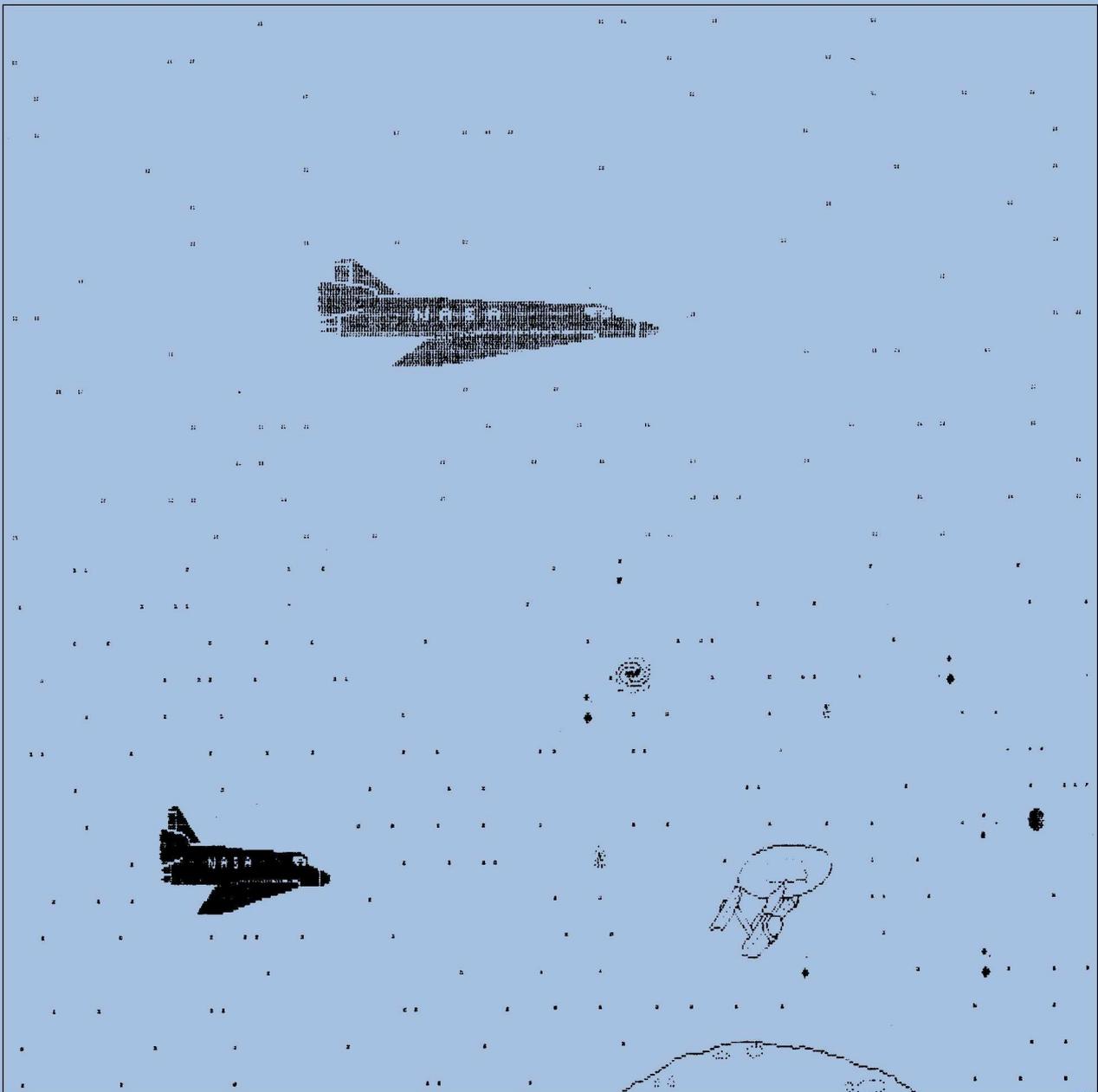


μ P

MICROPOWER

VOLUME 1, NUMBER 3

A MAGAZINE FOR NASCOM USERS



November, 1981

95 p



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EDITORIAL

We asked for your comments on the order forms for issues 3 and 4, and we hope to discuss some of the points raised in details in the next issue. However, the answers did show what a wide range there is in the interests of Nascom Owners, and in their levels of attainment. Many people said, in effect, don't publish articles for beginners, don't print games programs, we want articles on advanced hardware and software projects. But at least as many asked for simpler or more detailed explanations of points which they felt were skipped over because the author assumed they were too obvious to need expansion.

