6 or P7 and /MREQ are low, is not required if only the 64k version is to be used. It is then sufficient to tie the reset pin to the OR gate output as indicated by the dotted line. The inverter for the clock input to the flip-flop can be taken from pin 9 (input) and pin 8 (output) of IC 34 which does not appear to be used in the original design. Both the extra address line A7′ and the /CAS signal should be coupled to the RAM via 33R resistors to reduce electrical noise and ringing.

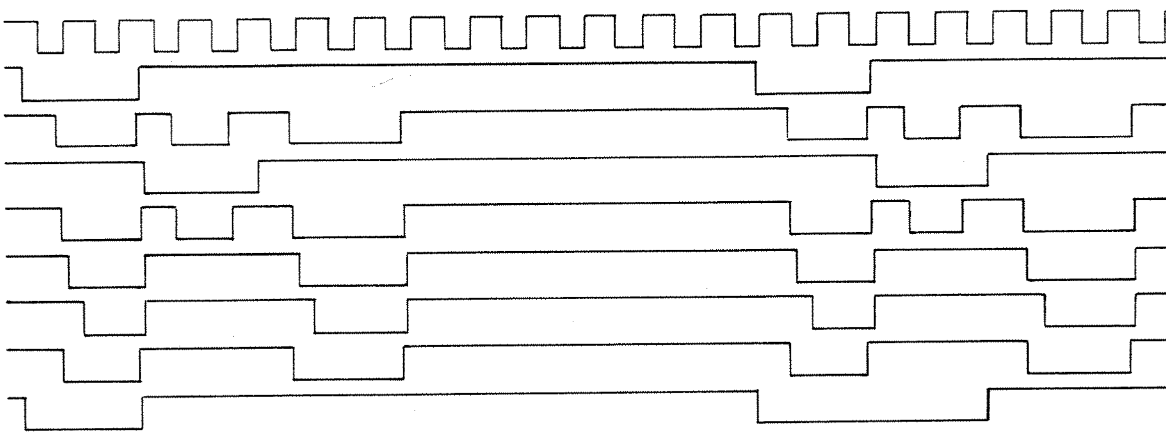


FIGURE 3

When it was first tested by writing a block of identical bytes using the NasSys C command, the RAM showed a lot of corrupted bytes. The reason for this took me many hours to uncover. Eventually I discovered that the read/write line on pin 1 of the data bus buffer IC 2 suffered from spurious negative pulses of about 50 nSec duration. These pulses occurred every time the /RAMDIS signal was activated. This line goes low about 50 to 60 nSec after /MREQ; thus, with /CS on P6 or P7 held low, the buffer is put into the read state as soon as /RD and /MREQ go active. Now if this is the start of a read-cycle of memory on the main board, the read buffer on the RAM board should not be activated, but it does not know that for 50 nSec or so, until /RAMDIS goes active. As designed, P6 or P7 are fed from the decoders IC 22 and IC 23, or IC 24, and these, together with the address latch IC 25, produce sufficient delay that /RAMDIS goes low before /CS and hence there is no timing problem. The solution which seemed to be most simple was to produce a version of /MREQ delayed by about 60 nSec, and apply it to the NASCOM SEL pin (which is coupled directly to bus line 11); this stops IC 36 from going low until after /RAMDIS goes active, if it is going to. I used two gates from a CMOS 4049 inverter connected in series, which produces sufficient delay. This is the only additional chip which is required to complete the 64k conversion. I must confess that I thought I still had problems, even after applying the delay, but this turned out to be nothing to do with the modified board, but rather, that I was testing it using a 10 inch extension board to give me more ready access to the RAM card; it turned out that this introduced sufficient spurious fluctuations to the bus lines to cause corruption of some of the data. Finding this also wasted a considerable amount of time - so be warned. With all the bugs removed, the board functioned perfectly without wait-states at 4 MHz.

If you do not like the thought of cutting up the tracks of your board until you are sure that these modifications will work, you can get round this by putting the ICs which require circuit changes to be made into new sockets; they should be the type with the pins oriented so that they can be plugged directly into the original IC sockets (you may have some difficulty finding this type). The new sockets have those pins which require modifications bent out so that they are accessible for soldering; they are then inserted into the original sockets and the rerouting of the wiring made to the bent-out pins. This technique can be used for a permanent modification and leads to quite a neat job but do not forget that the 5 volt line should be decoupled at each memory chip.

So that is all you have to do to produce a full 64k conversion job. Adding another 64k follows along the same lines, with the /CS for that block being taken from P7. The 74LS32 OR gate needs to be added to ensure that the flip-flop reset pin goes high when either block 1 or block 2 is selected. However, adding this additional gate led to another problem; on my board, the rising edge of the clock occurs almost simultaneously with the generation of the /RAS signal so that SWMx is produced within a few nanoseconds after /RAS. Even though the RAM specification states that the address should remain stable for 20 nS following /RAS, the unmodified board and the 64k version appear to work happily. However, the delay introduced by the OR-gate (even using the higher speed 74S32) causes the flip-flop reset to go high after the clock transition, which upsets the correct phasing of SWMx and /CAS. The solution is to delay the clock signal applied to the flip-flop by inserting four 74LS04 inverting buffers coupled in series between the clock signal from the bus and the flip-clop clock pin, which introduces a delay of about 30 nSec; this appears to be sufficient. I believe that similar modification to the original board was suggested in an early issue of the INMC to delay the generation of SWMx and /CAS, but I was unable to find a reference to this.

We now have to select which block, or part of a block (which we will call a page, following the usual custom) is coupled into the memory map. If you are content to couple in either one block or the other, you only have to toggle one bit derived from the PIO, so that when P6 is up P7 is down and vice versa. Provided you have NasSys overlaying the RAM you can keep control by using the O command. However, greater flexibility is achieved if you are able to couple in any 16k page from either block. One way of doing this is shown in Fig. 4; the 74LS75 4-bit latch is partly decoded as port 3 - this fits in with the partial decoding of the other ports used on the N2 main board; you can, of course, fully decode it to be any other number between 9 and 255, but then /IOEXT must be generated too. The four Q outputs from the latch are ANDed with the four 16k decodes which appear at the points labeled 0 to 3 on the RAM board, and the outputs ORed to produce a /CS for the first block of RAMs on P6. The /Q outputs are treated similarly and fed to P7. This ensures that there can be no contention between the two RAM blocks. Since /CS acts as the output buffer control line, it must only activate one block at a time; this is ensured using the 74LS32 to create logic-low AND gates with the inputs P6 and P7 to give two /CS lines, one for each block. Control of the paging can then be done by writing to Port 3, either statically by using the NasSys O command or as part of a program by using the out instruction. O 3 0 selects the whole of block 1, and similarly O 3 F selects block 2, while O 3 3, for example, maps pages 1 and 2 of block 2 and pages 3 and 4 of block 1 into the memory map.

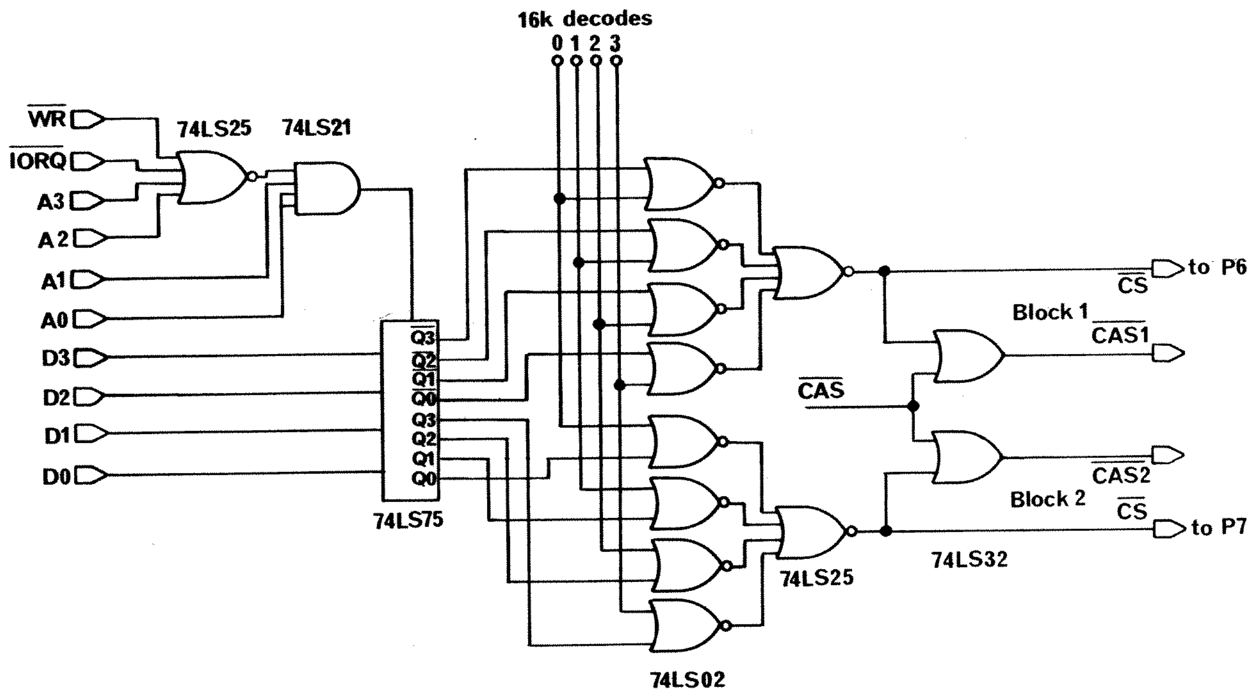


FIGURE 4

I built the additional circuitry on a 3 by 4 inch piece of Vero card which was mounted about 2 cm. above the main board; it was held at one end by wire-wrap pins which plugged into the empty EPROM sockets and was supported at the other end by two insulating pillars. These were held in place by fine insulated wire threaded through convenient holes in the boards. Connections to the various signal lines were then made by soldering to the IC socket pins on the underside of the main board. This made a reasonably neat arrangement of what is essentially a bodge job.

256k RAM chips are now becoming avaiable, but unfortunately they currently cost about £50 each, so even a single block would cost £400, which is beyond the reach of most of us. However, the price projection is that they will be under £10 by mid-1985. These chips require a full 8-bit refresh cycle and a little thought is required to toggle the A7 line at the appropriate times during refresh; a number of ingenious solutions have been suggested in various electronic journals. I wonder who will be the first to upgrade his RAM A board to half a megabyte?!

[1] INMC 80 News Vol 3, Feb-Apr 1981, page 16-17 see also 80-BUS News Jan-Mar 1982, page 12.
[2] 80-BUS News Vol. 1 Issue 3, July-Oct. 1982, page 21-23.
[3] D. Allen New Electronics Vol. 17 No. 5, 6th. March 1984, page 26.

An Insight into the Gemini IVC and SVC Part 2

By D. W. Parkinson

THE GEMINI SVC

To continue from where we left off ... The SVC is a close relative of the IVC that is upwards compatible with it, but offers extended features and greater power. The extra features that have arrived with the SVC are summarised in table 1.

I'll start by taking various of the hardware changes that have been made and indicating the software benefits that have been gained.

SCREEN MEMORY/CHARACTER GENERATORS

The IVC had a 2k x 8 static RAM for the screen memory, a 2k x 8 EPROM for the main character generator, and a 2k x 8 static RAM for the alternate character generator. With the SVC design these have been combined into a single 8k x 8 static RAM. The 8k of RAM is partitioned in various ways depending upon the selected display mode (see Figure 1). When in alpha mode the RAM is actually accessed twice per character. The first time is to pick up the character from somewhere in the lower 4k, and the second time to look-up the appropriate row of dots for that character from the upper 4k.

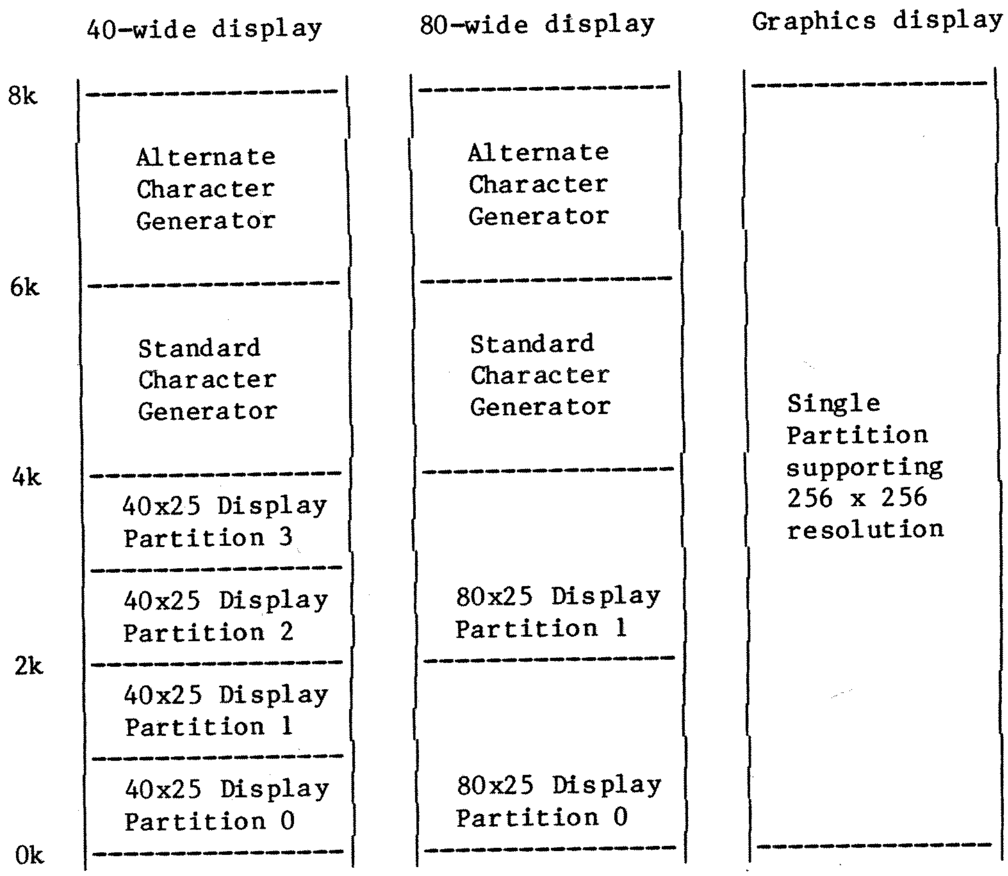


Fig 1. Display memory image

With the SVC the character set is now totally programmable. The initial character set is held within the monitor EPROM, and is copied out into the top half of the screen RAM on power-up, or whenever alpha-mode is reselected following a graphics display. The SVC-MON also holds various foreign character sets that can be selected by means of an on-board DIL switch. (The character generator is actually intialised with the English character set, and then, depending on the DIL switch settings, a small sub-set of characters may be overwritten by their foreign language versions.)

The two standard alpha display modes are now 80 x 25, (80 characters by 25 lines) and 40 x 25. With the increase in the size of the alpha screen memory from 2k to 4k, (remember the other 4k is used as a character generator), it was decided to add the concept of multiple `screens´. I felt that this offered certain advantages over treating the 4k of memory as a single screen, although the latter would offer the possibility of being able to scroll back through the last 50 lines (or 100 lines in 40-wide format) that had been displayed. With the `multiple screen´ concept you can select (via an escape sequence) which of the available screens is to be displayed, and which is to be updated by the incoming data/commands from the Host. My reasons for doing this I list below, but I must confess that reason (1) was perhaps a little selfish!

1. It required a very small change to the existing software to support it.
2. This feature had zero impact on the current performance of the SVC. (The alternative approach would have meant scrolling 4k of data, and also added the problem of handling any `locked´ screen lines.)
3. It allows programs to set up hidden `help´ screens that can be switched to instantly.
4. It simplifies (possibly) the implementation of concurrent tasks. (If you want to have two tasks running concurrently with independent screens on a system with an IVC there is the problem of how the undisplayed screen is handled. There are two options open: a) Queue all console output for the non-displayed task, wait until its screen image is swapped into the IVC, and then send it. Or b) Duplicate all the necessary parts of the IVC monitor in the system software so that the screen image can be updated immediately.)

When set into the graphics mode the SVC uses the entire 8kx8 screen memory as a 256 x 256 pixel display. (No colour, it´s black-and-white only I´m afraid!) As a result the RAM based character set is lost, although the default character set is still present within the monitor EPROM. The SVC will still display text in this mode, but the format is now 32 characters/line and you are restricted to the English character set. (Each incoming ASCII character is used to index into the EPROM-based character generator table from whence the bit patterns are copied out into the screen RAM. I have not as yet included any check for special sub-set characters, nor the subsequent check of the DIL switch settings to see if these should be modified.) Any enterprising Dane or German who is irritated by this could swop the relavent dot patterns of the subset characters in the default table with those in their language table, not forgetting to exchange the words `English´ and `Danish´ (or whatever) where necessary in the manual.

ATTRIBUTES

The IVC only offered one attribute - the selection of the alternate character generator. This is normally loaded with the complement of the main character set to give video-inverse characters.

The SVC offers a variation on this theme. For various reasons the screen memory word width remains at 8 bits. This, as before, leaves a single bit that can be used as an attribute bit. But the SVC, unlike the IVC, allows this bit to select a variety of attributes. So setting bit 7 of a character can select one or more of the following attributes:- use the alternate character generator, blink the character, half intensity character, and, display the character with a half-tone background. Note that I said `one or more´. The SVC supports an escape sequence that is used to select which attributes you want. You can select any combination of the above, e.g. blink + half-intensity, but the one thing to remember is that with only one attribute control bit available, all characters on the screen with this bit set will respond in the same way. Therfore it is not possible to have inverse characters on one part of the screen, and half-intensity characters on another part.

One apparent omission from the attribute list above is that of inverse video. This was originally included as a specific attribute, but was later dropped in favour of the half-tone background. It is assumed that inverse video is provided in the usual way via the alternate character generator.

TRANSPARENT ACCESS & ESP

With the SVC, a hardware technique is used to achieve transparent access. On the face of it all that has to be done is to connect the `display enable´ (or `display active´) signal from the display controller via a few gates to the Z80 /WAIT input. Thus, if the processor attempts to access the screen memory while the display is active, it is made to wait until the end of the display period, after which the Z80 is free to continue with its read/write cycle. However a problem arises when the Z80 finds, on going to access the display memory, that the display is inactive. The dilema here is that although the display memory is free at that instant, the display controller may start a new display line at any moment (like in the middle of the forthcoming read/write cycle of the Z80). If it does, this will lead to one of two outcomes: a corrupted read/write cycle, or interference down the left hand side of the display depending on which controller gets priority.

This is where ESP comes in. The arbitration circuit has to know whether there is time for the Z80 to complete its read/write cycle without interruption, or whether the /WAIT signal should be applied immediately as the display controller is about to start a new display line. Those of you who have followed the description so far are probably thinking - `ah! you just generate or tap off an earlier version of the Display Enable signal and use that´. Unfortunately this is easier said than done as the `display enable´ signal generation circuits are buried deep inside the 40-pin plastic package of the display controller and only the final signal emerges on one of the pins. (That´s what modern LSI does for you!) There is a way around this problem and that is to apply a classic wartime (and peacetime) ploy of mis-information. What happens with the SVC is that some external delay has been added to the `Display Enable´ signal, and in setting up the internal registers of the controller, the SVC monitor informs it that the first address of the display is a byte earlier than in fact it is.