We are grateful to all those who took the trouble to send in their comments, and also for the letters and articles that we have received. You can be assured that all are read carefully, and that wherever possible we shall act upon the ideas you send in – so please don't stop writing.

Many of you asked for games programs, so we shall try to include more of these, although this will annoy the purists. In this issue we have included a program by D. G. Johnson, the author of 'Graphic Golf'. Although it is a simple and well known game, it demonstrates brilliant use of the Nascom 2 graphics set.

ERRATUM In the article 'Modifications to Tiny Basic' on page 15 the eighth line from the bottom should read

11DE Change to DF6421210C7E23666FC9

LETTERS

Dear Sir,

I must congratulate Chris Blackmore on the clever software used by his Monitor.Com article. Readers may like to know that Nas-Sys 3 can equally well be adapted; however, the addresses at the top of page 13 need to be changed as follows:-

0800 - 00 00 00	0265 - 11 0A F8
019B - 21 0A F8	0268 - 21 4A F8
0236 - 11 0A F8	0254 - 11 CA FB
023E - 11 BA FB	

Key allocations need to be changed as well, as there are only two 'spare' keys available.

If a disc is used, then keys D, F, J, L, Y, Z will probably be unused for their original purpose and several routines may be added, e.g., Handshake, Find, Substitute, etc., as well as the extra routines in the article. At this stage I have dedicated keys as follows:

D - Dump to disc	0788	change to 3B 09
F - Find bytes	078C	change to 8F 0A*
L - Load from Disc	0798	change to 06 0A
Y - Return to CP/M	07B2	change to 15 09

* - Start address of my routine.

Incidentally, it may not be necessary to type in all of the Nas-Sys as described. If your Nascom can be switched from Nas-Sys to CP/M (see my article in INMC80-3), copy Nas-Sys or Zeap, or whatever into middle memory (4000 to 8000 somewhere) and switch to CP/M. Load in DDT or ZSID and you should still find your program in memory. It can be copied down as required using the M command. Alternatively, if you have R.COM and W.COM (Tape to disc Read and Write routines available from Nascom Dealers) you can transfer your programs that way.

Incidentally I use to think that ED was a pig. Now that I am more used to it I think it is a donkey – a bit hard to drive, but quite capable. One misses the screen editing, which is not even restored by SYS6, but the Macro commands are very useful.

C. Bowden, Stithians, Truro

P.S. I have almost got Zeap 2 (RAM Version) and Naspen VS converted to work with V.D.U. RAM at £F800, but there are a few queer effects. Can anyone, without infringing any copyrights, list the changes needed for 100% success.

Dear Sir

As I am at present working in Germany with the Forces I wonder if anybody else out here has a Nascom; if so perhaps a mini Nascom Club could be started. If so please contact me at the address below.

I have just acquired a Data Dynamics 390 printer, which appears to be normal ASR33 teletype in fancy clothing. I have no circuit diagrams for this printer and do not know how to interface it to my nascom. Can anyone help (Somebody must be using an ASR33 with a Nascom).

A. M. Morfee, Officers Mess
RAF Wildenrath, BFPO 42

HANDS-ON

by Viktor Part, the third

PRINT

Since most of us cut our programming teeth on the PRINT statement, there is not much point in covering acres of paper in explanations and illustrations – however for the benefit of those just beginning I will summarise the ground rules. [INPUT “Enter SKILL LEVEL”; X\$:IF X\$= “ADVANCED” THEN GOTO(next section)]

The PRINT statement outputs to a terminal, usually the screen or a printer(or both). It operates from the current position of the cursor. If used on its own, a carriage return/line feed(CR/LF) is output, thus placing the cursor at the start of the next line.