The following simplified description assumes a screen format of 80 x 25: When the display controller displays a TV line it loads its display memory address register with the starting address of where the current line of characters is stored in the memory (lets call it N). The address register is then incremented at the character rate for the entire TV line width (64uS) after which it is reset for the next line. If it is still working through one of the 25 `character' lines on the screen then it is reset to N and the character generator `line' address is incremented by one, otherwise it is reset to N+80 to select the next line of characters. When the display line starts the controller turns ON the `display enable' signal. This is turned OFF after address N+79 is passed. Then, as further pre-programmed character positions are passed, the controller generates the Horizontal Sync pulse, and finally the internal reset signal for the counter.

From the information we have given it the controller thinks it is displaying characters N to N+79, but by playing around with the external delays we actual display N+1 to N+80, and in the process gain sufficient advance warning of an active display line to prevent any unseemly clash between the Z80 and the display controller. As the controller has been fooled over the start of the display, it also has to be mis-informed about the cursor position, a task that the NMI routine carries out as it updates the internal registers of the controller.

INTERRUPTS

With the display contention problem solved by hardware, various other changes could be made. One was the use of the interrupt system. Previously, with the transparent screen access being determined by software loops, interrupts could not be used as they could interfere with critical parts of the loop. With the SVC, keyboard input is now done under interrupt. Also, while the SVC-MON is scrolling the screen (with an LDIR instruction), it enables an interrupt routine to collect and buffer incoming characters from the Host. Normally the SVC-MON polls for input characters.

KEYBOARDS

An option for a serial keyboard has been included in the SVC. This is an either/or option with the parallel keyboard, not an AND one, as they both share the same IO port (on the SVC) and some of the interface circuitry. The serial keyboard requires fewer wires to interface it, and this leads to lower cost. (See the latest Gemini price list - The multi-core `curly-wurly' cables for the parallel keyboard cost a fair bit! The difference in price solely reflects the cabling costs. There is no difference in keyboard costs as the change required on it was only a small one in the on-board software. (The keyboards use an 8035 single-chip microprocessor to scan the key matrix and generate the appropriate ASCII codes.)

NMI

As with the IVC, on the SVC the vertical sync output of the display controller is connected to the NMI input of the on-board Z80. However the SVC NMI service routine performs different functions. It no longer scans the keyboard as that has been transfered to a conventional interrupt routine (see above). It handles the timing of various attributes. The tone generator for the on-board bleeper is directly enabled and disabled by the SVC monitor and thus the duration (but not the frequency) of the `bleep' is fixed at an integral number of NMIs. Similarly the low frequency waveform used to `blink' characters is also generated by this software. One other feature, mentioned by Dave Hunt in the last issue, is the implementation of a software `clock'.

One point to bear in mind when you start thinking `wouldn't be nice if..' is the fact that the NMI routine is executed once every 20mS. The larger and more cumbersome it becomes, the more it is likely to have an impact on the general performance of the SVC. Thus the NMI software is written for speed, and tries to avoid specialised checks for unlikely occurences. (See below for the ramifications.)

THE SOFTWARE CLOCK

The SVC supports supports a software clock that works on the basis that NMIs are occuring at the rate of one every 20ms. (This assumes that the CRT controller's registers have been set up correctly.) A software counter repeatedly counts down from 50, and every time it reaches zero (once a second) an internal ASCII digital clock display is updated. After updating the clock the software checks a flag to see if it is to be displayed. If the flag is set, the clock is copied to a predetermined position on the screen. The default display position for the clock is at the top right of the display, but, by sending the appropriate escape sequence, it may be positioned anywhere on the screen.

Note that the clock software in the NMI routine only spends time updating the screen once per second when the internal ASCII clock is advanced. For the other 49 `ticks' of the clock no time is wasted updating a (probably) unchanged display. One other `feature' that resulted from the basic NMI philosophy of minimum overhead is that the SVC supports a 60 hour clock rather than the more usual 24 hour clock! The updating software does not include a check for the special case of the hours. This fact will only be noticed by those who burn the candle at both ends. (It would have been interesting to have kept quiet about this, and seen if it was ever reported as a bug. My feeling is that it would have been a year or two before anyone noticed it, and then it would probably have been by accident.)

GRAPHICS SOFTWARE

My intention with the initial graphics software was to provide the fundamental routines on-board where the graetest speed advantage could be obtained, and to leave the neat user interface and extended features to an intermediate interface program. (e.g. The Gemini/CCSOFT GRAPHPAC package.) Thus for example there are no Escape sequences for `pen-up' and `pen-down', or for relative plotting. The basic escape sequences deal with absolute coordinates, and include the pen-up-down command within them.

The routines included offer: Pixel set, reset, and test. Line drawing. Circle drawing. Flood fill.

The algorithms I used were simple and orientated towards speed. They only use addition, subtraction. There is no multiplication or division involved other than by a simple shift for division by 2. In this first release of the SVC-MON I concentrated on simplicity, and so certain possibly desirable features have not been included. (e.g. All the line drawing is done with a single line type - a solid line. There is as yet no option for dotted lines, dashed lines, or whatever.) The circle routine draws a true circle, there is as yet no support for drawing ellipses. (Depending on how your monitor is adjusted you might have to draw an ellipse in order to get a circle displayed!)

Internally the SVC graphics routines use 16-bit arithmetic. Although this does have a small impact on performance it also has two advantages.
i) It offers a possible upgrade path sometime in the future if Gemini should ever produce a card with higher resolution.

ii) Any over-sized plots that go off the screen re-appear in the correct place when they return within the bounds of the display. There are no sudden `wrap-around' problems that wreak havoc on some displays.

The graphics origin has been placed at the bottom left of the screen to line up with the pencil-and-paper convention. This also aligns with the approach taken by Hewlett-Packard in their extensive range of desk top computers, (98XX series, series 200, etc). These are widely used throughout Industry mainly in engineering applications.

There is also a `flood fill' routine that, given starting coordinates X,Y, will fill the enclosed area that includes X,Y. This routine will fill polygons of any shape, and is fast in operation. The hardest part of developing the `fill' algorithm was reducing the amount of workspace required by it. In escence a fill routine is very simple if recursion is allowed and a simple `C' implementation is shown below.

```
fill(X,Y)
int x,y;
{    if(test(x,y) return;        /* stop if point is already set */
     set(x,y);                   /* ..else turn point ON         */
     fill(x+1,y);                /* Now check adjacent points    */
     fill(x-1,y);
     fill(x,y+1);
     fill(x,y-1);
}
```

This routine will do the job. The drawbacks of it as it stands are various. If it fills an empty 256 x 256 screen in the worst possible order the routine FILL will call itself 65,535 times, requiring a stack depth of about 128k together with another 256k required for the new values of X and Y that are generated on each CALL to FILL. The problem can be eased by making FILL fill in a line at a time instead of a point, but it still requires a fair amount of memory.

I ended up using an algorithm that utilised a FIFO (First in First Out) buffer rather than recursion. (You could regard recursion as a LIFO - Last In First Out - buffer.) This reduced the workspace requirements considerably. In fact I found that I could fill very complex shapes with only 128 bytes of workspace. However the FILL routine did drop out when I was filling a particularly complex shape with the software clock also present on the display. (It gave up as it was filling around the numbers of the clock display.) Up to then I had managed to keep my hands off the 1k of memory on the SVC that was reserved for downloading user programs into. As this memory sits there unused in 99% of cases I decided to grab it for the FILL routine, but to temper this impudence by implementing an `intelligent' grab. What actually happens is this:

If no user program has been downloaded the FILL routine will use the full 1k as its workspace.

If a user program has been downloaded, then the FILL routine will use 3/4 of the remaining space as workspace. (i.e. If a program 227 bytes long is downloaded, the FILL routine will grab the last (1024-227)*3/4 bytes of the 1k RAM area for its buffer.)

This I believe is an acceptable approach as it is only likely to affect the 0.000001% of users who download 1k user programs while using the graphics fill command at the same time.

As a brief aside on FILL routines - You can always tell a recursive based FILL routine, as, when it is filling a complex area, there are often pauses while nothing apparently happens on the screen. What is actually happening is that the FILL routine has just filled to a `dead end`, and there then follows a period where the recursive structure `unwinds` itself, returning from layer to layer back up the stack until it finds an area that it has not yet filled.

BUG TIME

Well folks, it had to happen. Between writing the first part of this article and completing this one someone has unearthed a bug that is present in both the IVC and SVC monitors. That fact that it has taken so long to surface is indicative that none of you are likely to have met it yet (otherwise you would have reported it - wouldn't you?). It is in the ESC "f" ... sequence that allows you to redfine the function keys from a program. If you try and `undefine` a key using this sequence the key is not actually fully deleted from the function key table, and if the key is subsequently pressed something will be returned to the host system. What the `something` is cannot be easily predicted. Key definitions can be removed totally from the table, but only by using the Shift/Edit feature direct from the keyboard.

TABLE 1: Extra features of the SVC

HEX	ASCII	DECIMAL	COMMAND
General			
07	^G	7	Bell - sound on-board buzzer
Cursor Movement			
1B 0C	<ESC> ^L	27 12	Cursor home
Screen format			
1B 34	<ESC> "4"	27 52	Select graphics mode
1B 70...	<ESC> "p"...	27 112...	Select display/update partition
Character set			
1B 67...	<ESC> "g"...	27 103...	Set language
1B 62...	<ESC> "b"...	27 98...	Read back character set
256x256 graphics			
1B 52	<ESC> "R"...	27 82...	Reset point X,Y
1B 53...	<ESC> "S"...	27 83...	Set point X,Y
1B 54...	<ESC> "T"...	27 84...	Test point X,Y
1B 6C...	<ESC> "l"...	27 108...	Draw/Erase/Complement a line
1B 6F...	<ESC> "o"...	27 111...	Draw/Erase/Complement a circle
1B 6D...	<ESC> "m"...	27 109...	Move cursor to X,Y
1B 77	<ESC> "w"...	27 119	Fill a polygon
1B 64...	<ESC> "d"...	27 100...	Graphics screen dump
Keyboard			
1B 3E...	<ESC> ">"...	27 62...	Download soft-key display
Clock			
1B 74...	<ESC> "t"...	27 116...	Set clock time
1B 74 3D..	<ESC> "t="...	27 116 61.	Position clock display
1B 74 45	<ESC> "tE"	27 116 69	Enable clock display
1B 74 44	<ESC> "tD"	27 116 68	Disable clock display
1B 74 3F	<ESC> "t?"	27 116 63	Return clock time
Miscellaneous			
1B 61...	<ESC> "a"...	27 97...	Set/reset attributes

NASCOM ROM BASIC DIS-ASSEMBLED PART 7

BY CARL LLOYD-PARKER


```
FB8B CD13F8     RND:    CALL    TSTSGN          ; Test sign of FPREG
FB8E 211910             LD      HL,SEED+2       ; Random number seed
FB91 FAECFB             JP      M,RESEED        ; Negative - Re-seed
FB94 213A10             LD      HL,LSTRND       ; Last random number
FB97 CD51F8             CALL    PHLTFP          ; Move last RND to FPREG
FB9A 211910             LD      HL,SEED+2       ; Random number seed
FB9D C8                 RET     Z               ; Return if RND(0)
FB9E 86                 ADD     A,(HL)          ; Add (SEED+2)
FB9F E607               AND     00000111B       ; 0 to 7
FBA1 0600               LD      B,0
FBA3 77                 LD      (HL),A          ; Re-save seed
FBA4 23                 INC     HL              ; Move to coefficient table
FBA5 87                 ADD     A,A             ; 4 bytes
FBA6 87                 ADD     A,A             ; per entry
FBA7 4F                 LD      C,A             ; BC = Offset into table
FBA8 09                 ADD     HL,BC           ; Point to coefficient
FBA9 CD62F8             CALL    LOADFP          ; Coefficient to BCDE
FBAC CD08F7             CALL    FPMULT          ; Multiply FPREG by coefficient
FBAF 3A1810             LD      A,(SEED+1)      ; Get (SEED+1)
FBB2 3C                 INC     A               ; Add 1
FBB3 E603               AND     00000011B       ; 0 to 3
FBB5 0600               LD      B,0
FBB7 FE01               CP      1               ; Is it zero?
FBB9 88                 ADC     A,B             ; Yes - Make it 1
FBBA 321810             LD      (SEED+1),A      ; Re-save seed
FBBD 21F0FB             LD      HL,RNDTAB-4     ; Addition table
FBC0 87                 ADD     A,A             ; 4 bytes
FBC1 87                 ADD     A,A             ; per entry
FBC2 4F                 LD      C,A             ; BC = Offset into table
FBC3 09                 ADD     HL,BC           ; Point to value
FBC4 CDBEF5             CALL    ADDPHL          ; Add value to FPREG
FBC7 CD5FF8     RND1:   CALL    BCDEFP          ; Move FPREG to BCDE
FBCA 7B                 LD      A,E             ; Get LSB
FBCB 59                 LD      E,C             ; LSB = MSB
FBCC EE4F               XOR     01001111B       ; Fiddle around
FBCE 4F                 LD      C,A             ; New MSB
FBCF 3680               LD      (HL),80H        ; Set exponent
FBD1 2B                 DEC     HL              ; Point to MSB
FBD2 46                 LD      B,(HL)          ; Get MSB
FBD3 3680               LD      (HL),80H        ; Make value -0.5
FBD5 211710             LD      HL,SEED         ; Random number seed
FBD8 34                 INC     (HL)            ; Count seed
FBD9 7E                 LD      A,(HL)          ; Get seed
FBDA D6AB               SUB     171             ; Do it modulo 171
FBDC C2E3FB             JP      NZ,RND2         ; Non-zero - Ok
FBDF 77                 LD      (HL),A          ; Zero seed
FBE0 0C                 INC     C               ; Fillde about
FBE1 15                 DEC     D               ; with the
FBE2 1C                 INC     E               ; number
FBE3 CD1EF6     RND2:   CALL    BNORM           ; Normalise number
FBE6 213A10             LD      HL,LSTRND       ; Save random number
FBE9 C36BF8             JP      FPTHL           ; Move FPREG to last and return
```

```
FBEC 77         RESEED: LD      (HL),A          ; Re-seed random numbers
FBED 2B                 DEC     HL
FBEE 77                 LD      (HL),A
FBEF 2B                 DEC     HL
FBF0 77                 LD      (HL),A
FBF1 C3C7FB             JP      RND1            ; Return RND seed

FBF4 68B14668   RNDTAB: DEFB    068H,0B1H,046H,068H     ; Table used by RND
FBF8 99E99269           DEFB    099H,0E9H,092H,069H
FBFC 10D17568           DEFB    010H,0D1H,075H,068H

FC00 214AFC     COS:    LD      HL,HALFPI       ; Point to PI/2
FC03 CDBEF5             CALL    ADDPHL          ; Add it to FPREG
FC06 CD44F8     SIN:    CALL    STAKFP          ; Put angle on stack
FC09 014983             LD      BC,8349H        ; BCDE = 2 PI
FC0C 11DB0F             LD      DE,0FDBH
FC0F CD54F8             CALL    FPBCDE          ; Move 2 PI to FPREG
FC12 C1                 POP     BC              ; Restore angle
FC13 D1                 POP     DE
FC14 CD69F7             CALL    DVBCDE          ; Divide angle by 2 PI
FC17 CD44F8             CALL    STAKFP          ; Put it on stack
FC1A CDE6F8             CALL    INT             ; Get INT of result
FC1D C1                 POP     BC              ; Restore number
FC1E D1                 POP     DE
FC1F CDCAF5             CALL    SUBCDE          ; Make it 0 <= value < 1
FC22 214EFC             LD      HL,QUARTR       ; Point to 0.25
FC25 CDC4F5             CALL    SUBPHL          ; Subtract value from 0.25
FC28 CD13F8             CALL    TSTSGN          ; Test sign of value
FC2B 37                 SCF                     ; Flag positive
FC2C F236FC             JP      P,SIN1          ; Positive - Ok
FC2F CDBBF5             CALL    ROUND           ; Add 0.5 to value
FC32 CD13F8             CALL    TSTSGN          ; Test sign of value
FC35 B7                 OR      A               ; Flag negative
FC36 F5         SIN1:   PUSH    AF              ; Save sign
FC37 F43CF8             CALL    P,INVSGN        ; Negate value if positive
FC3A 214EFC             LD      HL,QUARTR       ; Point to 0.25
FC3D CDBEF5             CALL    ADDPHL          ; Add 0.25 to value
FC40 F1                 POP     AF              ; Restore sign
FC41 D43CF8             CALL    NC,INVSGN       ; Negative - Make positive
FC44 2152FC             LD      HL,SINTAB       ; Coefficient table
FC47 C35BFB             JP      SUMSER          ; Evaluate sum of series

FC4A DB0F4981   HALFPI: DEFB    0DBH,00FH,049H,081H     ; 1.5708 (PI/2)

FC4E 0000007F   QUARTR: DEFB    000H,000H,000H,07FH     ; 0.25

FC52 05         SINTAB: DEFB    5                       ; Table used by SIN
FC53 BAD71E86           DEFB    0BAH,0D7H,01EH,086H     ; 39.711
FC57 64269987           DEFB    064H,026H,099H,087H     ;-76.575
FC5B 58342387           DEFB    058H,034H,023H,087H     ; 81.602
FC5F E05DA586           DEFB    0E0H,05DH,0A5H,086H     ;-41.342
FC63 DA0F4983           DEFB    0DAH,00FH,049H,083H     ;  6.2832
```



```
FC67 CD44F8     TAN:    CALL    STAKFP          ; Put angle on stack
FC6A CD06FC             CALL    SIN             ; Get SIN of angle
FC6D C1                 POP     BC              ; Restore angle
FC6E E1                 POP     HL
FC6F CD44F8             CALL    STAKFP          ; Save SIN of angle
FC72 EB                 EX      DE,HL           ; BCDE = Angle
FC73 CD54F8             CALL    FPBCDE          ; Angle to FPREG
FC76 CD00FC             CALL    COS             ; Get COS of angle
FC79 C367F7             JP      DIV             ; TAN = SIN / COS

FC7C CD13F8     ATN:    CALL    TSTSGN          ; Test sign of value
FC7F FCA7FA             CALL    M,NEGAFT        ; Negate result after if -ve
FC82 FC3CF8             CALL    M,INVSGN        ; Negate value if -ve
FC85 3AE710             LD      A,(FPEXP)       ; Get exponent
FC88 FE81               CP      81H             ; Number less than 1?
FC8A DA99FC             JP      C,ATN1          ; Yes - Get arc tangnt
FC8D 010081             LD      BC,8100H        ; BCDE = 1
FC90 51                 LD      D,C
FC91 59                 LD      E,C
FC92 CD69F7             CALL    DVBCDE          ; Get reciprocal of number
FC95 21C4F5             LD      HL,SUBPHL       ; Sub angle from PI/2
FC98 E5                 PUSH    HL              ; Save for angle > 1
FC99 21A3FC     ATN1:   LD      HL,ATNTAB       ; Coefficient table
FC9C CD5BFB             CALL    SUMSER          ; Evaluate sum of series
FC9F 214AFC             LD      HL,HALFPI       ; PI/2 - angle in case > 1
FCA2 C9                 RET                     ; Number > 1 - Sub from PI/2

FCA3 09         ATNTAB: DEFB    9                       ; Table used by ATN
FCA4 4AD73B78           DEFB    04AH,0D7H,03BH,078H     ; 1/17
FCA8 026E847B           DEFB    002H,06EH,084H,07BH     ;-1/15
FCAC FEC12F7C           DEFB    0FEH,0C1H,02FH,07CH     ; 1/13
FCB0 74319A7D           DEFB    074H,031H,09AH,07DH     ;-1/11
FCB4 843D5A7D           DEFB    084H,03DH,05AH,07DH     ; 1/9
FCB8 C87F917E           DEFB    0C8H,07FH,091H,07EH     ;-1/7
FCBC E4BB4C7E           DEFB    0E4H,0BBH,04CH,07EH     ; 1/5
FCC0 6CAAAA7F           DEFB    06CH,0AAH,0AAH,07FH     ;-1/3
FCC4 00000081           DEFB    000H,000H,000H,081H     ; 1/1
```

```
FCC8 CD39FE     CASFFW: CALL    FLPLED          ; Turn on cassette
FCCB 0600               LD      B,0             ; Set 1 second delay
FCCD CD9BFD     DELAYB: CALL    DELAY           ; Wait a bit
FCD0 05                 DEC     B               ; Count
FCD1 C2CDFC             JP      NZ,DELAYB       ; More delay needed
FCD4 C9                 RET

FCD5 C339FE     CASFF:  JP      FLPLED          ; Flip tape LED

FCD8 C9         ARET:   RET                     ; A RETurn instruction

FCD9 E5C5D5F5   CONMON: PUSH    HL,BC,DE,AF     ; Output character to screen
FCDD CD6DFE             CALL    MONTST          ; See if NAS-SYS
FCE0 C2FBFC             JP      NZ,NASOUT       ; NAS-SYS - Output ASCII
FCE3 F1                 POP     AF              ; Get character
FCE4 F5                 PUSH    AF              ; And re-save
FCE5 FE0A               CP      LF              ; ASCII Line feed?
FCE7 CA00FD             JP      Z,IGCHR         ; Yes - Ignore it
FCEA FE08               CP      BKSP            ; ASCII back space?
FCEC C2F1FC             JP      NZ,CONOT1       ; No - Test for CR
FCEF 3E1D               LD      A,TBS           ; NASBUG back space
FCF1 FE0D       CONOT1: CP      CR              ; ASCII CR?
FCF3 C2FDFC             JP      NZ,OUTCHR       ; No - Output character
FCF6 3E1F               LD      A,TCR           ; NASBUG CR
FCF8 C3FDFC             JP      OUTCHR          ; Output it

FCFB F1         NASOUT: POP     AF              ; Get character
FCFC F5                 PUSH    AF              ; And re-save
FCFD CD45FE     OUTCHR: CALL    MONOUT          ; Output it
FD00 F1D1C1E1   IGCHR:  POP     AF,DE,BC,HL     ; Restore character
FD04 C9                 RET

FD05 E5C5D5     GETINP: PUSH    HL,BC,DE        ; Get an input character
FD08 CD6DFE             CALL    MONTST          ; See if NAS-SYS
FD0B CA13FD             JP      Z,GETTIN        ; "T" monitor - Get input
FD0E DF7B               SCAL    BLINK
FD10 C319FD             JP      CONVIN          ; Convert to ASCII

FD13 CD4D0C     GETTIN: CALL    TIN             ; "T" input a character
FD16 D213FD             JP      NC,GETTIN       ; No input - wait
FD19 FE1D       CONVIN: CP      TBS             ; NASBUG back space?
FD1B C220FD             JP      NZ,CNVIN1       ; No - Test for break
FD1E 3E08               LD      A,BKSP          ; ASCII back space
FD20 FE1C       CNVIN1: CP      TBRK            ; NASBUG break?
FD22 C227FD             JP      NZ,CNVIN2       ; No - Test for control Z
FD25 3E03               LD      A,CTRLC         ; Control C
FD27 FE1A       CNVIN2: CP      CTRLZ           ; ^Z?
FD29 C22EFD             JP      NZ,CNVIN3       ; No - Test for escape
FD2C 3E7F               LD      A,DEL           ; Delete
FD2E FE1B       CNVIN3: CP      ESC             ; "ESC" ?
FD30 C235FD             JP      NZ,CNVIN4       ; No - Test for CR
FD33 3E03               LD      A,CTRLC         ; Control C
FD35 FE1F       CNVIN4: CP      TCR             ; NASBUG CR?
FD37 C23CFD             JP      NZ,CNVIN5       ; No - Return character
FD3A 3E0D               LD      A,CR            ; ASCII CR
FD3C D1C1E1     CNVIN5: POP     DE,BC,HL
FD3F C9                 RET
```



```
FD40 AF         CHKBRK: XOR     A               ; Check for break
FD41 CD70FD             CALL    SFTENT          ; Test for shift/enter
FD44 CA50FD             JP      Z,TBRK2         ; Yes - Test for second break
FD47 3A4D10             LD      A,(BRKFLG)      ; Get break flag
FD4A B7                 OR      A               ; Break flag set?
FD4B C250FD             JP      NZ,TBRK2        ; Yes - Test for second break
FD4E AF                 XOR     A               ; Flag no break
FD4F C9                 RET

FD50 CD53FE     TBRK2:  CALL    BREAK2          ; Second break?
FD53 3EFF               LD      A,-1            ; Flag break
FD55 C9                 RET

FD56 DB02       GUART:  IN      A,(UARTS)       ; Get UART status
FD58 17                 RLA                     ; Any data ready?
FD59 D256FD             JP      NC,GUART        ; No - wait until there is
FD5C DB01               IN      A,(UARTD)       ; Get data from UART
FD5E C9                 RET

FD5F D301       UARTOT: OUT     (UARTD),A       ; Send data to UART
FD61 DB02       URTOLP: IN      A,(UARTS)       ; Get status
FD63 87                 ADD     A,A             ; Byte sent?
FD64 F8                 RET     M               ; Yes - Return
FD65 C361FD             JP      URTOLP          ; Keep waiting

FD68 F5         SUART:  PUSH    AF              ; Save A
FD69 CD5FFD             CALL    UARTOT          ; Send it to UART
FD6C F1                 POP     AF              ; Restore A
FD6D C9                 RET

FD6E 00                 NOP
FD6F 00                 NOP

FD70 E5         SFTENT: PUSH    HL              ; Test for Shift Enter from KBD
FD71 3E02               LD      A,00000010B     ; Reset KBD counter mask
FD73 21000C             LD      HL,PORT0        ; Get old contents
FD76 AE                 XOR     (HL)            ; Toggle bit
FD77 D300               OUT     (0),A           ; Reset KBD counter
FD79 EE01               XOR     00000001B       ; Toggle bit
FD7B D300               OUT     (0),A           ; Next row
FD7D EE02               XOR     00000010B
FD7F D300               OUT     (0),A           ; Clear "clear" strobe
FD81 7E                 LD      A,(HL)          ; Get old value
FD82 D300               OUT     (0),A           ; Original contents
FD84 19                 ADD     HL,DE           ; ?? WHAT ??
FD85 E1                 POP     HL              ; Restore HL
FD86 DB00               IN      A,(0)           ; Read in row
FD88 E612               AND     00010010B       ; Mask SHIFT and ENTER
FD8A C9                 RET

FD8B CD6DFE     CLS:    CALL    MONTST          ; See if NAS-SYS
FD8E CA96FD             JP      Z,TCLS          ; "T" CLS
FD91 3E0C               LD      A,CS            ; ASCII Clear screen
FD93 C3D9FC             JP      CONMON          ; Output character

FD96 3E1E       TCLS:   LD      A,TCS           ; NASBUG Clear screen
FD98 C3D9FC             JP      CONMON          ; Output character
```

```
FD9B AF         DELAY:  XOR     A               ; Delay routine
FD9C F5         DELAY1: PUSH    AF              ; PUSHes and POPs delay
FD9D F1                 POP     AF
FD9E F5                 PUSH    AF
FD9F F1                 POP     AF
FDA0 3D                 DEC     A               ; Count delays
FDA1 C29CFD             JP      NZ,DELAY1       ; More delay
FDA4 C9                 RET

FDA5 CD84F4     WIDTH:  CALL    GETINT          ; Get integer 0-255
FDA8 7B                 LD      A,E             ; Width to A
FDA9 324210             LD      (LWIDTH),A      ; Set width
FDAC C9                 RET

FDAD CD41ED     LINES:  CALL    GETNUM          ; Get a number
FDB0 CD8BE9             CALL    DEINT           ; Get integer -32768 to 32767
FDB3 ED534610           LD      (LINESC),DE     ; Set lines counter
FDB7 ED534810           LD      (LINESN),DE     ; Set lines number
FDBB C9                 RET

FDBC CD8BE9     DEEK:   CALL    DEINT           ; Get integer -32768 to 32767
FDBF D5                 PUSH    DE              ; Save number
FDC0 E1                 POP     HL              ; Number to HL
FDC1 46                 LD      B,(HL)          ; Get LSB of contents
FDC2 23                 INC     HL
FDC3 7E                 LD      A,(HL)          ; Get MSB of contents
FDC4 C3F2F0             JP      ABPASS          ; Return integer AB

FDC7 CD41ED     DOKE:   CALL    GETNUM          ; Get a number
FDCA CD8BE9             CALL    DEINT           ; Get integer -32768 to 32767
FDCD D5                 PUSH    DE              ; Save address
FDCE CD90E6             CALL    CHKSYN          ; Make sure "," follows
FDD1 2C                 DEFB    ","
FDD2 CD41ED             CALL    GETNUM          ; Get a number
FDD5 CD8BE9             CALL    DEINT           ; Get integer -32768 to 32767
FDD8 E3                 EX      (SP),HL         ; Save value,get address
FDD9 73                 LD      (HL),E          ; Save LSB of value
FDDA 23                 INC     HL
FDDB 72                 LD      (HL),D          ; Save MSB of value
FDDC E1                 POP     HL              ; Restore code string address
FDDD C9                 RET

FDDE F3         JJUMP1: DI                      ; Disable interrupts
FDDF DD21FFFF           LD      IX,-1           ; Flag cold start
FDE3 C312E0             JP      CSTART          ; Go and initialise
```



```
FDE6 CD84F4     SCREEN: CALL    GETINT          ; Get integer 0 to 255
FDE9 F5                 PUSH    AF              ; Save column
FDEA CD90E6             CALL    CHKSYN          ; Make sure "," follows
FDED 2C                 DEFB    ","
FDEE CD84F4             CALL    GETINT          ; Get integer 0 to 255
FDF1 C1                 POP     BC              ; Column to B
FDF2 E5                 PUSH    HL              ; Save code string address
FDF3 C5                 PUSH    BC              ; Save column
FDF4 CD11FE             CALL    SCRADR          ; Calculate screen address
FDF7 E5                 PUSH    HL              ; Save screen address
FDF8 CD6DFE             CALL    MONTST          ; See if NAS-SYS
FDFB CA04FE             JP      Z,TMNCUR        ; "T" monitor - "T" cursor
FDFE E1                 POP     HL              ; Restore screen address
FDFF 22290C             LD      (CURSOR),HL     ; Set new cursor position
FE02 E1                 POP     HL              ; Rstore code string address
FE03 C9                 RET

FE04 2A180C     TMNCUR: LD      HL,(TCUR)       ; Get address or cursor
FE07 3620               LD      (HL)," "        ; Remove cursor
FE09 E1                 POP     HL              ; Get new cursor address
FE0A 22180C             LD      (TCUR),HL       ; Set new cursor
FE0D 365F               LD      (HL),"_"        ; Put it on screen
FE0F E1                 POP     HL              ; Restore code string address
FE10 C9                 RET

FE11 21C907     SCRADR: LD      HL,VDU+10-65    ; SCREEN VDU address (0,0)
FE14 0600               LD      B,0
FE16 4F                 LD      C,A             ; Line to BC
FE17 B7                 OR      A               ; Test it
FE18 CAA0E9             JP      Z,FCERR         ; Zero - ?FC Error
FE1B FE11               CP      16+1            ; 16 lines
FE1D F2A0E9             JP      P,FCERR         ; > 16 - ?FC Error
FE20 D1                 POP     DE              ; RETurn address
FE21 F1                 POP     AF              ; Get column
FE22 D5                 PUSH    DE              ; Re-save RETurn
FE23 1600               LD      D,0
FE25 5F                 LD      E,A             ; Column to DE
FE26 B7                 OR      A               ; Test it
FE27 CAA0E9             JP      Z,FCERR         ; Zero - ?FC Error
FE2A FE31               CP      48+1            ; 48 characters per line
FE2C F2A0E9             JP      P,FCERR         ; > 48 - ?FC Error
FE2F 19                 ADD     HL,DE           ; Add column to address
FE30 1600               LD      D,0
FE32 59                 LD      E,C             ; Line to DE
FE33 0640               LD      B,64            ; 64 Bytes per line
FE35 19         ADD64X: ADD     HL,DE           ; Add line
FE36 10FD               DJNZ    ADD64X          ; SIXTY FOUR TIMES!!!
FE38 C9                 RET

FE39 CD6DFE     FLPLED: CALL    MONTST          ; See if NAS-SYS
FE3C CA42FE             JP      Z,TMFLP         ; "T" MFLP
FE3F DF5F               SCAL    MFLP
FE41 C9                 RET

FE42 C35100     TMFLP:  JP      MFLP            ; Flip drive LED
```

```
FE45 F5         MONOUT: PUSH  AF            ; Save character
FE46 CD6DFE             CALL  MONTST        ; See if NAS-SYS
FE49 CA4FFE             JP    Z,TMNOUT      ; "T" output
FE4C F1                 POP   AF            ; Restore character
FE4D F7                 ROUT                ; Output it
FE4E C9                 RET

FE4F F1         TMNOUT: POP   AF            ; Restore character
FE50 C34A0C             JP    TOUT          ; "T" output

FE53 3A4D10     BREAK2: LD    A,(BRKFLG)    ; Break flag set?
FE56 C265FE             JP    NZ,RETCTC     ; Yes - Return ^C
FE59 CD6DFE             CALL  MONTST        ; See if NAS-SYS
FE5C CA62FE             JP    Z,TCHINP      ; Get "T" character input
FE5F DF62               SCAL  RIN           ; Scan for a character
FE61 C9                 RET

FE62 C34D0C     TCHINP: JP    TIN           ; "T" input a character

FE65 3E00       RETCTC: LD    A,0           ; Clear Break flag
FE67 324D10             LD    (BRKFLG),A
FE6A 3E03               LD    A,CTRLC       ; Return ^C
FE6C C9                 RET

FE6D 3A0100     MONTST: LD    A,(MONSTT+1)  ; "T" monitor or NAS-SYS?
FE70 FE33               CP    33H           ; 31 00 10 / 31 33 0C
FE72 C9                 RET

FE73 CD39FE     SAVE:   CALL  FLPLED        ; Flip tape LED
FE76 CD6DFE             CALL  MONTST        ; See if NAS-SYS
FE79 CA7FFE             JP    Z,TSAVE       ; "T" save
FE7C DF57               SCAL  WRITE         ; Save program
FE7E C9                 RET

FE7F 3A8D00     TSAVE:  LD    A,(MONTYP)    ; "T2" or "T4" (FLAGS!!!)
FE82 CA0004             JP    Z,T4WR        ; T4 Write
FE85 C3D103             JP    T2DUMP        ; T2 Dump

FE88 CD39FE     MONLD:  CALL  FLPLED        ; Flip tape LED
FE8B CD6DFE             CALL  MONTST        ; See if NAS-SYS
FE8E CA99FE             JP    Z,TLOAD       ; "T" load
FE91 3E52               LD    A,"R"         ; Set READ
FE93 322B0C             LD    (ARGN),A
FE96 DF52               SCAL  READ          ; Load program
FE98 C9                 RET

FE99 3A8D00     TLOAD:  LD    A,(MONTYP)    ; "T2" or "T4" (FLAGS!!!)
FE9C CA0C07             JP    Z,T4READ      ; T4 Read
FE9F C3D103             JP    T2DUMP        ; T2 Dump ??????????

FEA2 CD6DFE     MONITR: CALL  MONTST        ; See if NAS-SYS
FEA5 CA0000             JP    Z,MONSTT      ; Jump to zero if "T"
FEA8 DF5B               SCAL  MRET          ; Return to NAS-SYS
```



```
FEAA CD39FE     MONVE:  CALL  FLPLED        ; Flip tape LED
FEAD CD6DFE             CALL  MONTST        ; See if NAS-SYS
FEB0 CAA0E9             JP    Z,FCERR       ; Verify not available on "T"
FEB3 3E56               LD    A,"V"         ; Set VERIFY
FEB5 322B0C             LD    (ARGN),A
FEB8 DF56               SCAL  VERIFY        ; Verify tape
FEBA C9                 RET

FEBB 3E00       INITST: LD    A,0           ; Clear break flag
FEBD 324D10             LD    (BRKFLG),A
FEC0 CD6DFE             CALL  MONTST        ; See if NAS-SYS
FEC3 CA19E0             JP    Z,INIT        ; "T" - No NMI vector
FEC6 21DEFE             LD    HL,BREAK      ; Set NMI gives break
FEC9 227E0C             LD    (NMI),HL
FECC DDE5               PUSH  IX            ; Get start up condition
FECE F1                 POP   AF            ; "Z" set if cold , Else clear
FECF B7                 OR    A             ; "Cold" or "Cool" start?
FED0 C219E0             JP    NZ,INIT       ; "Cool" don't init NAS-SYS
FED3 060F               LD    B,15          ; Delay for keyboard clear
FED5 CDCDFC             CALL  DELAYB        ; Allow time for key release
FED8 CD0D00             CALL  STMON         ; Initialise NAS-SYS
FEDB C319E0             JP    INIT          ; Initialise BASIC

FEDE F5         BREAK:  PUSH  AF            ; Save character
FEDF 3EFF               LD    A,-1
FEE1 324D10             LD    (BRKFLG),A    ; Flag break
FEE4 F1                 POP   AF            ; Restore character
FEE5 ED45       ARETN:  RETN                ; Return from NMI

FEE7 00                 NOP

FEE8 DF63       INLINE: SCAL  INLIN         ; Get an input line
FEEA D5                 PUSH  DE            ; Save cursor address
FEEB D5                 PUSH  DE            ; Cursor address to HL
FEEC E1                 POP   HL
FEED 112F00             LD    DE,48-1       ; Lengh of line-1
FEF0 19                 ADD   HL,DE         ; Point to end of line
FEF1 7E         ENDLIN: LD    A,(HL)        ; Get end of line
FEF2 FE20               CP    " "           ; Space?
FEF4 C202FF             JP    NZ,LINTBF     ; No - Copy to buffer
FEF7 1D                 DEC   E             ; Back 1 character
FEF8 3E00               LD    A,0           ; Wasteful test on E
FEFA B3                 OR    E
FEFB CA02FF             JP    Z,LINTBF      ; Start of line - Copy it
FEFE 2B                 DEC   HL            ; Back 1 character
FEFF C3F1FE             JP    ENDLIN        ; Keep looking for end
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```
FF02 D5         LINTBF: PUSH  DE              ; Line length to BC
FF03 C1                 POP   BC
FF04 03                 INC   BC              ; Length +1
FF05 116110             LD    DE,BUFFER       ; Input buffer
FF08 E1                 POP   HL              ; Line start
FF09 C5                 PUSH  BC              ; Save length
FF0A EDB0               LDIR                  ; Move line to buffer
FF0C 3E00               LD    A,0
FF0E 12                 LD    (DE),A          ; Mark end of buffer with 00
FF0F C1                 POP   BC              ; Restore buffer length
FF10 41                 LD    B,C             ; Length returned in B
FF11 216010             LD    HL,BUFFER-1     ; Point to start of buffer-1
FF14 C9                 RET

FF15 CD90E6     GETXYA: CALL  CHKSYN          ; Make sure "(" follows
FF18 28                 DEFB  "("
FF19 CD41ED             CALL  GETNUM          ; Get a number
FF1C CD8BE9             CALL  DEINT           ; Get integer -32768 to 32767
FF1F D5                 PUSH  DE              ; Save "X"
FF20 CD90E6             CALL  CHKSYN          ; Make sure "," follows
FF23 2C                 DEFB  ","
FF24 CD41ED             CALL  GETNUM          ; Get a number
FF27 CD90E6             CALL  CHKSYN          ; Make sure ")" follows
FF2A 29                 DEFB  ")"
FF2B CD8BE9             CALL  DEINT           ; Get integer -32768 to 32767
FF2E E5                 PUSH  HL              ; Save code string address
FF2F FDE1               POP   IY              ; In IY
FF31 CD96FF             CALL  XYPOS           ; Address and bit mask
FF34 F5                 PUSH  AF              ; Save mask
FF35 CDC2FF             CALL  ADJCOL          ; Adjust column
FF38 CD11FE             CALL  SCRADR          ; Get VDU address
FF3B F1                 POP   AF              ; Restore bit mask
FF3C 06C0               LD    B,11000000B     ; Block graphics base
FF3E B0                 OR    B               ; Set bits 7 & 6
FF3F C9                 RET

FF40 CD15FF     SETB:   CALL  GETXYA          ; Get co-ords and VDU address
FF43 F5                 PUSH  AF              ; Save bit mask
FF44 7E                 LD    A,(HL)          ; Get character from screen
FF45 FEC0               CP    11000000B       ; Is it a block graphic?
FF47 D250FF             JP    NC,SETOR        ; Yes - OR new bit
FF4A F1                 POP   AF              ; Restore bit mask
FF4B 77         PUTBIT: LD    (HL),A          ; Put character on screen
FF4C FDE5       RESCSA: PUSH  IY              ; Restore code string address
FF4E E1                 POP   HL              ; From IY
FF4F C9                 RET

FF50 C1         SETOR:  POP   BC              ; Restore bit mask
FF51 B0                 OR    B               ; Merge the bits
FF52 C34BFF             JP    PUTBIT          ; Save on screen
```



```
FF55 CD15FF     RESETB: CALL  GETXYA          ; Get co-ords and VDU address
FF58 F5                 PUSH  AF              ; Save bit mask
FF59 7E                 LD    A,(HL)          ; Get byte from screen
FF5A FEC0               CP    11000000B       ; Is it a block graphic?
FF5C DA75FF             JP    C,NORES         ; No - Leave it
FF5F 063F               LD    B,00111111B     ; Six bits per block
FF61 A0                 AND   B               ; Clear bits 7 & 6
FF62 C1                 POP   BC              ; Get bit mask
FF63 A0                 AND   B               ; Test for common bit
FF64 CA4CFF             JP    Z,RESCSA        ; None - Leave it
FF67 7E                 LD    A,(HL)          ; Get byte from screen
FF68 E63F               AND   00111111B       ; Isolate bit
FF6A A8                 XOR   B               ; Clear that bit
FF6B FEC0               CP    11000000B       ; Is it a graphic blank?
FF6D C24BFF             JP    NZ,PUTBIT       ; No - Save character
FF70 3E20               LD    A," "           ; Put a space there
FF72 C34BFF             JP    PUTBIT          ; Save the space

FF75 C1         NORES:  POP   BC              ; Drop bit mask
FF76 C34CFF             JP    RESCSA          ; Restore code string address

FF79 CD15FF     POINTB: CALL  GETXYA          ; Get co-ords and VDU address
FF7C 46                 LD    B,(HL)          ; Get character from screen
FF7D CDEDFF             CALL  TSTBIT          ; Test if bit is set
FF80 C291FF             JP    NZ,POINTO       ; Different - Return zero
FF83 3E00               LD    A,0
FF85 0601               LD    B,1             ; Integer AB = 1
FF87 E1         POINTX: POP   HL              ; Drop return
FF88 FDE5               PUSH  IY              ; PUSH code string address
FF8A 111DEE             LD    DE,RETNUM       ; To return a number
FF8D D5                 PUSH  DE              ; Save for return
FF8E C3F2F0             JP    ABPASS          ; Return integer AB

FF91 0600       POINTO: LD    B,0             ; Set zero
FF93 C387FF             JP    POINTX          ; Return value

FF96 C1         XYPOS:  POP   BC              ; Get return address
FF97 E1                 POP   HL              ; Get column
FF98 E5                 PUSH  HL              ; And re-save
FF99 C5                 PUSH  BC              ; Put back return address
FF9A 7D                 LD    A,L             ; Get column
FF9B 0601               LD    B,00000001B     ; 2 bits per character
FF9D A0                 AND   B               ; Odd or even bit
FF9E F5                 PUSH  AF              ; Save it
FF9F D5                 PUSH  DE              ; Get row
FFA0 E1                 POP   HL              ; to HL
FFA1 110000             LD    DE,0            ; Zero line count
FFA4 010300             LD    BC,3            ; 3 blocks per line
FFA7 23                 INC   HL
FFA8 ED42       DIV3LP: SBC   HL,BC           ; Subtract 3
FFAA 13                 INC   DE              ; Count the subtractions
FFAB CAB1FF             JP    Z,DIV3EX        ; Exactly - Exit
FFAE F2A8FF             JP    P,DIV3LP        ; More to do
```

```
FFB1 09         DIV3EX: ADD     HL,BC           ; Restore number
FFB2 F1                 POP     AF              ; Restore column and odd/even
FFB3 B7                 OR      A               ; Set flags (NZ or Z)
FFB4 7D                 LD      A,L             ; Get remainder from /3
FFB5 CABAFF             JP      Z,NOREMD        ; No remainder
FFB8 C603               ADD     A,3             ; Adjust remainder
FFBA 47         NOREMD: LD      B,A             ; Bit number+1 to B
FFBB 3E01               LD      A,00000001B     ; Bit to rotate
FFBD 07         SHFTBT: RLCA                    ; Shift bit left
FFBE 10FD               DJNZ    SHFTBT          ; Count shifts
FFC0 1F                 RRA                     ; Restore correct place
FFC1 C9                 RET

FFC2 C1         ADJCOL: POP     BC              ; Restore return address
FFC3 F1                 POP     AF              ; Get bit mask
FFC4 E1                 POP     HL              ; Get column
FFC5 F5                 PUSH    AF              ; Re-save but mask
FFC6 7D                 LD      A,L             ; Get column
FFC7 1F                 RRA                     ; Divide by 2
FFC8 C601               ADD     A,1             ; Start at column 1
FFCA E63F               AND     00111111B       ; 0 to 63
FFCC 67                 LD      H,A             ; Save column in H
FFCD E5                 PUSH    HL              ; Re-save column
FFCE C5                 PUSH    BC              ; Put back return
FFCF 7B                 LD      A,E             ; Get row
FFD0 C9                 RET

FFD1 CDD5FC     SMOTOR: CALL    CASFF           ; Flip tape drive
FFD4 7E                 LD      A,(HL)          ; Get byte
FFD5 C9                 RET

FFD6 3ACE10     JPLDSV: LD      A,(BRKLIN)      ; CLOAD or CSAVE?
FFD9 FEFF               CP      -1
FFDB C206E9             JP      NZ,SNDHDR       ; CSAVE - Send header
FFDE C310E9             JP      GETHDR          ; CLOAD - Get header

FFE1 CD81EB     CRLIN1: CALL    PRNTCR          ; Output CRLF
FFE4 C3F2E5             JP      GETLIN          ; Get an input line

FFE7 CD81EB     CRLIN:  CALL    PRNTCR          ; Output CRLF
FFEA C3F2E5             JP      GETLIN          ; Get an input line

FFED F5         TSTBIT: PUSH    AF              ; Save bit mask
FFEE A0                 AND     B               ; Get common bits
FFEF C1                 POP     BC              ; Restore bit mask
FFF0 B8                 CP      B               ; Same bit set?
FFF1 3E00               LD      A,0             ; Return 0 in A
FFF3 C9                 RET

FFF4 CD9BE6     OUTNCR: CALL    OUTC            ; Output character in A
FFF7 C381EB             JP      PRNTCR          ; Output CRLF

FFFA C3DEFD     JJUMP:  JP      JJUMP1          ; "Cool" start

FFFD C3B1E0     ZJUMP:  JP      BRKRET          ; Warm start
```