You can also print numbers [PRINT 5] , the answers to calculations [PRINT 5*6 (=30)], the value of variables [PRINT A (=10 where A=10)], string literals [PRINT “Fred”], strings [PRINT X\$ (Nascom-where X\$ has been defined as “Nascom”), plus a whole series of intrinsic functions which are listed in the manual. Useful examples are:-

PRINT CHR\$(X) – where X has any ASCII value from 0 to 255. For example, CHR\$(65) prints the letter A, CHR\$(181) prints a small human figure, if your system is equipped with the Nascom 2 graphics ROM.

PRINT FRE(0) – gives you the remaining memory space available for your BASIC program.

PRINT SQR(X) – outputs the square-root of X.

In formatting text it is obviously important to know where the cursor will be positioned after the computer has carried out a PRINT instruction. If a PRINT statement is terminated with a colon, or if the line ends without a special terminator, the next PRINT statement will begin at the start of the next line, the Nascom having output a CR/LF. However, if you end the statement with a semi-colon, the next PRINT statement will start at the next available space; e.g.

10 FOR A=1 to 5:PRINT A;:NEXT will give you:-

1 2 3 4 5

Note that a space is output in front of each number – if you PRINT a negative number this space will be occupied by a minus sign.

A further modification, available within the PRINT statement itself, is the use of commas to divide the output into zones. PRINT 1,2,3 puts 1 in position 0,2 in position 14 and 3 in position 28. If you not redefined WIDTH then the third zone is 20 characters wide. If a zone is completely filled or exceeded the instruction will still be carried out but the cursor will then be moved to the start of the next free zone.

In setting out text on the screen or for printing there are a number of other useful functions in BASIC which you can use with the PRINT statement, viz.

SCREEN X,Y . . . places the cursor on the Xth position across and Yth line down.

PRINT TAB(I) . . . moves the cursor to the Ith horizontal tab position.

PRINT SPC(X) . . . moves the cursor X spaces along from the current position.

POS(I) . . . returns the current position of the cursor. This is useful where the cursor might finish up in one of a number of different tab positions after following alternative routes to reach the current program line. In order to obtain a satisfactory print layout you could insert a line as follows:-

```
20 R=POS(I):IF R>25 THEN PRINT
```

Note (I) is only a dummy argument in this instruction, that is, because POS is a function, not a command, it has the format of a function, but what you put within the brackets is immaterial.

SPACE SAVING IN PRINT STATEMENTS

Since extra memory chips are so cheap these days saving space by shortening Basic lines has few advantages. However, it is quite often annoying to find that you are one or two characters in excess of 48 and therefore must have yet another line. You will no doubt have discovered by now that in many situations it is not necessary to use the second quotation mark when printing or defining strings. (e.g. [X\$="FRED] is acceptable as a statement on its own or at the end of a multiple-statement line.)

Now consider the following lines:

```
20 V=99:X$="15th":Y$="JAN":Z$="1981  
30 PRINT"Amount";V;TAB(25);"Period ";X$;" ";Y$;" ";Z$
```

T12'15th' and 'JAN' require closing quotes but '1981 ' does not. Line 30 will not fit onto one screen line, and could only be entered by using direct entry of the single-byte reserved words from the keyboard, using the 'GRAPHICS' key. But several characters can in fact be left out since the second quotation marks can double for the statement separators. i.e.

```
30 PRINT "Amount"V;TAB(25)"Period "X$" "Y$" "Z$
```

DEEK & DOKE

Like PEEK & POKE , DEEK & DOKE allow you direct access to the data held in

memory, so that you can modify or read its contents. However, because PEEK & POKE operate only on single bytes the highest value that you can POKE into a memory is 255; similarly, PEEK(X) returns the value held in the single byte whose address is X.