ABPASS	F0F2	ABS	F838	ACCSUM	E940	ACPASS	F0F1	ADD64X	FE35
ADDEXP	F7D1	ADDIG	F977	ADDPHL	F58E	ADJCOL	FFC2	ALLFOL	F3C0
ANTVLU	EC65	ANYNAM	F51C	ARET	FCD8	ARETN	FEE5	ARG1	0C0C
ARG2	0C0E	ARGN	0C2B	ARLDSV	F012	ARREND	10DA	ARRLD1	E8B9
ARRLP	F28B	ARRSV1	E8BB	ARYLP	E920	ASC	F391	ASCTFP	F91A
ASPCS	EBC7	ATN	FC7C	ATN1	FC99	ATNTAB	FCA3	ATOH	E9A5
BAD	F59D	BADINP	EBEC	BAKSTK	E356	BAKTMP	F371	BASTXT	105E
BCDEFP	F85F	BFREE	E0B7	BKSP	0008	BNORM	F61E	BNRMLP	F621
BREAK	FEDE	BREAK2	FE53	BRKFLG	104D	BRKLIN	10CE	BRKMSG	E350
BRKRET	E0B1	BS	0010	BSERR	F045	BUFFER	1061	BYTSFT	F756
CASFF	FCD5	CASFFW	FCC8	CFEVAL	EFA8	CHARTY	EF56	CHEKFN	F189
CHKBRK	FD40	CHKLTR	E977	CHKSTK	E38A	CHKSUM	104A	CHKSYN	E690
CHKTYP	ED46	CHR	F3A2	CHSUMS	E960	CIN	0C75	CLEAR	E9CA
CLOAD	F4F9	CLOAD1	F52B	CLOAD2	F52D	CLOADE	F55F	CLOADV	F55C
CLOTST	E6CC	CLREG	E4DF	CLRPTR	E4BA	CLS	FD8B	CMPFP	F8A8
CMPLOG	EEBA	CMPNUM	F88E	CMPRES	EEFE	CMPSTR	EEE6	CN	0020
CNVIN1	FD20	CNVIN2	FD27	CNVIN3	FD2E	CNVIN4	FD35	CNVIN5	FD3C
CNVNUM	F926	COMMAN	1043	COMPL	F67E	CONCAT	F306	CONEXP	F956
CONMON	FCD9	CONOT1	FCF1	CONPOS	F61B	CONT	E89E	CONTAD	10D4
CONVAR	EE22	CONVIN	FD19	COPY	E021	COS	FC00	COUNT	E746
CPDEHL	E68A	CPYLIT	E5B1	CR	000D	CRARLP	F065	CREARY	F04A
CRESTR	EAC9	CRLIN	FFE7	CRLIN1	FFE1	CRNCLP	E512	CRTMST	F1C2
CRTST	F1CE	CRTSTE	F1E4	CRUNCH	E509	CS	000C	CSAVE	F4C3
CSTART	E012	CTLOFG	1045	CTRLC	0003	CTRLG	0007	CTRLO	000F
CTRLR	0012	CTRLS	0013	CTRLU	0015	CTRLZ	001A	CUROPR	10C5
CURPOS	10AB	CURSOR	0C29	DATA	EA70	DATFLG	10AE	DATLIN	10C9
DATSNR	E3A7	DCBCDE	F8DF	DD	0012	DDERR	E3B6	DEEK	FDBC
DEF	F106	DEFSIZ	F06D	DEINT	E98B	DEL	007F	DELAY	FD9B
DELAY1	FD9C	DELAYB	FCCD	DELCHR	E5E1	DEPINT	E985	DETHL4	F86E
DETHLB	F870	DIGTXT	FA20	DIM	EF28	DIMRET	EF1F	DINPOS	E6BF
DIV	F767	DIV1	100A	DIV10	F75B	DIV2	100E	DIV3	1012
DIV3EX	FFB1	DIV3LP	FFA8	DIV4	1015	DIVLP	F78E	DIVSUP	1009
DOAGN	E4F8	DOCOM	EB98	DODEL	E5C1	DOEBIT	FA60	DOFN	F133
DOKE	FDC7	DONULL	EB86	DOSPC	EBC2	DOSUM	E94D	DOTAB	EBAF
DPOINT	F952	DTSTR	F1D2	DVBCDE	F769	DZ	0014	DZERR	E3B0
ECHDEL	E5D5	EDIGIT	F999	ENDBUF	E5B8	ENDCON	F965	ENDDIM	F0CC
ENDINP	EB7C	ENDLIN	FEF1	ENDNAM	EF4A	ENDPRG	E87A	ENFMEM	E393
ERRIN	E3E1	ERRLIN	10D2	ERRMSG	E33F	ERROR	E3C1	ERRORS	E2B9
ESC	001B	EVAL	ED5A	EVAL1	ED5D	EVAL2	ED66	EVAL3	ED69
EVLPAR	EE09	EVNOT	EF08	EXCUTE	E816	EXP	FAFA	EXPLP	F944
EXPTAB	FB3A	EXPTEN	FA72	EXTIG	ECC1	FANDT	ECEB	FC	0008
FCERR	E9A0	FDTLP	ECD2	FILE	F58E	FILFND	F574	FINDEL	F0A8
FLGDIF	F81E	FLGREL	F825	FLGVER	F509	FLPLED	FE39	FNARG	10E0
FNCTAB	E10F	FNDARY	F018	FNDELP	F0AD	FNDEND	E48D	FNDNUM	F481
FNDTOK	E71B	FNDVAR	EF8F	FNDWRD	E53C	FNOFST	EE33	FNRGNM	10DE
FNTHR	EF9D	FNVAL	EE5F	FOPRND	ED92	FOR	E779	FORFLG	10CB
FORFND	E7A9	FORSLP	E78D	FOUND	F594	FPADD	F5CD	FPBCDE	F854
FPEXP	10E7	FPINT	F8BB	FPMULT	F708	FPREG	10E4	FPROND	F665
FPSINT	E97F	FPTHL	F86B	FRE	F0D0	FRENUM	F0EC	FRMEVL	EE25
GARBGE	F253	GARBLP	F256	GETCHR	E836	GETCMD	E405	GETHDR	E910
GETINP	FD05	GETINT	F484	GETLEN	F386	GETLIN	E5F2	GETLN	E9A6
GETNUM	ED41	GETNXT	E557	GETSTR	F350	GETTIN	FD13	GETVAR	EF2D
GETXYA	FF15	GNXARY	F28A	GOFUNC	EE67	GOSUB	EA1C	GOTO	EA2D
GRBARY	F2AA	GRBDON	F22B	GRBLP	F264	GSTRCU	F353	GSTRDE	F357
GSTRHL	F356	GTFLNM	F395	GTFNAM	EF32	GTLNLP	E9A9	GTSIXD	F9EA
GTVLUS	EC3D	GUART	FD56	HALF	FA91	HALFPI	FC4A	HDRLP	E912
ID	0016	IDTEST	F17B	IF	EAFF	IFGO	EB0D	IFJMP	E81D
IGCHR	FD00	INCHL	F869	INCLEN	E6BB	INDFND	E370	INEWLN	E455

INIT	E019	INITAB	E2DF	INITBE	E33F	INITST	FEBB	INLINE	FEE8
INMSG	E346	INP	F441	INPBIN	EC8F	INPBRK	E877	INPORT	103F
INPSUB	103E	INPUT	EBFD	INRNG	F9F3	INT	F8E6	INTVAR	E4C9
INVSGN	F83C	ITMSEP	EC80	JJUMP	FFFA	JJUMP1	FDDE	JPLDSV	FFD6
JSTZER	FA7C	KILFOR	ED31	KILIN	E5EC	LCRFLG	10AC	LDNMI1	E73C
LEFT	F3B2	LEN	F382	LET	EA87	LETNUM	EADA	LETSTR	EAA2
LF	000A	LFRGNM	F437	LINEAT	105C	LINEIN	F9A5	LINES	FDAD
LINESC	1046	LINESN	1048	LINFND	E43E	LINTBF	FF02	LIST	E6DD
LISTLP	E6E9	LOADFP	F862	LOG	F6C7	LOGTAB	F6BA	LOKFOR	E35A
LOOPST	10C7	LS	001C	LSTBIN	10CC	LSTLP2	E709	LSTLP3	E70C
LSTRAM	10AF	LSTRND	103A	LTSTND	EC9A	LWIDTH	1042	MAKINT	F487
MAKNUM	FA0F	MANLP	F92E	MATCH	E589	MEMMSG	E103	MFLP	0051
MID	F3EC	MID1	F3B8	MIDNUM	F43C	MINCDE	F60D	MINUS	EE11
MKTMST	F1BF	MLDBLP	F907	MLDEBC	F8FF	MLOOP	E049	MLSP10	F7FC
MO	0024	MONITR	FEA2	MONLD	FE88	MONOUT	FE45	MONSTT	0000
MONTST	FE6D	MONTYP	008D	MONVE	FEAA	MORDT	ECA6	MORINP	E610
MOVBUF	E474	MOVDIR	E591	MOVLP	E37F	MOVSTR	E37C	MOVUP	E379
MRPRNT	EB1F	MSIZE	E036	MUL8LP	F733	MULLN2	F6FF	MULT	F706
MULT8	F72A	MULTEN	F970	MULVAL	10F6	MVSTPT	EAD1	NASOUT	FCFB
NEDMOR	EC39	NEGAFT	FAA7	NEW	E4B9	NEXITM	EBD2	NEXT	ECF6
NEXT1	ECF9	NF	0000	NFERR	E3B3	NMI	0C7E	NMIFLG	104C
NOCHNG	E581	NOENED	FA7F	NOLIN	E88D	NOMADD	F744	NOMLAD	F915
NOPMPT	EC17	NOREMD	FFBA	NORES	FF75	NORMAL	F638	NOSPC	E578
NOSWAP	F5E7	NOTSTR	EF65	NOXOR	F467	NSCFOR	EF75	NULFLG	1044
NULL	E8B1	NULLP	EB8D	NULLS	1041	NUMASC	F9B8	NXTARY	F02C
NXTBYT	E567	NXTCHR	E5A8	NXTDAT	10DC	NXTDTA	EA6F	NXTITM	EC31
NXTOPR	10D0	NXTSTL	EA76	NXTSTT	EA79	OD	0006	OKMSG	E34B
OM	000C	OMERR	E3A2	ON	EAE1	ONGO	EAF0	ONGOLP	EAF1
ONJMP	E81E	OPNPAR	ED56	OPRND	EDD1	OS	001A	OTKLN	E5E9
OTPORT	1007	OUTBAD	F56B	OUTC	E69B	OUTCHR	FCFD	OUTEXP	FA70
OUTIT	E67C	OUTNBS	E682	OUTNCR	FFF4	OUTSUB	1006	OUTWRD	E725
OV	000A	OVERR	E3BC	OVTST1	F7EF	OVTST2	F7F4	OVTST3	F7F5
PADD	F994	PAND	EE81	PASSA	F101	PBUFF	10E9	PEEK	F5A3
PEND	E872	PHLTFP	F851	PLUCDE	F672	PNORM	F640	POINT	1051
POINTO	FF91	POINTB	FF79	POINTX	FF87	POKE	F5AA	POPAF	F245
POPHL	F36F	POPHRT	F754	POPNOK	E3F7	POR	EE80	POR1	EEA3
PORTO	0C00	POS	F0FE	POSINT	E982	POUT	F44D	POWER	FAB5
POWER1	FAC5	POWER2	FAE2	POWERS	FA95	PRINT	EB23	PRITAB	E2A4
PRNTCR	EB81	PRNTHL	F9AD	PRNTLP	EB26	PRNTNB	EB69	PRNTOK	E3F8
PRNTST	EB6D	PRNUMS	F20F	PROCES	E629	PROGND	10D6	PROGST	10F9
PROMPT	E4FC	PRS	F210	PRS1	F213	PRSLP	F21A	PSET	1054
PSUB	F5C8	PTRLP	E481	PUTBIT	FF4B	PUTBUF	E668	PUTCTL	E66D
PUTFID	E7EE	QTSTLP	F1D5	QTSTR	F1CF	QUARTR	FC4E	READ	EC2C
READFG	10CD	REDO	EBD9	REM	EA72	RESCSA	FF4C	RESDIV	F7A1
RESEED	FBEC	RESET	1057	RESETB	FF55	RESTNL	E85B	RESTOR	E846
RESZER	F633	RETADR	EFDC	RETCTC	FE65	RETINT	F82A	RETLIN	EA6A
RETNAD	E58D	RETNUL	EFDF	RETNUM	EE1D	RETREL	F81C	RETURN	EA4B
RG	0004	RIGHT	F3E2	RIGHT1	F3B6	RINPUT	104E	RLTLP	ED76
RND	FB8B	RND1	FBC7	RND2	FBE3	RNDTAB	FBF4	RNGTST	FA82
RONDB	F654	RONDUP	F653	ROUND	F5BB	RSCALE	F98E	RSLNBK	E770
RSTSTR	F405	RUART	F4B4	RUN	EA10	RUNCNT	E7F2	RUNFST	E4C5
RUNLIN	EA2C	SAVE	FE73	SAVEXP	F634	SAVSTP	E7E5	SAVSTR	F1AA
SBSCPT	EFEA	SCALE	F692	SCALLP	F694	SCALMI	F959	SCALPL	F96F
SCNEND	F2E1	SCPTLP	EFF0	SCRADR	FE11	SCREEN	FDE6	SEARCH	E555
SEED	1017	SETB	FF40	SETIO	F471	SETLIN	E733	SETLIT	E59F
SETOR	FF50	SETPTR	E47C	SETTOP	E06D	SFTENT	FD70	SFTPRG	E446
SGN	F822	SGNEXP	EE70	SGNRES	10E8	SHFTBT	FFBD	SHRITE	F6A1
SHRLP	F6A4	SHRT1	F6A8	SIGNON	E0C5	SIGNS	F879	SIN	FC06

SIN1	FC36	SINTAB	FC52	SIXDIG	F9D5	SMOTOR	FFD1	SMPVAR	F275
SMSER1	FB6A	SN	0002	SNDARY	E91D	SNDHDR	E906	SNERR	E3AD
SPCFST	F9C6	SPCLP	EBCB	SQR	FAAC	SRCHLN	E499	SRCHLP	E49C
SSTSA	F33D	ST	001E	STACK	1066	STAKFP	F844	STALL	E866
START	E000	STARTB	E003	STKTHS	EDBA	STLOOK	115D	STMON	000D
STOP	E870	STORED	E9ED	STPOOL	F2B8	STR	F19A	STRADD	F2BB
STRBOT	10C3	STRENT	EC83	STRSPC	105A	STTLIN	EB74	SUART	FD68
SUBCDE	F5CA	SUBPHL	F5C4	SUMLP	FB73	SUMOFF	E937	SUMSER	FB5B
SUPTLZ	FA54	SVNAM2	EF49	SVSTAD	F1C8	T2DUMP	03D1	T4READ	070C
T4WR	0400	TAN	FC67	TBRK	001C	TBRK2	FD50	TBS	001D
TCHINP	FE62	TCLS	FD96	TCR	001F	TCS	001E	TCUR	0C18
TESTOS	F247	TESTR	F229	THSFIL	F548	TIN	0C4D	TLOAD	FE99
TM	0018	TMERR	E3BF	TMFLP	FE42	TMNCUR	FE04	TMNOUT	FE4F
TMPSTR	10BF	TMSTPL	10B3	TMSTPT	10B1	TOPOOL	F3AE	TOSTRA	F346
TOUT	0C4A	TRYAGN	FA2F	TSALP	F347	TSAVE	FE7F	TSTBIT	FFED
TSTBRK	E861	TSTMEM	E05B	TSTNUM	ED44	TSTOPL	F1F0	TSTRED	EEA8
TSTREM	E5A2	TSTSGN	F813	TSTSTR	ED45	TTYLIN	E607	TYPE	10AD
UARTD	0001	UARTOT	FD5F	UARTS	0002	UF	0022	UFERR	E3B9
UL	000E	ULERR	EA46	UNITY	F6B6	UPDATA	E85C	URTOLP	FD61
USR	1003	VAL	F41C	VAREND	10D8	VDU	0800	WAIT	F453
WAITLP	F468	WARMST	E0AE	WIDTH	FDA5	WORDS	E143	WORDTB	E25A
WRKSPC	1000	WUART	F4BA	WUART2	F4B7	XYPOS	FF96	ZDATA	0083
ZDIV	00AF	ZEND	0080	ZEQUAL	00B4	ZERARY	F08B	ZERBYT	E34A
ZEROLP	EFCE	ZFN	00A7	ZFOR	0081	ZGOSUB	008C	ZGOTO	0088
ZGTR	00B3	ZJUMP	FFFD	ZLEFT	00CD	ZLTH	00B5	ZMINUS	00AD
ZNEW	00A4	ZNOT	00AA	ZONELP	EBA6	ZOR	00B2	ZPLUS	00AC
ZPOINT	00C7	ZPRINT	009E	ZREM	008E	ZSGN	00B6	ZSPC	00A8
ZSTEP	00AB	ZTAB	00A5	ZTHEN	00A9	ZTIMES	00AE	ZTO	00A6

THE END

Dave Hunt's Bits

Introductory Wafflings

Time flies, it seems like only yesterday I was writing my last piece in a panic to get something into the mag. Yet, in the intervening time I have been on holiday, come back again, sat around, another mag. has come out, I have done this and that and I still don't feel inclined to start setting anything down for the next issue. Still having read the letters in the last issue, and having a distinct feeling that I'm being got at, I have summoned up the energy to put fingers to keyboard, and pour out more of the same old gibberish I'm famous for.

As I seem to have got away with some rude remarks about our Editor in my last piece, we'll try again. He's had a new toy for the last six months!! No, it's not Viv, as mentioned in my last article ... but read on. If any one in the readership happens to be a traffic cop on the M1 or M6, en route from Chesham to Blackburn, and if you happen to stop a white TVR doing what it's supposed to (about 150, that is), don't put him away for too long, or we'll not see another mag until you let him out again .... That's if you can catch him in the first place!!

Computer Illiteracy

Now there seems to be an interesting case of computer illiteracy in our local junior school, and I hasten to add that this school is one of the better thought of schools in our area, progressive but sensible with it. Anyway the story goes like this:

They recently spent some of the PTA loot, extorted from mugs like me who have to spend good money going to school fetes and things, on four computers of the type very popular in schools right now. That's four computers between 400 kids, a pretty poor ratio for a start. Then they sent one class teacher off for a one day course on teaching the kids the mysteries of the computers. Now I believe you can learn a lot in one day, but the mysteries of computers ... in one day? Well when I was dragged along to the last open evening by the Mrs (I had to go, duty or something, as she's on the Board of Govenors), I decided to find out what they did with these computers. I chatted up the teacher in charge of the computers and tried to find out what was taught. Well it wasn't programming as he didn't know a PEEK from a POKE, it wasn't how it worked, because he didn't know what a processor was, yet alone what type, or what the accumulator was, or anything. I was told they had 32K of RAM whatever that was, but he seemed to somewhat wooly about how much of that was workspace, video RAM, etc. What they did have was some `educational' software, but the purposes of this were somewhat obscure, despite the teacher's obvious enthusiasm.

In all quite a waste of twelve hundred quid if you ask me, but I haven't finished yet. Number one daughter, who is twelve, shows no inclination towards computers apart from playing `Wheelie' on a Spectrum. She's more into carpentry at present and spends her time murdering pieces of wood and mangling my tools.

Number two daughter is different, ten years old and altogether a quieter and more studious character. She wants to learn about computers, and fully appreciates that if you can program them, they can do very clever things far faster than you can do them. So after seeing the computer teacher, she went to the school library and borrowed some books. Rather good books they are, with serious intent, but amusing with it. Partially in comic strip, with cartoon bugs upsetting the programs, and written in the most generalised way. They are written for Microsoft BASIC, so what is so syntactically different, that you can't get them to work? The type of computers they use in schools of course.

Pitiful isn't it. Kids with interest can't get past the first few hurdles because the machines they have don't match the books in the library, while the teachers whilst keen, don't know what it's about. Number two daughter is now allowed on my machine, and is bashing in all the programs from David Ahl's book `101 BASIC Computer Programs'. Good practice is this book, it's written for Microsoft BASIC and because many of the programs don't work properly they require modification to make them go. She's actually getting very good, and is writing a database to keep track of her bird watching activities.

Altogether not bad for a ten year old (Dads are allowed a little pride in their kids, aren't they?), but an indictment on the current way computers are being taught in our local junior school. I hope this isn't par for the course in other junior schools, but I rather suspect it might be.

The printer revolution (horrid pun, you work it out)

A couple of years ago daisy wheel printers were priced such that you could only afford one if you were the sort of chap who could afford to buy gold plated ashtrays for the spare Roller. Certainly not the sort of thing to be purchased by the home user (to write poshly typed pleading letters to the Bank Manager), nor the sort of thing which may be used by smaller companies to write a couple of dozen letters a day, or to bash off the odd quote or two. In other words they were expensive!

Despite their price what you got for your money was something which was built like a battleship (so it didn't wear out churning out thousand upon thousand of circular letters which looked hand typed) and that went at a fair old speed (so it didn't take a month of Sundays to churn out the thousand upon .....). You know the sort I mean, the Readers' Digest ones which get consigned to the round filing cabinet unread. Qume and Diablo were the byword for these printers. As such, these beasts were (and still are) worth the money. And if you can lay hands on one at a reasonable price, they would still do for the better quality print job around the home.

However, over the last year a number of `cheaper' daisy wheel printers have appeared. Some of these are simply office typewriters fitted with computer interfaces, some are purpose built computer printers. The office typewriter types tend towards the lightweight, both physically and also in longevity.

Two or three years ago one famous typewriter manfacturer got very cross with some enterprising people who had fitted an interface to one of their lightweight typewriters which was not designed to pound out text, sheet after sheet at a continuous 12 characters per second without stopping every now and then for coffee or to got to the loo (the typist, not the typewriter; before I get any more letters about DRH's funny little mistooks). The reliability problems started to get the manufacturer a bad name. Things have improved now, and the interfaced office typewriters are now robust enough for the average low duty cycle of the typical one person word processor user. Some even have the keyboard arranged to be a serial output device so it can be connected to the computer as the main keyboard. These also act as stand alone office typewriters, and so are seeing increasing use in offices around the country. As far as I'm concerned the only snag with these is the size. With the built in keyboard they are too big for my situation (and I dare say most other home users). I need something I can stick in the corner, and as I already have a keyboard for my computer I don't need (nor want to pay for) another.

When I started playing with computers the only choice at a price I was prepared to pay, was an antiquated IBM golfball. Solid (if its weight was anything to go by, made of lead), reliable, horribly mechanical, noisy and slow. These could be purchased for two or three hundred pounds and provided hours of innocent amusement trying to interface them to a Nascom. I wonder how many readers remember the early issues of the INMC magazine, that was printed on the old IBM golfball, which I might add is still giving sterling service, although no longer in my ownership. Somewhat dearer at that time were surplus Diablo and Qume daisy wheels, equally as heavy and reliable, less mechanical and more electronic, almost as noisy, a lot faster and a nightmare to interface as a lot of them were not fitted with serial or parallel interfaces as we know them today. Software and the necessary hardware drivers for these were diabolical, hampered by the total lack of cooperation on the part of the manufacturers in supplying interface information.

Whilst thinking of interface and service information, I remember IBM computers were totally unhelpful when it came to details on their golfball printers. However, in this instance, a point worth noting was that the IBM typewriter division didn't exactly go a bundle on the 'stuck up twits' in the computer division (their description, not mine). When we told the typewriter division just how unhelpful the computer lot were, the typewriter guys bent over backwards to provide all the stuff we needed.

More recently, a number of medium priced (500.00 to 600.00 price bracket), medium duty daisy wheel printers have become available, mostly from the Far East. Brother, the Japanese typewriter people (is it the same as the sewing machine and knitting machine company?) have a number of daisy wheel computer printers with or without keyboards in all price brackets except the very lowest. Of the Brother machines the best way to describe them is 'average', you seem to get what you pay for. None are exceptional for the price, but all seem to be provided with the facilities that you might expect from the competition at a similar price. Qume, Olivetti, Triumph Adler, Tec and many others have followed the lead with machines in this bracket. But these are still too expensive for the home and small business user.

The Juki 6100 (I might have the number wrong, but the one you can get for about 300.00) is a very nice machine. Not fast, but a well built mechanism and very precise character registration. The only thing I don't like is the choice of wheels and ribbons. Now I'm all for standardisation is this area. I recently came across a 'Kores' printer ribbon catalogue (trade bible), and there are about 600 different types of cassette ribbon in the catalogue. About half of these are visually similar, but bet your bottom dollar, a ribbon for one machine which looks almost like a ribbon for another won't fit. The same applies to daisy wheels, there is a bit more standardisation here, but a growing trend for each printer manufacturer to make his own unique wheel for his printer. Like I says, the Juki have chosen Triumph Adler wheels and ribbons for their printer. On the face of it a very sensible idea, as these are the wheels and ribbons used by the Triumph Adler office typewriters, and so, should be available at your local stationers. Well I tried our local branch of a big chain stationer, and yes, they had them. The snag? The price. 6.00 for a ribbon and 22.00 for an ordinary plastic daisy wheel. I tried the local Indian stationers, he was a bit cheaper for the ribbons, 5.50, but didn't have the wheels. What a rip-off!!.

Two daisy wheel printers have recently come under my scrutinization, and having given then an intense scrute, I will now pronounce myself!! The Sanple Daisy Step 2000 and the almost identical (but not quite) Quen-Data printer. Both printers cost about 225.00 and both are Qume clones in all but speed and quality of construction. Actually, Quen might just be a Far Eastern misspelling for Qume, who knows. Anyway, both use Qume wheels, which are cheap at about 5.50 to 6.00. and available in a vast range of type styles and pitches (if you can only find someone who actually keeps more than just a couple of types), and the carbon multistrike ribbons are cheap at about 3.00 and seem to last for ever.

Both printers have a Centronics interface with a 256 character buffer. The Sanple has a serial RS232 option at about 55.00 with a 2K buffer. The Quen probably has a serial option available, but I haven't yet discovered for sure or how much. The printer control protocols are a superset of the Qume Sprint 5, and being a superset have a few extras thrown in, for example software selectable bidirectional logic seeking printing, selectable hammer strike pressure, etc. Printing speeds are about 20 characters per second with high speed skipping of white space. All the internal software seems to work without bugs, and although slow, the print output is of very good quality.

What about the mechanism? Well it's Ok so long as you keep the lid shut and don't look too closely. Pressed steel chassis, guides and runners where the Qume has a diecast aluminium chassis and precision ground steel guides and runners. The carriage is poorly located on the guides with nylon carriage slides. By contrast the Qume has phosphor bronze bushings for the front guides and sprung ball races for the rear. A not so subtle difference between the Qume mechanism on the one hand, and the Sanple and Quen on the other. Mind you the price difference isn't so subtle either, the Qume costs nearly ten times as much as the other two. The point is that both these cheap printers work, and work well. There can be no doubt that they won't stay working as long as the Qume, but then in a home environment, that sort of longevity isn't required. These two are DRH's best buy at the moment.

And so on to other things

I've spent some time doing some late spring cleaning amongst my disks and in the process came across a nice little program by Ward Christensen. Now for those who aren't devotees of the various CP/M User Groups, Ward Christensen is a software writer of some renown and greater output. You could be forgiven for thinking that he has single handedly written all the software on all the couple of hundred US CP/M User Group disks. He hasn't, but his name must certainly appear more often than most. Anyway, SCRAMBLE is a neat little encryption program for scrambling the text or code of a disk file. I liked the program so I spent a little time doing a little tidy here and a little tidy there just to provide fodder for those who like to find DRH's deliberate mistakes. Now I'll not take the blame for all the mistakes, only the ones I've committed, as the source code came to me as a Z80 source program. Now I haven't yet seen a Ward Christensen program written in Z80, it's always 8080 assembler, so someone has translated the file, and possibly done goodness knows what else in the process. So with no more said, I'll re-print Ward's original DOC file here, and the source will appear somewhere else in this mag.

"SCRAMBLE is a command used to encode a CP/M f'

The format of the command is:

"SCRAMBLE filename.type password"

where "password" is an 8 character password made of characters permissible in a file name (i.e. no ".", etc). To obtain a good "initial seed" for the scrambling process, no character in the password may appear more than twice.

The requested file is scrambled, and re-written in place. To unscramble the file, the IDENTICAL command is issued, i.e:

>SCRAMBLE filename.type password

This is because SCRAMBLE does an "exclusive-or" type modification to the file, and doing two identical exclusive-or's to data result in the same data being returned.

I feel a scrambled file is quite secure. Given that a file was scrambled and the password forgotten, I know of no way to determine what the original file was. Even a file which is all binary-0's, is sufficiently scrambled to defy finding out what the password or original data was. ...But I assume no responsibility for the "security" of files scrambled with SCRAMBLE as I am not a "student of cryptology".

Note also, that if an attempt is made to unscramble a scrambled file, using the WRONG password, then the file is technically "double scrambled" and SCRAMBLE would then have to be executed TWICE, once with the original password, and once with the erroniously-used password. Because of the exclusive or-ing process, either password may be used either time.

03/11/79 Ward Christensen"

Comms Software

Following Ward's Scramble, I've had a letter from Arto Liimatta in Finland, who has thrown all the beautiful and complicated 'comms software out of the window and come up with a very simple patch to PIP.COM to make it communicate with another PIP on another machine, suggested by an article in "Microsystems" July 1983. As he writes,

"I also put here one program PIP, and how to use it for transfering data between maschines. It uses some kind of handshaking in the transmitting procedure, so the receiving maschine won't lost data, while it is saving it to disk. The transmitting computer sends a character and when the receiving computer gets it, it echoes it back to the transmitter who then knows the receiver is ready. When the receiver is not ready it does not echo until it is ready to receive. I think it has been used for many years, but I haven't seen it yet in 80-BUS News."

Now I haven't seen this one either and the code consists of a simple patch in the front of PIP. Once changed, this version of PIP can't be used for anything else, so Arto's suggestion is that the patched PIP be called IOPIP. The code came as a hard copy dump and wasn't quite complete. Fortunately Arto also sent a disk with IOPIP.COM on it, so I disassembled it and then re-assembled it. I then checked the newly assembled code was the same as the code on disk, just in case. Now if you look at the patch area in PIP as supplied, you'll see that there is the start jump, two fake RETs and a great wodge of bytes which read (INP:/OUT:SPACE). This routine neatly fits in this space with acres to spare, which now I know the space is there, I can think of a number of things which could be shoved in. Anyway, Arto's source code is shown later.