When using DEEK & DOKE two consecutive bytes are accessed. This means that there are sixteen bits available for arithmetic, giving a theoretical maximum of 65535 (that is two to the sixteenth power, less one). When you DOKE a value to a specific address, the least significant byte is stored at the next byte above. Why are they stored in that order? Simply because that is the normal order in which the Z80 microprocessor stores sixteen-bit values. In order to cope with negative numbers the most significant bit of the high order byte is used to indicate the sign; if this bit is set, then the number is to be read as negative. The range of available values is thus -32768 to +32767.

Let's try an example:-

Enter DOKE 3200,32767. If you now return to NAS-SYS and tabulate from 0C80, you will find 0C80 contains FF (low-order byte with all bits set) and 0C81 contains 7F (high-order byte having all bits except the most significant one set).

Now try DOKE 3200,-1:DOKE 3202,-2:DOKE 3204,-32767

The result should be as follows:-

0C80 (low byte) FF
0C81 (high byte) 7F

Note computer holds this as 65536-1 i.e. $(15 \times 4096) + (15 \times 256) + (15 \times 16) + (15 \times 1)$

0C82 (low byte) FE
0C83 (high byte) 7E

The computer has 65536-2, i.e. $(15 \times 4096) + (15 \times 256) + (15 \times 16) + (14 \times 1)$

0C84 (low byte) 01
0C85 (high byte) 80

The computer stores 65536-32767, i.e. $(8 \times 4096) + (1 \times 1)$

Why, though, do we have to bother with all this complicated nonsense? Let us have a look at a few examples. Firstly, a series of DOKES is very useful for setting up short machine code subroutines, which are to be called from a BASIC program. Here the values DOKE'd have no meaning in the BASIC program – they are just the decimal values which when converted to hexadecimal can be interpreted by the computer as machine code instructions. The USR(0) routine (given in the manual) to scan the keyboard for a key depression is a very good example of this.

Secondly, POKE & DOKE are often used to change options in the monitor. You will know that under NAS-SYS the command K1 gives you lower case as the standard print output. This can be achieved from BASIC directly, or in the course of a program by the statement POKE 3111,1. Similarly, if you want to turn on output to your printer in the middle of a program, you can use the various DOKE instructions outlined in the manual. N.B. Different values apply in NAS-SYS 3 from those in NAS-SYS 1.

A third use might be to store a value which is to be picked up later by a machine code subroutine. The example which follows allows you to generate sounds from a BASIC program by flipping Bit 5 of the keyboard port.

Sub-routine:

```
6000 DOKE 3200,23533:DOKE 3202,3330:DOKE 3204, 19437
6010 DOKE 3206,3328:DOKE3208,8254:DOKE3210,211
6020 DOKE 3212,30731:DOKE3214,8369:DOKE3216,-4613
6030 DOKE 3218,75:DOKE3220,-20723:DOKE3222,211
6040 DOKE 3224,30731:DOKE 3226,8369:DOKE 3228,7163
6050 DOKE 3230,-19590:DOKE 3232,-7648:DOKE 3234,201
6060 RETURN
```

Main routine:

```
1000 GOSUB 6000:DOKE 4100,3200 (Dec. Addr.of M/C routine)
1010 DOKE 3330,X (where X=no. of complete loops)
1020 FOR I=A TO B, STEP C (where different values of A,B & C
give different sounds)
1030 DOKE 3328,I:U=USR(0): NEXT I:
```

Memory location 3330 (0D02 hex) is DOKE'd with the value which will control the length of the sounds generated, while 3328 (0D00 hex) is DOKE'd with the frequency parameters.

Another use to which I have put these instructions was in the creation of an array in a large program when I was short of memory. The original array was something like A(8,8), i.e. 64 variables, requiring 6 bytes each. By using DOKE to put values in memory and DEEK to retrieve them it was possible to use only two bytes for each variable, e.g. if the start of the array is 3584, to put the value X into what was previously A(I,J), you enter DOKE 3584+[16*(I-1)]+[2*(J-1)],X. The instruction is a lot more cumbersome but there is still a significant saving in memory usage.

RANDOM NUMBERS

Random numbers are very useful in games programming, both in games of chance like Pontoon or Fruit Machine and also in more complex programs like Star Trek, where you wish to vary the results of selecting a particular option in the course of the game.

The RND function does not, in fact, generate random numbers at all; it merely starts with a pre-determined value and then produces new numbers according to a formula. These values are always in the range 0 to 0.999999. If the argument used

with the RND function is negative, a new sequence of numbers will be started. While different negative numbers produce different sequences, any particular negative number will always produce the the same sequence. If the argument is greater than zero, the function returns the next number in the current sequence, while RND(0) reproduces the previous number output in the current series.

To vary the start of a game you need a random start somewhere in the list, so to speak, of the numbers being generated. One method would be as follows:

```
10 INPUT"Enter a no.";N:IF N > 0 THEN N= -N 20 A = RND(N)
```

When the player enters a number he selects a new sequence for the game. However, this allows players to cheat – they can affect the random sequence, and hence the course of the game, by there initial selection. A better method is to use the keyboard scan user routine referred to above (see the manual for the m/c code and the decimal equivalents):

```
10 DOKE 4100, 3200:REM Tell BASIC where routine is located
20 PRINT "When you are ready, press any key"
30 A=RND(1):B=USR(0):IF B=0 THEN 30
```

Here, each time you start, the generation of numbers will stop at a different point due to the varying time taken to react to the message.

Another helpful routine which uses the RND function is the generation of integers within a given range e.g. a number between 1 and 12. Some BASICS already have this as a built – in function. On the Nascom you need to adopt a formula similar to the following:

```
10 A=INT((RND(1)*T)+B)
```

where T equals the top of the range and B equals the bottom. If we substitute 12 and 1 for T and B we get 12 x (no. between 0 and 0.999999) which should be less than 12. If we then add 1 and then reduce the answer to integer format the result in most cases will be in range 1 to 12. However, due to the rounding system in the BASIC a number larger than 0.999995 is treated as being equal to 1, and the computer will then, in this instance produce answers in the range 2 to 13. So for a perfect program you will need to test for data which is out of range.

Next issue will probably see the last look at various statements and functions within BASIC. After that we can perhaps dissect a few programs or interesting parts of programs, and in doing so cover various points not looked at so far.

HAPPY KEYBOARD BASHING !!

READING TRS-80 PROGRAM TAPES

by Mike Fox

There is a great deal of software available for micro-computers, but it is generally not possible to exchange programs between systems because the data is stored on tape in different formats. This article describes a method for reading and converting TRS-80 tapes for the Nascom. The project needs both hardware and software, and is for TRS-80 Level 2 Basic (also Video Genie in the U.K., P.M.C-80 in U.S.A, and System 80 in Australia and N.Z.), but it could be modified for other machines.

The TRS-80 writes tapes at 500 Baud. An 80 microsecond clock pulse is sent to the tape every 2 milliseconds. The data bits to be stored are represented by inserting an extra 80 microsecond pulse between two clock pulses for a 1, and leaving the gap empty for a 0. This of course is incompatible with the CUTS standard used in the Nascom II. Therefore a small circuit consisting of one LM3900 (an IC containing four operational amplifiers) and a couple of dozen discrete components is used to input the signal from the cassette via the Nascom PIO. Figure 1 shows the circuit diagram of the interface, while a suggested Vero layout is shown in figure 2. Make sure that pin 11 of the Nascom 2 PIO plug is connected to 0 volts on pin 16.