All very simple and straight forward, this program should work with a direct wired connection or through a modem via the telephone, but there have to be snags. One problem is that you can not assume an 8-bit data transfer, some machines only have 7-bit serial I/O implemented, so transfering object code files is a problem. Apart from that Arto's letter implies that the [O] option with PIP doesn't work as the receiver can not see a ^Z under this option and therefore doesn't know when the file is finished (I know this to be true, and the [B] option doesn't work either). Hitting RESET does not close the file, so some or all the file will be lost. His suggestion is to transmit all files in HEX in the Intel HEX format and use the LOAD.COM program provided with CP/M to convert back it into a .COM file. This is alright if you have the CP/M User Group utility UNLOAD.COM which converts a file into Intel HEX format. If you haven't tough!! Well perhaps not tough, just tough work, you see, I've just used UNLOAD to unload itself, so if you are really masochistic, you can sit down and type the following in using a word processor and then use LOAD to turn it into a .COM file. If you use Wordstar, do this in the non-document mode, otherwise you'll have soft carriage returns, and that will probably upset LOAD.

```
:100100002A06002BF9C311017E1223130DC2080128
:10011000C9215C00111F010E09CD0801C346010071
:1001200000000000000000000434F4D00000000000F0
:100130000000000000000000000000000000000000BF
:10014000ED0300040000C3B6012A4201EB2A44017A
:100150007D937C9ADA9F01210000224401EB2A4220
:1001600017B957A9CD291012A400119EB0E1ACDA0
:100170000500111F010E14CD0500B7C28B011180BF
:100180000002A440119224401C35D012A440122428C
:1001900001118000E1ACD050021000022 4401EB60
:1001A0002A400119EB2A42017DB43E1AC81A2A449A
:1001B00001232244 01C9AF322B01323F0121000447
:1001C00022420122440 10E0F111F01CD05003CC245
:1001D000ED010E0911DD01CD0500C300000D0A4E31
:1001E0004F2049464 94C452046494C4524215C0056
:1001F00011FB010E09CD0801C322020000000001E
:100200000000000000048455800000000000000000009
:10021000000000000000000000000000000ED070004E6
:1002200000000C3A502F52A1E02EB2A20027D937C62
:100230009ADA95022100002 22002EB2A1E027B9509
:100240007A9CD287022A1C0219EB0E1ACD050011E6
:10025000FB010E15CD0500B7C268021180002A20EF
:100260000219222002C33A020E0911 7402CD0500C0
:10027000F1C300000D0A4449534B2046554C4C3AFB
:10028000204F46494C45241180000E1ACD0500210F
:100290000000222002EB2A1C0219EBF1122A200294
:1002A00023222002C9AF320702321B02210004229E
:1002B0001E02210000222002 0E1311FB01CD0500B9
:1002C0000E1611FB01CD05003CC2ED020E0911D73F
:1002D00002CD0500C300000D0A4E4F2044495220B4
:1002E0005350414345 3A204F46494C4524210001 93
:1002F000600116D001A13D630DA1403FE0ADA0B69
:1003000003D607DA1403FE10D2140329292929 4F32
:1003100009C3F50222EA03CD4901CA8A03F53E3A30
:10032000CD2502AF32EC033E10CD4E033AEB03CDA8
:100330004E033AEA03CD4E03AFCD4E03F10610C58E
:10034000CD4E03C105CA7003CD4901C33F034F3AE7
:10035000EC039132EC0379 0F0F0F0FCD5F0379E6B9
:10036000FC630FE3ADA6A03C607C5CD2502C1C9F9
:100370003AEC03CD4E033E0DCD25023E0ACD2502BB
:100380002AEA0311100019C314033E3ACD250206D0
:100390005AFC5CD4E03C105C291033E0DCD25026B
:1003A0003E0ACD25022A20027DE67FC2B103221E2D
:1003B00023E1AF5CD2502F1C2A5030E1011FB0174
:1003C000CD05003CC2E7030E0911D203CD0500C3E1
:1003D000E7030D0A43414E4E4F5420434C4F5345C3
:1003E000204F46494C4524C3000000000000000097
:1003F0000000000000000000000000000000000000FD
:0000000000
```

Well that just about sums it all up for this time. I'll keep Arto's article on switching between NASDOS and Nascom CP/M over until next time, so until next time have fun getting UNLOAD typed in.

```
SCRAMBLE      M-80      14 Oct 1984      20:45    PAGE    1


                        Title SCRAMBLE
                        Subttl Program to scramble CP/M files using an 8-bit password.

                                  .z80

 000D                   day       equ     13               ; Last..
 000A                   month     equ     10               ; ..modification..
 0054                   year      equ     84               ; ..date

                        .Comment "
                        SCRAMBLE by Ward Christensen
                        Minor assembly changes.        D. R. Hunt        13/10/84

                        Scrambling is done in place, i.e. the file is modified
                        on top of itself. The same password used to scramble
                        the file is used to unscramble it, using the exact same
                        command.  This is because the scrambling code is
                        exclusive-or'ed with the data file, and two same exclusive
                        ors result in the original value being returned.

                        Command format:

                                  scramble filename.type password

                        where password is any 8 character string which is
                        allowable as a file name (i.e. no '.', etc).       "

                        ; CP/M equates
 0009                   print     equ     9
 000F                   open      equ     15
 0010                   close     equ     16
 0014                   read      equ     20
 0015                   write     equ     21
 0005                   bdos      equ     0005h
 005C                   fcb       equ     005ch
 006C                   fcb2      equ     006ch
 0068                   fcbext    equ     fcb+12
 007C                   fcbrno    equ     fcb+32

 000D                   cr        equ     0dh
 000A                   lf        equ     0ah

 0000                   mf        defl    0                ; Show move not requested
 0000                   cf        defl    0                ; Show comp not requested

                        ; Define some macros to make things easier

                        ; Define data move macro: move from,to,length
                        ;         from may be addr, or quoted string
                        move      macro   ?f,?t,?l
                                  if      not nul ?f
                                  irpc    ?c,?f
                        ?q        defl    '&?c&?c'         ; Test for quote
                                  exitm
                                  endm
```

```
                        if      ?q eq ''''
                        local   ?b,?z
                        call    ?z
                ?b:     defb    ?f
                ?z:     pop     hl              ; Get from
                        ld      bc,?z-?b        ; Get len
                        else
                        ld      hl,?f
                        endif
                        endif
                        if      not nul ?t
                        ld      de,?t
                        endif
                        if      not nul ?l
                        ld      bc,?l
                        endif
                        call    mover
                mf      defl    -1              ; Show expansion
                        endm

                ; Define CP/M macro - cpm fnc,parm
                cpm     macro   ?f,?p
                        push    bc
                        push    de
                        push    hl
                        if      not nul ?f
                        ld      c,?f
                        endif
                        if      not nul ?p
                        ld      de,?p
                        endif
                        call    bdos
                        pop     hl
                        pop     de
                        pop     bc
                        endm

0000'                   aseg
                        org     100h

                ; Start of program execution
0100    CD 0122         call    start
0103    0D 0A 53 43     defb    cr,lf,'SCRAMBLE as of '
0107    52 41 4D 42
010B    4C 45 20 61
010F    73 20 6F 66
0113    20
0114    31 33 2F        defb    '0'+day/10,'0'+day mod 10,'/'
0117    31 30 2F        defb    '0'+month/10,'0'+month mod 10,'/'
011A    38 34 2E        defb    '0'+year/10,'0'+year mod 10,'.'
011D    0D 0A 0D 0A     defb    cr,lf,cr,lf,'$'
0121    24

0122    D1      start:  pop     de              ; Get id
0123    0E 09           ld      c,print
0125    CD 0005         call    bdos            ; Print id
```



```
                ; Init. local stack
0128    21 0000         ld      hl,0
012B    39              add     hl,sp
012C    22 0407         ld      (stack),hl
012F    31 0407         ld      sp,stack

                ; Scramble a while to mix up the seed
0132    26 00           ld      h,0             ; Get 256 £'s
0134    CD 02F8 mixup:  call    pseuran         ; Get a £
0137    25              dec     h               ; More?
0138    C2 0134         jp      nz,mixup        ; Loop if so

                ; See that the password is 8 characters
013B    3A 0074         ld      a,(fcb2+8)
013E    FE 20           cp      ' '
0140    C2 0162         jp      nz,pwis8
0143    CD 03A8         call    exit
0146    2B 2B 20 50     defb    '++ Password not 8 bytes. ++$'
014A    61 73 73 77
014E    6F 72 64 20
0152    6E 6F 74 20
0156    38 20 62 79
015A    74 65 73 2E
015E    20 2B 2B 24

                ; Save the password
0162            pwis8:  move    fcb2+1,passwd,8
0162    21 006D   +     ld      hl,fcb2+1
0165    11 03BF   +     ld      de,passwd
0168    01 0008   +     ld      bc,8
016B    CD 039D   +     call    mover

                ; Password is 8 bytes, now make sure no character
                ; is repeated more than 2 times
016E    21 03BF         ld      hl,passwd
0171    06 08           ld      b,8             ; 8 chars to test
0173            duptest:
0173    CD 031B         call    ckdup           ; Aborts if 3 = chars
0176    23              inc     hl              ; To next char
0177    05              dec     b
0178    C2 0173         jp      nz,duptest

                ; See that the input file exists
                        cpm     open,fcb
017B    C5        +     push    bc
017C    D5        +     push    de
017D    E5        +     push    hl
017E    0E 0F     +     ld      c,open
0180    11 005C   +     ld      de,fcb
0183    CD 0005   +     call    bdos
0186    E1        +     pop     hl
0187    D1        +     pop     de
0188    C1        +     pop     bc
0189    3C              inc     a               ; Ok?
018A    C2 01A4         jp      nz,scramlp      ; Yes, scramble the file
```

```
018D    CD 03A8                 call    exit
0190    2B 2B 20 4E             defb    '++ No such file. ++$'
0194    6F 20 73 75
0198    63 68 20 66
019C    69 6C 65 2E
01A0    20 2B 2B 24

                        ; Read the file, scramble a sector, re-write it.
01A4                    scramlp:
01A4    CD 0212                 call    rdsect          ; Read a sector
01A7    DA 01B6                 jp      c,finish        ; Exit loop if eof
01AA    CD 0253                 call    scrambl         ; Scramble it
01AD    CD 0260                 call    backup          ; Re-position for write
01B0    CD 02C1                 call    wrsect          ; Re-write the sector
01B3    C3 01A4                 jp      scramlp         ; Loop until eof

                        ; All done ...
                        ; ... On a "normal" cp/m system, we wouldn't have to do
                        ; anything, because we re-wrote in place. However, for
                        ; such systems as the NorthStar CP/M, we must
                        ; explicitly close the file, because the write to the
                        ; directory will cause the clever Lifeboat-designed BIOS
                        ; to flush it's memory-resident disk buffers.

01B6                    finish: cpm     close,fcb
01B6    C5               +      push    bc
01B7    D5               +      push    de
01B8    E5               +      push    hl
01B9    0E 10            +      ld      c,close
01BB    11 005C          +      ld      de,fcb
01BE    CD 0005          +      call    bdos
01C1    E1               +      pop     hl
01C2    D1               +      pop     de
01C3    C1               +      pop     bc
01C4    3C                      inc     a               ; This better work..
01C5    CA 01DB                 jp      z,finishl
01C8    CD 03A8                 call    exit
01CB    2B 2B 20 41             defb    '++ All done. ++$'
01CF    6C 6C 20 64
01D3    6F 6E 65 2E
01D7    20 2B 2B 24
01DB                    finishl:
01DB    CD 03A8                 call    exit
01DE    2B 2B 20 43             defb    '++ Close error - file left in '
01E2    6C 6F 73 65
01E6    20 65 72 72
01EA    6F 72 20 2D
01EE    20 66 69 6C
01F2    65 20 6C 65
01F6    66 74 20 69
01FA    6E 20
01FC    75 6E 6B 6E             defb    'unknown condition. ++$'
0200    6F 77 6E 20
0204    63 6F 6E 64
0208    69 74 69 6F
```



```
020C    6E 2E 20 2B
0210    2B 24

                        ; Sector read routine
0212                    rdsect: cpm     read,fcb
0212    C5               +      push    bc
0213    D5               +      push    de
0214    E5               +      push    hl
0215    0E 14            +      ld      c,read
0217    11 005C          +      ld      de,fcb
021A    CD 0005          +      call    bdos
021D    E1               +      pop     hl
021E    D1               +      pop     de
021F    C1               +      pop     bc
0220    B7                      or      a
0221    C8                      ret     z               ; All Ok

                        ; Read error or eof
0222    FE 01                   cp      1               ; eof?
0224    37                      scf                     ; Carry shows eof
0225    C8                      ret     z               ; ret, carry set
0226    CD 03A8                 call    exit
0229    2B 2B 20 52             defb    '++ Read error - file may be '
022D    65 61 64 20
0231    65 72 72 6F
0235    72 20 2D 20
0239    66 69 6C 65
023D    20 6D 61 79
0241    20 62 65 20
0245    64 65 73 74             defb    'destroyed. ++$'
0249    72 6F 79 65
024D    64 2E 20 2B
0251    2B 24

                        ; Scramble the sector
0253                    scrambl:
0253    21 0080                 ld      hl,80h          ; Point to sector
0256    CD 02F8         scrlp:  call    pseuran         ; Get pseudo random £
0259    AE                      xor     (hl)            ; Scramble
025A    77                      ld      (hl),a
025B    2C                      inc     l               ; More in sector?
025C    C2 0256                 jp      nz,scrlp
025F    C9                      ret

                        ; Backup the file pointer for the re-write
0260    3A 007C         backup: ld      a,(fcbrno)      ; Get sector £
0263    3D                      dec     a               ; Back up
0264    32 007C                 ld      (fcbrno),a
0267    F0                      ret     p               ; Return if Ok

                        ; We backed up into previous extent, will have
                        ; to re-open it
0268    3A 0068                 ld      a,(fcbext)      ; Get extent
026B    3D                      dec     a               ; Back up l
026C    32 0068                 ld      (fcbext),a
```

```
                                cpm     open,fcb        ; Re-open
026F    C5              +       push    bc
0270    D5              +       push    de
0271    E5              +       push    hl
0272    0E 0F           +       ld      c,open
0274    11 005C         +       ld      de,fcb
0277    CD 0005         +       call    bdos
027A    E1              +       pop     hl
027B    D1              +       pop     de
027C    C1              +       pop     bc
027D    3C                      inc     a
027E    C2 02BB                 jp      nz,open2ok
0281    CD 03A8                 call    exit
0284    2B 2B 20 52             defb    '++ Re-opening extent failed -',cr,lf
0288    65 2D 6F 70
028C    65 6E 69 6E
0290    67 20 65 78
0294    74 65 6E 74
0298    20 66 61 69
029C    6C 65 64 20
02A0    2D 0D 0A
02A3    20 20 20 66             defb    '   file is clobbered ++$'
02A7    69 6C 65 20
02AB    69 73 20 63
02AF    6C 6F 62 62
02B3    65 72 65 64
02B7    20 2B 2B 24
02BB                    open2ok:
02BB    3E 7F                   ld      a,7fh           ; Get hi sector
02BD    32 007C                 ld      (fcbrno),a
02C0    C9                      ret

                        ; Write back the sector
02C1                    wrsect: cpm     write,fcb
02C1    C5              +       push    bc
02C2    D5              +       push    de
02C3    E5              +       push    hl
02C4    0E 15           +       ld      c,write
02C6    11 005C         +       ld      de,fcb
02C9    CD 0005         +       call    bdos
02CC    E1              +       pop     hl
02CD    D1              +       pop     de
02CE    C1              +       pop     bc
02CF    B7                      or      a
02D0    C8                      ret     z
02D1    CD 03A8                 call    exit
02D4    2B 2B 20 57             defb    '++ Write error - file clobbered. ++$'
02D8    72 69 74 65
02DC    20 65 72 72
02E0    6F 72 20 2D
02E4    20 66 69 6C
02E8    65 20 63 6C
02EC    6F 62 62 65
02F0    72 65 64 2E
02F4    20 2B 2B 24
```



```
                        ; Get a pseudo-random 8 bit number using the password
                        ; as a seed.
                        ;       For speed, this routine does no register
                        ;       pushes and pops, however hl isn't used.
02F8                    pseuran:
02F8    0E 04                   ld      c,4             ; Grab every 4th pseu. £
02FA                    pseulp0:
02FA    06 08                   ld      b,8             ; Shift thru 8 bytes
02FC    11 03BF                 ld      de,passwd
02FF    B7                      or      a               ; Clear initial carry
0300                    pseulp1:
0300    1A                      ld      a,(de)          ; Get a char
0301    1F                      rra                     ; Shift
0302    12                      ld      (de),a
0303    13                      inc     de
0304    05                      dec     b
0305    C2 0300                 jp      nz,pseulp1
                        ; Exclusive-or the last few bits into the first one
0308    1B                      dec     de              ; Back up to last
0309    1F                      rra
030A    1F                      rra                     ; Shift a few more
030B    EB                      ex      de,hl
030C    AE                      xor     (hl)
030D    0F                      rrca                    ; Shift lo bit into hi
030E    E6 80                   and     80h             ; Isolate single bit
0310    21 03BF                 ld      hl,passwd       ; Get first byte
0313    B6                      or      (hl)            ; 'or' in the bit
0314    77                      ld      (hl),a          ; Move it back
0315    EB                      ex      de,hl           ; Restore hl
0316    0D                      dec     c
0317    C2 02FA                 jp      nz,pseulp0      ; Loop if more passes
031A    C9                      ret

                        ; Routine to check for duplicate chars in password
031B    0E 03           ckdup:  ld      c,3             ; Dup char counter
031D    11 03BF                 ld      de,passwd
0320    3E 08                   ld      a,8             ; Char count
0322    F5              ckdlp:  push    af              ; Save count
0323    1A                      ld      a,(de)          ; Get char
0324    BE                      cp      (hl)            ; Dup?
0325    C2 0396                 jp      nz,ckndup
0328    0D                      dec     c               ; Count dups
0329    C2 0396                 jp      nz,ckndup
032C    32 0381                 ld      (dupchar),a     ; Save for print
032F    CD 03A8                 call    exit
0332    2B 2B 20 4E             defb    '++ No character may appear more '
0336    6F 20 63 68
033A    61 72 61 63
033E    74 65 72 20
0342    6D 61 79 20
0346    61 70 70 65
034A    61 72 20 6D
034E    6F 72 65 20
0352    74 68 61 6E             defb    'than twice in the password.',cr,lf
0356    20 74 77 69
```

```
SCRAMBLE        M-80    14 Oct 1984     20:45   PAGE    1-7
Program to scramble CP/M files using an 8-bit password.

 035A   63 65 20 69
 035E   6E 20 74 68
 0362   65 20 70 61
 0366   73 73 77 6F
 036A   72 64 2E 0D
 036E   0A
 036F   20 20 20 54              defb    '  The character '
 0373   68 65 20 63
 0377   68 61 72 61
 037B   63 74 65 72
 037F   20
 0380   27                       defb    ''''
 0381                   dupchar:
 0381   00 27 20 64              defb    $-$,''' does in yours. ++$'
 0385   6F 65 73 20
 0389   69 6E 20 79
 038D   6F 75 72 73
 0391   2E 20 2B 2B
 0395   24
 0396   13              ckndup: inc     de
 0397   F1                      pop     af              ; Get count
 0398   3D                      dec     a
 0399   C2 0322                 jp      nz,ckdlp
 039C   C9                      ret                     ; Ok, not 3 dup

                        ; Move subroutines
                                if      mf              ; Macro expansion flag set?
 039D   7E              mover:  ld      a,(hl)
 039E   12                      ld      (de),a
 039F   23                      inc     hl
 03A0   13                      inc     de
 03A1   0B                      dec     bc
 03A2   78                      ld      a,b
 03A3   B1                      or      c
 03A4   C2 039D                 jp      nz,mover
 03A7   C9                      ret
                                endif

                        ; Exit with "informational" message
 03A8   D1              exit:   pop     de              ; Get msg
 03A9   0E 09                   ld      c,print
 03AB   CD 0005                 call    bdos
 03AE   CD 03B4                 call    exitl
 03B1   0D 0A 24                defb    cr,lf,"$"
 03B4   D1              exitl:  pop     de
 03B5   0E 09                   ld      c,print
 03B7   CD 0005                 call    bdos
                        ; Exit, restoring stack and return
 03BA   2A 0407                 ld      hl,(stack)
 03BD   F9                      ld      sp,hl
 03BE   C9                      ret                     ; To ccp
 03BF                   passwd: defs    8               ; Password kept here
 03C7                           defs    40h             ; Stack area
 0407                   stack:  defs    2
                                end
```

```
SCRAMBLE        M-80    14 Oct 1984     20:45   PAGE    S
Program to scramble CP/M files using an 8-bit password.

Macros:
CPM             MOVE

Symbols:
6666    ?Q              0260    BACKUP          0005    BDOS
0000    CF              0322    CKDLP           031B    CKDUP
0396    CKNDUP          0010    CLOSE           000D    CR
000D    DAY             0381    DUPCHAR         0173    DUPTEST
03A8    EXIT            03B4    EXIT1           005C    FCB
006C    FCB2            0068    FCBEXT          007C    FCBRNO
01B6    FINISH          01DB    FINISH1         000A    LF
FFFF    MF              0134    MIXUP           000A    MONTH
039D    MOVER           000F    OPEN            02BB    OPEN2OK
03BF    PASSWD          0009    PRINT           02FA    PSEULPO
0300    PSEULP1         02F8    PSEURAN         0162    PWIS8
0212    RDSECT          0014    READ            0253    SCRAMBL
01A4    SCRAMLP         0256    SCRLP           0407    STACK
0122    START           0015    WRITE           02C1    WRSECT
0054    YEAR
```

```
PIP handshaking interface       M-80    17 Oct 1984     21:51   PAGE    1

                        Title PIP handshaking interface

                        .z80

                        ; CP/M equates
 0003                   rdrin   equ     3               ; Reader input
 0004                   punout  equ     4               ; Punch output
 0005                   bdos    equ     0005h           ; BDOS call

 0000'                          aseg
                                org     100h

 0100   C3 04CE                 jp      04ceh           ; Jump into start of PIP
 0103   C3 010A                 jp      recv            ; Receive a character
 0106   C3 0119                 jp      txmit           ; Send a character
 0109                   buf:    defs    1               ; Temp. space for rx'd byte
 010A   0E 03           recv:   ld      c,rdrin         ; Get a character from RDR:
 010C   CD 0005                 call    bdos
 010F   32 0109                 ld      (buf),a         ; Put it in buffer
 0112   5F                      ld      e,a             ; Echo it straight out ...
 0113   0E 04                   ld      c,punout        ; ... through PUN:
 0115   CD 0005                 call    bdos
 0118   C9                      ret
 0119   59              txmit:  ld      e,c             ; Send a character to PUN:
 011A   0E 04                   ld      c,punout
 011C   CD 0005                 call    bdos
 011F   0E 03                   ld      c,rdrin         ; Wait for the echo
 0121   CD 0005                 call    bdos
 0124   C9                      ret                     ; Echo received, all done.
                                end
```