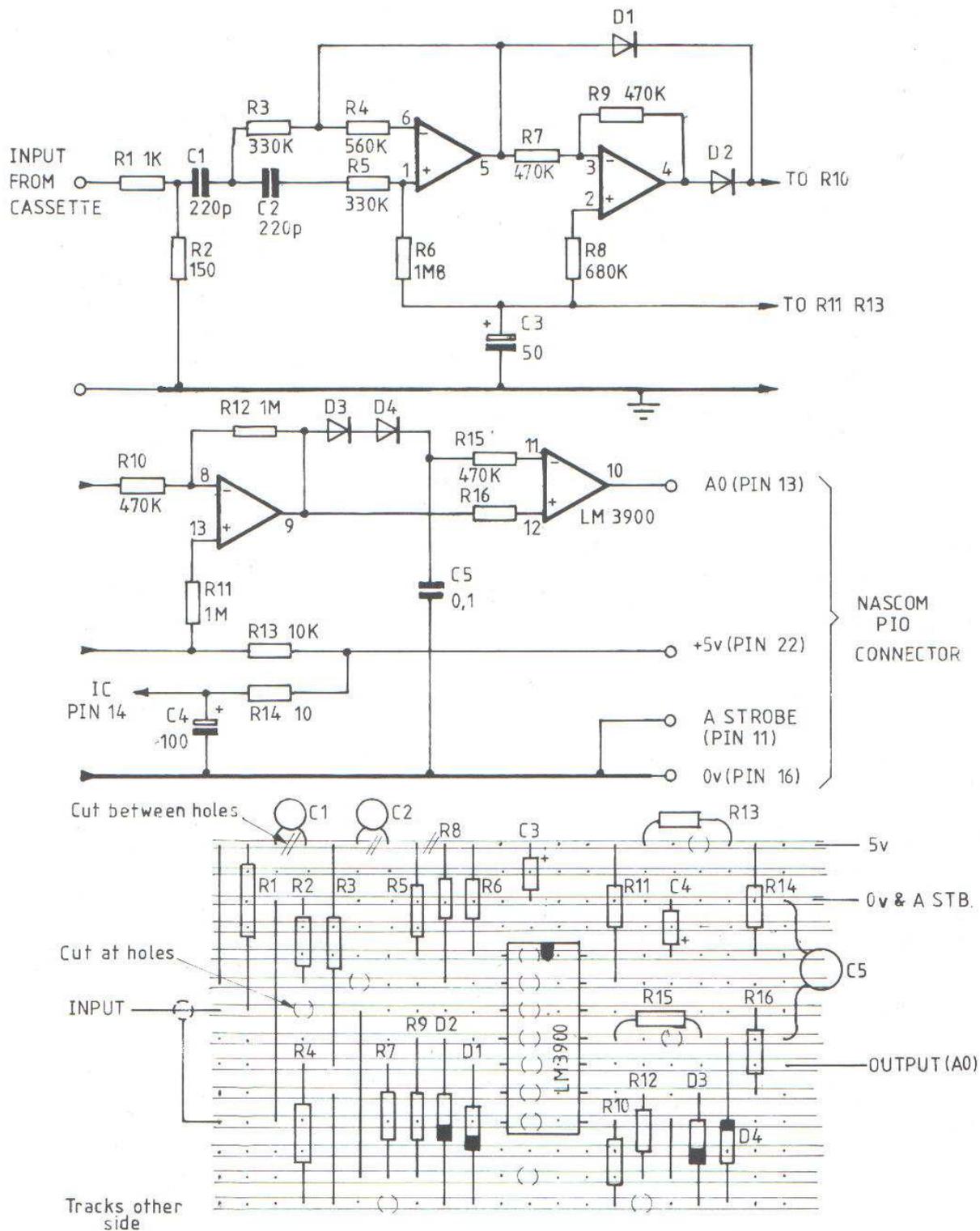
COMPONENTS REQUIRED

Resistors		Capacitors		Semiconductors			
R1	1 kohm	R9	470 kohm	C1	220 pf	LM3900	Quad.
R2	150 kohm	R10	470 kohm	C2	220 pf		Op-Amp.
R3	330 kohm	R11	1 megohm	C3	50 μ F	D1-D4	Small-
R4	560 kohm	R12	1 megohm	C4	100 μ F		signal
R5	330 kohm	R13	10 kohm	C5	0.1 μ F		silicon
R6	1.8 megohm	R14	10 ohms				diode
R7	470 kohm	R15	470 kohm				
R8	680 kohm	R16	470 kohm				

SOFTWARE FOR MICROSOFT BASIC

The first part of the program reads the tape and loads it into the correct memory location for Nascom 2 Basic. As the reading is done by software timing, the delay values in the program will vary for machines running at 2 Mhz and 4Mhz. At the start of the tape there is about 4 seconds of nulls (00), followed by a sync character of A5 hex. When this character is detected the program starts to load the data from the tape starting at address £10F6; as it is stored, the data is also displayed on line one of the screen. The first four characters are SSSn, where n is the program identification. These are not used, and the actual Basic program starts at £10FA. The end of the program is indicated by three nulls, which cause a jump to part two of the tape reading routine.

In this second section, the token values used in TRS-80 Basic are converted to



TOP: CIRCUIT DIAGRAM
 BOTT: 0.1in.VERO BOARD LAYOUT

the values used by Nascom's Basic (Tokens are the single byte codes used for reserved words, e.g., PRIN is stored as £9E in the Nascom, as £B2 in the TRS-80). Any token which cannot be converted is changed to a REM, and its memory location, line number (in decimal) and TRS-80 value are displayed on the screen. The first two bytes of each line point to the start address of the next line. As the TRS-80 Basic starts at £42E9 and Nascom 2 Basic at £10FA, £31EF must be subtracted from the value read from the tape. Finally location £10F9 is set to zero, and the address of the end of the Basic program is stored at £10D6, 10D8 and £10DA. The conversion routine then returns to the monitor.

To use the program, first enter Nascom Basic with a cold start by command J, then exit by entering MONITOR or by pressing RESET. Next load the tape reading/conversion program, with the correct delay values for your clock speed. Run the program by entering E0C80, connect your cassette recorder to the input port via the given circuit, and start the TRS-80 program tape. After loading is completed and control has returned to Nas-Sys, re-enter Basic with a warm start. The TRS-80 program can now be listed, and may even run.

There are several factors which can prevent the Basic program running. Some of the commands used in TRS-80 Basic are not available in the Nascom Basic, and the program may have to be modified to carry out these instructions in some other way. From the listed program and the table of token values given at the end of this article it should be possible to find out what the program is doing. Two useful articles are "Whose Basic Does What", BYTE, January 1981, page 318, and "TRS-80 Program Recovery", INTERFACE AGE, December 1980, page 100. "The Basic Handbook", by David A. Lien, published in the U.S.A. by Compusoft, is an invaluable book.

Peek and poke addresses may also vary. In particular, the TRS-80 screen consists of 16 lines of 64 characters, and is located from £3C00 to £3FFF. The decimal values of the screen locations run from 15360 at the top left, 15423 top right, to 16320 bottom left, 16383 bottom right. Remember that the Nascom top line is not scrolled, and that it is located in memory after the bottom line.

You will find that the volume and tone settings of the cassette recorder are very critical. If nothing appears on the screen, re-run the program with £008E set to 00 to stop sync checking, and £0C80 set to 00 to prevent the program ending on reading the first null characters, (the program will have to be terminated by pressing the RESET button, and the second part of the program, token conversion, will not have been executed.) Adjust the volume and tone settings until a display appears. Probably the display will not make sense, because the characters will be out of sync. Replace the original values at £0C8E and £0CC0, and try again.

If you load a program and find that when you LIST it starts correctly but then produces rubbish, the line address pointers have probably been misread. Try adjusting the volume or tone slightly and reloading.

It is possible to have a Basic cassette tape from a TRS-80 disc system, where the starting address is £6A46. The result will be that only the first line will LIST correctly, and the rest will be rubbish. Replace the subtraction values at £0D16 with £4C and at £0D1B with £59.

Don't forget to use the correct delay settings for your clock speed. For operation at 2Mhz the values required are: £0CC8=£26, £0CDA=£3C, £0CE1= £1D. At 4 Mhz the corresponding values are £53, £81, and £3D. The clock frequency of a standard TRS-80 is 1.7 Mhz, so the programs should run more quickly on a Nascom.