The 80-BUS 800 Series

by P. A. Greenhalgh

In these hallowed pages in the past you must have come across various 800 series numbers (e.g. "I use a GM802 plus EV814.....") and wondered what the writer was referring to. Well, fear no longer. This is the first part of an `article´ describing what physical products these magic incantations refer to.

So what is an `800 Series´ product? Well, the 800 series was started by Gemini Microcomputers some considerable time ago, and consecutive numbers were given to each product as it was developed. An 800 number is allocated by Gemini only to major 80-BUS related items, and this therefore includes all of their 80-BUS boards, power supplies, keyboards, assembled motherboards etc. All of these Gemini numbers are given a `GM´ prefix. Gemini also decided to include other `preferred´ products from other manufacturers, and therefore the `EV´ referred to above means that the product comes from EV Computing. Similarly Belectra, Climax Computers, IO Research, and Microcode Processes have all had 800 series products.

So what is special about 800 series products? Well basically these are all built and tested products (there are one or two exceptions, and these have a `K´ suffix, meaning `kit´), any 800 product should run with any other 800 product, and software support is available for most permutations. This is a somewhat over-simplified view, as, because of the exceedingly high number of permutations, there will inevitably be some exceptions, but for example to the question "Will a GM813+GM832+GM829+GM888+GM833+IO828+IO830+EV814+GM862+GM825 +GM835+GM816+GM818+MP840 system run, and is there software for this?" the answer would be "Yes, if you can afford it, and if you have Battersea Power Station at your disposal."!!! However, if the question substituted that string of 800 numbers for just "GM813+MAP256+GM812+NASCOM-AVC" then the answer would be a resounding "NO", as the AVC and 812 are set to conflicting ports, the AVC memory has to overlay the MAP256, the GM813 and MAP256 have different uses of port 0FEH, etc. Now the problem is not, at the end of the day, totally insoluble, but you would have to have a very good working knowledge of all of these products, and you are certainly going to face a severe challenge in finding any software that will run straight away, even if you overcome these `slight´ problems.

So the point is that if you have an 800 series based system then you will certainly find life much easier if you stick with 800 series add-ons, and hopefully the following list will give you a much greater insight into what these are..... (Please note that the following information is NOT guaranteed to be correct, although it hopefully is! Contact your dealer if you have a specific requirement.)

GM801
A complete 64K twin disk CP/M computer based on a single board designed by Gemini and sold to British Micro, who later released it as the `Mimi´.

GM802
80-BUS 64K dynamic RAM board from Gemini incorporating Nascom style `page-mode´ to allow up to four of these boards to be used in a system. Also available as a kit in 16K form and minus page-mode circuitry. Does not support the `Extended Addressing´ mode later introduced by Gemini (see GM813).

GM803
80-BUS EPROM/ROM board from Gemini taking up to 16 EPROMs, either 2708 (1Kx8) or 2716 (2Kx8) types. Also has socket for Nascom 8K BASIC ROM. Incorporates `page-mode´ but not `Extended Addressing mode´. Was also available as a kit. Discontinued, to be superceeded by GM853.

GM804
A linear power supply for powering up to two 5.25" floppy disk drives. Used inside GM805, GM815 and GM825. Only ever sold as a kit. Discontinued (although still used by Gemini in the GM825).

GM805
A single/twin 5.25" disk drive unit incorporating Henelec single density disk controller board and GM804 PSU. Pertec FD250 double sided 48tpi drives used giving 160K bytes formatted per drive. For use with Nascoms, connected to the system via the Nascom´s Z80 PIO. Discontinued.

GM806
A combined 5A power supply board, buffer board with `Reset jump´ circuitry, and 5 slot backplane for expanding Nascom 1 computers. Sold as kit only. Also sold in `A´ version without PSU components. Only `A´ version now available.

GM807
A 3A linear power supply unit suitable for powering small systems. Was also available as a kit. Now discontinued and replaced by various switch-mode units (see on).

GM808
An EPROM programmer for 2708 and 2716 EPROMs. Originally produced by Bits and PCs and later taken over by Gemini. Attaches to the system via a Z80 PIO. Supplied with software for use with Nascom and Nas-Sys. CP/M software for Gemini systems available on request. Only available as a kit.

GM809
80-BUS single/double density floppy disk drive controller board. Supplied suitable for 5.25" use only, but small modification possible to support 8" only. Superceeded by GM829.

GM810
80-BUS motherboard incorporating 8 80-BUS positions (and connectors) and 5A linear power supply. Discontinued.

GM811
80-BUS CPU board. 4MHz Z80A processor, Z80A PIO, 8250 UART providing programmable baud rates, stop bits, parity, etc., RS232 interface, 1200 baud CUTS cassette interface, 8-bit input port. Most powerful feature of this board is the four `byte-wide´ 28 pin sockets that may be populated with EPROMs, ROMs or static RAMs from 2Kx8 to 16Kx8 (32Kx8?) per socket, thus making the board suitable for many control applications with, for example, 48K of EPROM and 8K of RAM on board. On-board memory may be switched out of memory map under software control. Memory decoding is provided by PROM which must be replaced if the standard 4 by 4Kx8 decoding is unsuitable. Normally supplied with RP/M monitor that emulates CP/M in a cassette based environment, and can also `boot´ GM809/GM829 based floppy disk system.

GM812

80-BUS IVC (Intelligent Video Controller) board. Has own on-board 4MHz Z80A to control all video functions. Interfaces to the host computer via three 80-BUS I/O addresses, thus not encroaching on any host memory. Normal mode 80 characters per line by 25 lines, with optional second mode (supplied set to 48x25, but user alterable). System keyboard (parallel type) is normally connected via the IVC, which thus provides `type-ahead´ facility, and with certain keyboards also provides user-definable function keys (see GM827 and GM852). Light pen input provided. 256 different characters may be displayed, 128 fixed in EPROM and 128 user-programmable, being held in on-board RAM. Many control sequences include cursor addressing, partial screen scroll lock, pixel graphics (160x75), clear to end of line, clear to end of screen, define function keys, define programmable characters, insert or delete character from line, etc, etc. Now replaced by GM832 SVC.

GM813

80-BUS CPU/RAM board. Similar overall specification to GM811 above, but without 8-bit input port and with the `byte-wide´ sockets replaced by a 2K/4K EPROM socket (removable from memory map under software control) plus 64K of dynamic RAM. This RAM is switchable as Page 0 under the Nascom style `page-mode´ operation. This board also includes the Gemini `Extended Addressing´ mode by utilising memory mappers. This allows the user to select the 64K of memory that the Z80 `sees´ at any time as any 16 blocks of 4K each, out of a total memory space of 512K. This `Extended Addressing mode´ may also be used in conjunction with `page-mode´ to provide up to 4 pages of up to 512K, i.e. 2MBytes total. However note that very specialised software would be required to do this. Normally supplied with RP/M (see GM811), but in complete systems (e.g. Gemini Galaxy) supplied with an auto-boot EPROM that detects whether Winchester hard disks or 5.25" floppy disks are present on a GM809/GM829 and automatically `boots up´.

EV814

80-BUS IEEE 488 interface board from EV Computing for (surprise, surprise) connecting to other IEEE 488 devices. Incorporates on-board control software under the `page-mode´ scheme that can be brought in and out of the system memory map. Does not support `Extended Addressing´.

GM815

Single/double 5.25" disk drive unit for use with GM809/GM829, incorporating 1 or 2 Pertec FD250 double sided 48tpi drives and GM804 PSU. Capacity, in double density mode, 350K (formatted) per drive. Discontinued - replaced by GM825.

GM816

80-BUS Multi-I/O board. Originally designed by Quantum, and then taken over by Gemini, this board provides 3 Z80A PIOs, a Z80 CTC, and a National Semiconductor 58174 Real-Time-Clock chip with battery back-up. An interesting feature of this board is the internal expansion bus - this allows additional boards to be `piggy-backed´ onto the GM816 and make use of the I/O decoding and buffering that it provides. Currently available `piggy-backs´ are the GM818 (see below) and the GM663 prototyping board.

GM817

An 85 Watt switch-mode power supply unit. Suitable for systems with about 5 boards and 2 5.25" drives.

GM818
A serial daughter board for the GM816 (see above) providing two 8250 UARTs with RS232 interfaces. These UARTs have programmable baud rates, stop bits, parity, stop bits etc, and also spare user-programmable input and output bits.

AM819
80-BUS Speech board, using the National Semiconductor Digitalker chip set. This card has a limited on-board vocabulary contained in ROM, and making it say anything outside of this limited library is extremely difficult. Produced by Arfon Microelectronics, who unfortunately went into receivership. Boards MAY still be available from one or two dealers.

AM820
Light pen, suitable for use with the GM812, GM832 and GM837 boards. Again, as AM819, this was an Arfon product, and so unfortunately it may prove impossible to obtain any more.

GM821
Original 59 key parallel interface keyboard from Gemini for use with the GM812/GM832 video boards. Although only 59 physical keys, all 128 possible 7-bit ASCII codes can be generated. Discontinued (see 827 and 852).

GM822
A small board containing a Nat. Semi. 58174 Real Time Clock chip with battery back-up. Connected to the system via a Z80 PIO. Only available in kit form.

GM823
Special version of the Gemini GM827 keyboard for the Danish market. Replaced by GM852 low profile version.

GM824
80-BUS A/D convertor board. Originally produced by IO Research, but later taken over by Gemini. This board provides 8 channels, each of 8 bit resolution. Input range is 0 - 5 volts with over-voltage protection. Conversion time is approx. 30 uS, including sample and hold phase. Support for vectored interupts, and on-board prototyping area.

GM825
A single/twin 5.25" disk drive unit using one or two Micropolis drives and GM804 PSU. For use with GM809/GM829. Available in single and double sided 96tpi versions. Capacity in double density mode is 400K single sided, 800K double sided (formatted).

MP826
80-BUS CMOS RAM board from Microcode Processes. Contains 32K of battery-backed static RAM to give 1000 hours of memory retention during power-down periods. Flexible address decoding and Page Mode operation, but does not support Extended Addressing.

GM827
Gemini's 87 key keyboard (parallel interface) for use with the GM812/GM832 video boards. The keyboard has a 57 key main cluster, plus 11 function keys, 4 cursor keys, and 15 key numeric pad. Theses latter 30 keys may ALL be user-defined (via the G812 or GM832 video boards) in both their normal and shifted modes. Replaced by GM852 low profile versions.

<u>IO828</u>
80-BUS 'Pluto' colour board from IO Research. The number of permutations of this board should be the subject of an article of its own! Started off with on-board 5MHz 8088 processor, 640x288 resolution, 8 colours, two screens. Then there were 640x576 options, 8MHz options, and the current product is normally 768x576, 8 colour, 8MHz 8088, although the 640x576 (640x288x2) version can also be ordered! Also see other IO 800 products. Any volunteers for a 'Pluto Family' article?

<u>GM829</u>
80-BUS floppy disk controller board. Fully compatible with the GM809 that it replaced, but with a previously unused bit of the control port being used to switch the board between 5.25" and 8" operation, allowing both types (and 3.5" drives that electrically 'look' like 5.25" drives) to be attached to the GM829 at the same time. In addition the board contains a SASI interface that is used for the connection of Winchester disk controller boards. For an example of the flexibility of this board look at the Gemini Galaxy M-F-B family, the top model of which has a 16 Mbyte Winchester, double-sided 96tpi 5.25" drive, double-sided 48tpi 5.25" drive, double-sided 8" drive, and double-sided 3.5" drive all connected via a GM829.

<u>IO830</u>
Mini-pallette board from IO Research, available as an add-on for the IO828 'Pluto' (although the latter then needs a new monitor EPROM). Gives the user the ability to select any 8 screen colours out of a Pallette of 256. This can be particularly impressive if 8 grey levels are selected, the resulting picture almost looking as good as a B&W photograph. Two look-up tables are supported, and the user may switch rapidly between them.

<u>GM831</u>
5 slot 80-BUS backplane (with 1" pitch between boards) including 77-way 80-BUS edge connectors. Discontinued as a built product, but the PCB continues to be available.

<u>GM832</u>
80-BUS SVC (Super Video Controller) board. Fully compatible with the GM812 IVC that it replaces, but with the following enhancements. 6MHz Z80B CPU used, which in conjunction with other hardware and software changes provides far greater speed. Second text mode is now 40x25. Graphics mode added of 256x256, with on-board monitor containing line and circle drawing routines, polygon fill routines etc. Buzzer added. Attributes added - half-intensity characters, half-tone background, blinking. All 256 characters are now user-definable - on power up they are down-loaded from the on-board monitor, and this includes switch options for French, Danish, German, Swedish, American and English characters. Serial keyboard input option added - although this is of Gemini's own design (see GM852).

<u>GM833</u>
Gemini's 80-BUS RAM-DISK board. Provides 512K bytes of RAM driven via a 'disk-like' 80-BUS I/O port interface of 'track', 'sector' and 'data' ports. On-board switch allows up to 16 boards to be decoded at the same port addresses, theoretically providing up to 8MBytes!

GM834
Special version of the Gemini GM827 keyboard for the German market. Replaced by GM852 low profile version.

GM835
5.25" Winchester hard disk drive sub-system. Contains a Rodime drive, along with hard-disk controller board and switch-mode power supply. Currently available in 5.4, 10.8 and 16.2MByte (formatted) capacities. Connects to SASI interface on GM829 board.

GM836
MultiNet interface board. This small board is connected to the system via a Z80A PIO. An on-board DIL switch provides a unique station address to allow up to 32 systems to be connected together. The board transmits data onto the Network at 250 kbaud, at distances up to 600 metres using RS422 differential transmission.

GM837
80-BUS Colour board. Previously produced by Climax Computers, production of this board has now been taken over by Gemini. The board uses the Thomson EF9365 controller chip and provides high speed vector graphics of 256 x 256 in 16 colours. The chip also has a built-in character generator, and can write text in various orientations. Output is PAL UHF and analogue RGB TTL.

GM838
Special version of the Gemini GM827 keyboard for the French market. Replaced by GM852 low profile version.

GM839
80-BUS prototyping board. One of the great attractions of 80-BUS is the ease with which one-off boards can be interfaced to it, and this board provides an ideal base for one of these, incorporating extensive power rail connections, and laid out to allow high density IC packing.

MP840
14 slot 80-BUS backplane from Microcode. NOT supplied with any 80-BUS 77-way edge connectors. All active BUS signals are terminated into a potential balanced RC filter and are interlaced with ground shield tracks. The board can be easily `cut-down' if required for smaller systems.

GM841
This 80-BUS extender board allows 80-BUS boards to be brought outside of a frame for testing and debugging purposes. Test point pins are provided on all lines, and all lines have their 80-BUS nomenclature.

Well, that's enough for this time. Next issue I hope to continue through to GM888, and possibly beyond !! I hope that the above descriptions bring out a few points that you were possibly unaware of before, and thus help you to find your way through the growing maze of products. 80-BUS provides a very flexible means of producing so many possible self-tailored systems, and if the information above in some way helps just one reader from making a potentially costly incorrect decision then it has been justified.

AN IMPROVED NAS-SYS?

by Olav Lerflaten

Here are some suggested modifications to NAS-SYS 3. NAS-SYS 3, while an excellent piece of software, has a couple of shortcomings from my point of view. In particular:

- It does not support a parallel printer.
- Access to the ASCII characters "{", "|", and "}" is awkward.

The latter point is perhaps of most concern to Scandinavians, as these characters are redefined as special Scandinavian letters. To ease word processing, the requirements are that the small "letters" { | } shall correspond to the capital "letters" [\ ], respectively, each pair of "letters" assigned to its own key on the keyboard.

Both these shortcomings are corrected by these modifications to NAS-SYS 3. The requirements are:

- NASCOM 2 keyboard (57 keys)
- Centronics standard printer connector
- PIO port A (8 lines) to printer DATA lines
- PIO line B0 to printer STROBE line
- PIO line B2 to printer BUSY line
- PIO connector ground to printer LOGIC GROUND

The PIO is initialized during power-up, and reset to the printer requirements; this must be taken into account if the PIO is to be used for other purposes.

One problem with NASCOM standard software is differences in supplying LF or not after each CR, this gives problems when using printers. On EPSON printers this is easily fixed, as the CR is not needed, only LF may be used to separate lines. Consequently, this NAS-SYS version converts all CRs to LFs, and ignores all LF codes sent from some software packages. If your printer insists on CRs, it should be possble to convert all CRs to a CR and a LF, still ignoring incoming LFs.

To make room for the extra facilities inside the alloted NAS-SYS space, it was necessary to remove some existing code. I chose to attack the register display routine, shortening it so that now it will only display the contents of the Program Counter. After all, if you have DEBUG, you never use it anyway.

Description of new NAS-SYS facilities

a) Keyboard changes

{ and [are on the "[\" key
| and \ are on the "CH/LF" key
} and] are on the "]_" key
@ is now unshifted, repeating
_ is Shift/@

Remarks: The @ key is no longer available as an extra CTRL key (this facility is only needed on NASCOM-1 keyboards). CH and LF are not very important control codes, consequently they do not need their own key. CH is still available as CTRL/W, and LF is available as CTRL/J. Whether [\ ] and { | } are shifted or unshifted depends on the Keyboard option. With these changes, the full ASCII character set is still available from the keyboard.

b) Parallel printer support

Upon power-up or reset, the PIO is initialized. Printer output is activated by the U command, and deactivated by the N command. This is made possible by a change in the workspace initialisation, $UOUT will initially point to the printer driver routine. Initial contents of $UOUT: C3 CB 04

c) New NAS-SYS commands

Two new NAS-SYS commands are provided:

L PRINT

The contents of the accumulator are sent to the printer, using the printer driver routine. Please note that this command is independent of the N and U commands, working always. If the accumulator contains code £0A, data will not be sent to printer, code £0D will be sent to the printer as £0A. The printer must be on line, or the routine will make the Nascom hang up. This command is best used as a subroutine call in programs:

    £DF £4C PRINT   Sends contents of A to printer.

F aa bb cc dd .... SEND ARGUMENTS TO PRINTER

Up to ten hexadecimal arguments following the command are converted to 8-bit data and sent to the printer. If arguments >£FF are specified, only the least significant byte is sent. Please note that this command is independent of the N and U commands, working always. The printer must be on line, or the command will make the Nascom hang up. As this command uses the printer driver routine, arguments of £0A will be ignored, and arguments of £0D will be converted to £0A. This command is very useful for sending control codes to the printer, for example to activate or deactivate emphasized or enlarged print mode.

Using modified NAS-SYS and printer with standard Nascom firmware

a) NAS-SYS

    Printer on - U command
    Printer off - N command

The user is in direct communication with the printer, that is, everything that is typed on the keyboard will be sent to the printer. Line feeds are ignored. Carriage returns will be sent as line feeds.

b) NASPEN

For the P command to function, the printer reflection must be changed:

    101D DF 4C C9 SCAL "L RET

c) DEBUG

DEBUG uses the NAS-SYS $UOUT jump, and therefore turns off the printer when started. Use these DEBUG commands to control the printer:

    Printer on - :C 04CB
    Printer off - :C C143

```
;
; NAS-SYS 3  modifications
; by Olav Lerflaten.
;
; Bergen, Norway
; Nov.27, 1983
;
        ORG £0005
        JP PRINIT       ;Link PIO init routine

        ORG £00B6
        LD D,£E7        ;Change kbd mask (@ repeating)

        ORG £012F
        CP "]+1         ;Support lower case [ \ ]

        ORG £0145
        JR £0155        ;@ as CTRL key not supported

;Rest of PRARGS code
CONTUE  RET Z           ;Return if no arguments
        LD B,A          ;No. of args in B reg.
        LD HL,£0C0C     ;ARG1
NXTARG  LD A,(HL)       ;Arg in A reg.
        SCAL "L         ;Output arg to printer
        INC HL
        INC HL          ;HL points to next arg
        DJNZ NXTARG     ;Cont until no more args
        RET             ;End of PRARGS
        DEFB 0          ;Fill

        ORG £0183
        JP DRIVER       ;Workspace init $UOUT

        ORG £0408
        DEFM /* NAS-SYS 3.1 */ ;New commercial

        ORG £04A9
;Shortened PREGS routine
PREGS   RST £28         ;PRS
        DEFB £18        ;CCR
        DEFM /PC=/
        DEFB 0
        LD HL,(£0C69)   ;HL=(PC) before brkpt
        SCAL £66        ;TBCD3
        SCAL £6A        ;CRLF
        RET             ;End of PREGS routine

;PIO initialization routine
PRINIT  LD A,£FF
        OUT (6),A
        XOR A
        OUT (6),A
        DEC A
        OUT (7),A
        DEC A
        OUT (7),A
        LD A,1
        OUT (5),A       ;STROBE line high
        JP £03FE        ;jump to MRET

;Printer driver routine
DRIVER  PUSH AF         ;Save AF
BUSY    IN A,(5)        ;Line B2 high if busy
        AND £04         ;Mask
        JR NZ,BUSY      ;Try again if busy
        POP AF          ;Data restored in A
        PUSH AF
        CP £0A          ;Is it LF ?
        JR Z,FIN        ;If so, ignore
        CP £0D          ;Is it CR ?
        JR NZ,NOCHG     ;If not so, don't modify
        SUB 3           ;Make a LF from the CR
NOCHG   OUT (4),A       ;Data to printer
        XOR A
        OUT (5),A       ;Strobe low
        INC A
        OUT (5),A       ;Strobe high again
FIN     POP AF          ;Restore AF before return
        RET             ;End of printer driver

;Start of NAS-SYS  F command
PRARGS  LD A,(£0C0B)    ;ARGN worksp loc
        OR A            ;Set Z flag if no arguments
        JP CONTUE       ;Continue elsewhere

;Changes to the keyboard table
        ORG £05C4
        DEFB £FF        ;No LF on LF key

        ORG £05D1
        DEFB £FF        ;No CH on CH key

        ORG £0616
        DEFB £0E        ;CH/LF key gives "\" and "|"

        ORG £0619
        DEFB £8D        ;Shift/@ gives "_" char

;Changes in subroutine table
        ORG £078C
        DEFW £04E8      ;F command, args to printer

        ORG £0798
        DEFW £04CB      ;L command, printer driver
```

d) NAS-DIS
Use in Direct mode (NAS-SYS U command).
As NAS-DIS asks for memory addresses, unpredictable things may happen to the printer. This is because the subroutine outputs an ESC code, which the printer takes as the start of a control code. The cure:
- Either turn the printer momentarily off when NAS-DIS signals "Go?"
- Or change these memory locations in NAS-DIS:

CD00	00	NOP
CD01	00	NOP
CD02	00	NOP

e) ZEAP
Change printer reflection:

```
OF04   DF 4C C9   SCAL "L   RET
```

ZEAP U command will now list the source file, and ZEAP A command will, with option 04, give assembly listing.

f) BASIC
Use in direct mode (NAS-SYS U command). It is possible to turn printing on and off from BASIC with DOKE statements:

```
Printer on  -  DOKE 3187,1912
Printer off -  DOKE 3187,1913
```

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Random Rumours (and Truths?) by S. Monger

Lot's to report this time. For example, IO Research...Pluto 2 is here!! Yes, fed up with reading in this column about how little they do, IO Research have produced a super-duper new Pluto. There is the inevitable catch, the unreal price, but let's forget that while I lay down the mouth-watering fax:

"Pluto II is a brand new powerful single board graphics display system which has been designed to be completely hardware and software compatible with the original Pluto board. [Pluto I + £50.] Re-designed to use up-to-date technology [add £200] the board replaces 3 boards from the original Pluto range [add £1000] with one compact unit giving high reliability [+£150] and ease of use [+£80]. Based upon the highly successful Pluto concept [+£25], Pluto II's more advanced [+£50] video circuitry produces truly advanced colour graphics [+£100]. The board format is a compact 12" by 8" [-£500], multi-layer, 80-BUS compatible [+£300]. The processor is an 8MHz 8088 [+£0]. Half a megabyte of memory as standard [+£50] etc, etc, etc."

Anyway, the press release goes on to say that Pluto II is basically Pluto I plus Pluto Pallette (256 colours from 16.7 million), hardware pan and zoom, fast text scrolling and smooth shading (what's that?), and optional 50Hz frame grabber. The final figure?? Well over £2000 (two thousand pounds). Oh well, I didn't really want one anyway as I can't fit a 12"x8" board in my system!

Whilst on the graphics topic it may be worth mentioning that Gemini have implemented GSX on Pluto. (Why not on their own GM837 board???) GSX is supposed to do for graphics what CP/M did for disk drives. When I've found out what that means I'll let you know.

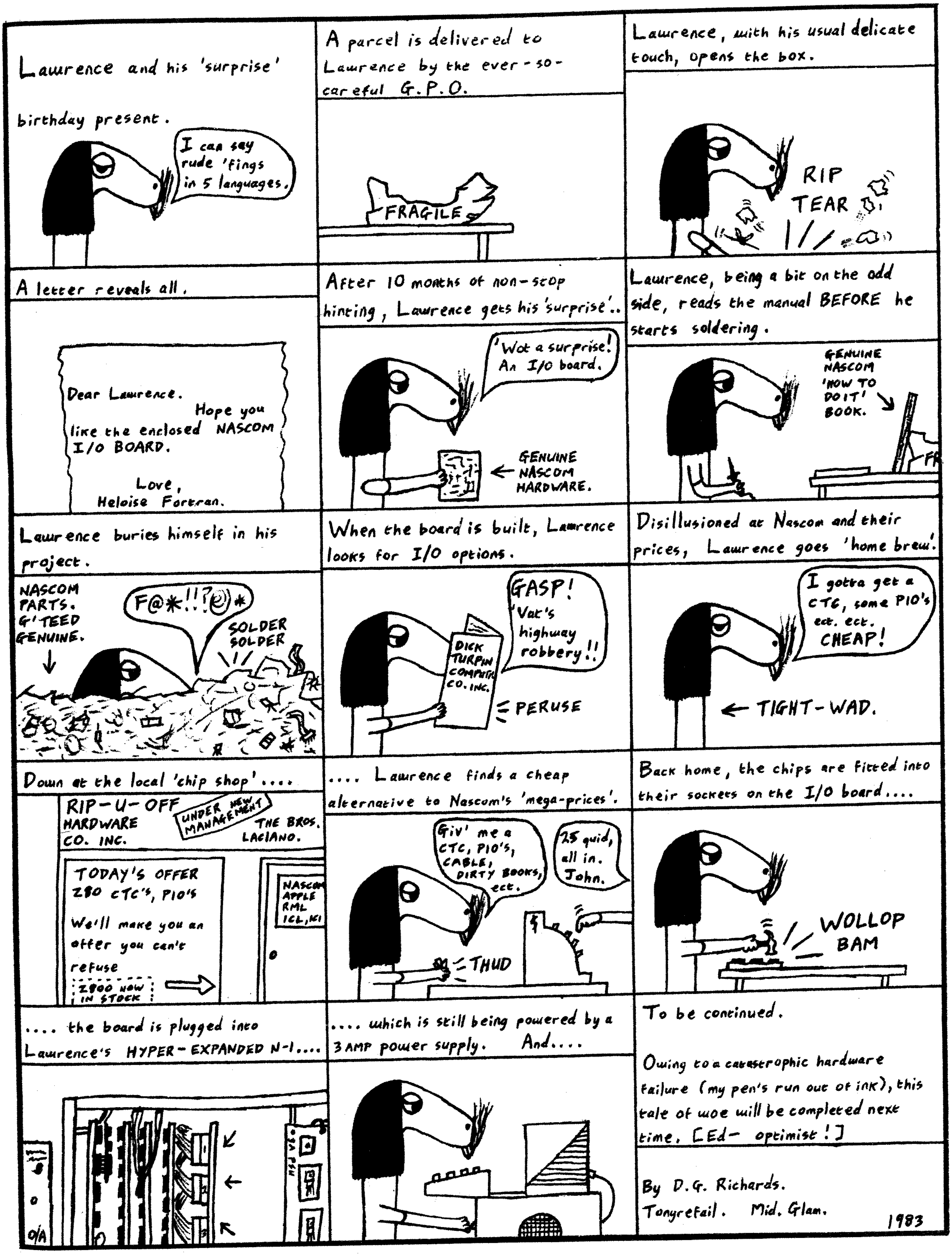
And what else has appeared? Yes, Gemini have been reading my bit as well as IO, as they have at last released the almost forgotten about GM848 Multi-Serial Board. This board has two Z80 SIOs, each providing 2 serial channels, and each direction of each channel of each device (phew) can be set to a different baud rate (must be some use). There is also a PIO thrown on the board for good measure, and the board occupies a switch-selectable block of 16 I/O ports. The SIOs of course cater with both synchronous and asynchronous protocols. Now where did I leave that mainframe? The price? £125 + VAT to you. Big 'G' are also shipping their new whizzo EPROM basher with some success, although I'm not quite sure where I'd put the 27256 that I could then program. (No, that is not a request for suggestions, thank you all the same.)

In my last bit (80-BUS Vol 3, Iss 1) I didn't have the price of the GM888, 8Mhz 8088, 8"x8", 8oz. board. that is now being delivered. £888? No, £190 actually, and CP/M-86? £175. (All plus VAT.) The CP/M-86 is currently for Gemini based systems only - will a Nascom version follow?

EV Computing have 're-vamped' their EV814 IEEE 488 board. I'm uncertain as to what 're-vamped' means, but it gives them reason to also 're-vamp' (i.e. raise) the price to, I think, £195 + VAT.

Lucas are apparently (and totally contrary to popular belief) still alive. It seems that from time to time the odd (very odd) Nascom 2 or 3 manages to escape from Warwick. But where oh where are there any new products? Or how about some advertising to show that they still exist??

And finally back to Gemini, the only great white hope where other manufacturers seem to have become stale in their lack of new products. Is the fact that they are a signed-up 'EasyLink' (some sort of computer telephone/telex/electronic mail system) customer an indicator that we may see an approved modem from them soon? Or is that a forelorn hope? And do the GM853 and GM863 boards described in their 'New Products' data sheet exist as much as/the same as/more than (delete as appropriate) the GM848 did a year ago?


Laurence and his 'surprise' birthday present.
I can say rude 'fings in 5 languages.
A parcel is delivered to Laurence by the ever-so-careful G.P.O.
FRAGILE
Laurence, with his usual delicate touch, opens the box.
RIP
TEAR
A letter reveals all.
Dear Laurence. Hope you like the enclosed NASCOM I/O BOARD. Love, Heloise Fortran.
After 10 months of non-stop hinting, Laurence gets his 'surprise'..
'Wot a surprise! An I/O board.
GENUINE NASCOM HARDWARE.
Laurence, being a bit on the odd side, reads the manual BEFORE he starts soldering.
GENUINE NASCOM 'HOW TO DO IT' BOOK.
Laurence buries himself in his project.
NASCOM PARTS. G'TEED GENUINE.
F@*!!?@*
SOLDER SOLDER
When the board is built, Laurence looks for I/O options.
GASP! 'Vat's highway robbery!!
DICK TURPIN COMPUTER CO. INC.
PERUSE
Disillusioned at Nascom and their prices, Laurence goes 'home brew'.
I gotta get a CTC, some PIO's ect. ect. CHEAP!
TIGHT-WAD.
Down at the local 'chip shop'....
RIP-U-OFF HARDWARE CO. INC.
UNDER NEW MANAGEMENT
THE BROS. LACIANO.
TODAY'S OFFER Z80 CTC's, PIO's We'll make you an offer you can't refuse
Z800 NOW IN STOCK
NASCOM APPLE RML ICL, ICI
.... Laurence finds a cheap alternative to Nascom's 'mega-prices'.
Giv' me a CTC, PIO's, CABLE, DIRTY BOOKS, ect.
25 quid, all in. John.
THUD
Back home, the chips are fitted into their sockets on the I/O board....
WOLLOP
BAM
.... the board is plugged into Laurence's HYPER-EXPANDED N-1....
3A PSU
O/A
.... which is still being powered by a 3 AMP power supply. And....
To be continued.
Owing to a catastrophic hardware failure (my pen's run out of ink), this tale of woe will be completed next time. [Ed- optimist!]
By D.G. Richards. Tonyrefail. Mid. Glam. 1983

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The Minor Miracles 2000 direct connect answer and originate modem is an all 'bells and whistles' modem capable of Bell and CCITT protocols at 300/300, 600/75, 600/600, 1200/75 and 1200/1200 BAUD receive/transmit with optional auto-dial and auto-answer. Automatic mode select under software control. Requires RS232 I/O for data transmission and an optional 4-bit port for mode control. Uses the AMD 7910 'world series' modem control chip. BT approved (until you remove the link to activate the Bell protocols). Separate 220-240V AC mains powered. Size approx. 140mm x 70mm x 180mm. Supplied complete with lead terminated in BT620 (the new rectangular type) plug, manuals, etc.

Modem 148.35 inc. VAT. (129.00 + VAT).
Auto-dial option 34.50 inc. VAT. (30.00 + VAT).
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GEC LTU-11 modem card 14.95 inc. VAT. (13.00 + VAT).
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```
      P
    P R E
  P R E S T
P R E S T E L
  E S T E L
    T E L
      L
```

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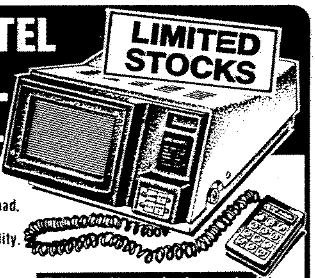

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Yes, you guessed it. Some enterprising person has now 'disconbooberated' the BDOS in CP/M and rewritten it as a Z80 program. Its fully compatible with the original with no bugs found to date. Because it's written in Z80 code it's smaller, this has allowed room for tidying up all the annoying stupids in the original BDOS so that errors like:
BDOS ERROR ON x: R/O
which usually causes you to lose everything you've just done, becomes the far more helpful:
Disk x: is set R/O
Do it anyway? (Y/N/^C)
Which, of course, means you don't lose anything. It even allows you to change disks when they are full without loss of data. In all, a lovely piece of software. Available in most popular 5.25" formats (please state when ordering) at 11.50 inc. VAT.
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NEW SUPER DISKPEN (PENVG:3)

DISKPEN has been rewritten and revised. This popular text editor/formatter now includes a 'HELP' facility, and new features for the print control of the most popular printers, underline, bold, etc (also user patchable for the less popular types). New features include block delete, better move commands, new cursor control, optional hyphenation, visible indentation setting and lots more. A major enhancement is the ability to handle overlay files so that PEN can use auxilliary packages such as the MAXiFILE free field file searching utility or the print spooling utility.

The new DISKPEN is useable on all Gemini multiboard computers (Galaxy, Kenilworth, Quantum) and Nascom/Gemini hybrids, (MAPPEN is available for users of the MAP video card). DISKPEN is available as an upgrade to earlier DISKPENs and GEMPENs at 17.25 inc. VAT., or to new purchasers at 57.50 inc. VAT. (Please state disk format when ordering.)
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THE 69SD5 HALL EFFECT KEYBOARD

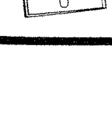
Compact 64 key + 5 function keys made by Microswitch Inc for Borroughs. Hall effect keyboard with reprogrammable (2716) ASCII output encoder EPROM. Steel key frame for good rigidity. Eight bit parallel output with negative strobe. Requires +5 volt and -12 volt supplies. Full details supplied.
29.95 inc. VAT. (26.04 + VAT).

THE 2070 GENERAL PURPOSE KEYBOARD

58 sculptured key, contactless keyboard made by Alphameric for the RML 380Z computer. Features black key tops with white legends, standard QWERTY layout, caps lock and repeat keys and steel key plate, etc. Single rail +5 volt supply, 8-bit parallel output with negative strobe. Uses 8035 on-board processor, with program held in a 2716 (for those who fancy reprogramming it). Full details supplied.
32.50 inc. VAT. (28.26 + VAT).

SPECIAL OFFER EXPERIMENTORS' KEYBOARD

A deluxe version of the 69SD5 made by Microswitch Inc. for Borroughs. A processor controlled serial version, using an 8048 mask programmed processor. 400K BAUD serial interogate and data output. Hall effect switches, steel keyplate, single rail +5 volt design. Circuit diagrams supplied, but no other info available. Would make a superb keyboard if the processor were replaced with an 8035 and separate EPROM for internal program. Superb value, at a price that reflects the hassle involved in making it go.
11.50 inc. VAT (10.00 + VAT) Carriage & packing 1.00



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