The conversion program halts when the screen has filled with tokens that can not be converted. You should make a note of the details, and then press any key to continue

USING THE PROGRAM WITH CRYSTAL BASIC

The table of equivalent tokens at the end of the article can be used to modify the program so that it will read and convert TRS-80 programs for Crystal Basic. Replace the Nascom tokens in the table starting at £0DD9 with the equivalent Crystal Basic token. You will also have to change the addresses at £0C86, £0C87 and at £0D12, £0D13 to suit the start of text in your version of Crystal Basic; for example, if the program text starts at £2D00, £0C87, £0C87 must be changed to £FC2C and £0D12, £0D13 to £002D. As the first four bytes from the tape overwrite the last four bytes of the interpreter, these will have to be restored before running the program. The line pointer offsets at £0D16 and £0D1B must be also be changed; for text starting at £2D00 the values should be £E9 and £15 respectively. The end of program address should be stored at £0C87, £0C88. The program should then be listable after a warm start.

READING MACHINE CODE TAPES

The second listing is a routine to read TRS-80 machine code programs. Such a program is first read into a block of memory starting at £1000. The routine then scans the loaded program, testing the checksums and removing the loading addresses, checksum bytes, sync bytes etc. If a checksum error is detected the start address of the block containing it is displayed; try to reload the program at a slightly different volume or tone setting. If all the checksum are correct the routine displays the executions address and returns to Nas-Sys.

You can now use Nas-Dis to disassemble the program. Of course, you will still have a lot of work to do to produce a running program. All calls to the monitor will have to be identified and replaced by their Nascom equivalent. The screen addresses and format will have to be modified. Any program using pixels will have to be changed to take account of the different codes used on the two machines (add £40 to the TRS-80 character and change bits 1,2,3,4 to 2,4,1,3).

```

0010 ; PROGRAM TO READ TRS-80 LEVEL 2
0020 ; BASIC PROGRAM TAPES INTO NASCOM
0030 ; AND THEN CONVERT TO RUN UNDER
0040 ; NASCOM MICROSOFT BASIC
0050 ;
0060 ; BY MIKE FOX
0070 ; AUCKLAND, NEW ZEALAND
0080 ;
0090 ; 14th JULY, 1981
0100 ;
0C80          0110          ORG £0C80
0C80 0E00      0120          LD C, 0          ; RESET COUNTER
0C82 210A08    0130          LD HL, £080A     ; VDU LINE 1
0C85 11F610    0140          LD DE, £10F6     ; BASIC START
0C88 CDC50C    0150 NSYSC   CALL SUB      ; GET A BIT
0C8B FEA5      0160          CP £A5          ; SYNC BYTE A5?
0C8D 20F9      0170          JR, NZ, NSYSC  ; IF NOT, LOOP
0C8F CDC50C    0180 NEXT   CALL SUB      ; NOW GET 8 BITS
0C92 CDC50C    0190          CALL SUB
0C95 CDC50C    0200          CALL SUB
0C98 CDC50C    0210          CALL SUB
0C9B CDC50C    0220          CALL SUB
0C9E CDC50C    0230          CALL SUB
0CA1 CDC50C    0240          CALL SUB
0CA4 CDC50C    0250          CALL SUB
0CA7 77        0260          LD (HL), A     ; LOAD TO SCREEN
0CA8 12        0270          LD (DE) A     ; LOAD TO MEMORY
0CA9 7D        0280          LD A, L
0CAA FE39      0290          CP £39          ; END OF LINE?
0CAC 2803      0300          JR Z, EOL
0CAE 2C        0310          INC L          ; CONTINUE ON THIS LINE
0CAF 1802      0320          JR INLINE
0CB1 2E0A      0330 EOL    LD L, 10     ; BACK TO LINE START
0CB3 1A        0340 INLINE LD A (DE)    ; RECALL BYTE
0CB4 13        0350          INC DE
0CB5 FE00      0360          CP 0          ; IS IT ZERO?
0CB7 2008      0370          JR NZ, NOZERO ; CHECK FOR END
0CB9 0C        0380          INC C          ; INCREMENT COUNTER
0CBA 79        0390          LD A, C
0CBB FE03      0400          CP 3          ; 3 IN A ROW?
0CBD 2004      0410          JR NZ, NOTEND
0CBF 184F      0420          JR TOKEN     ; TO TOKEN PROGRAM
0CC1 0E00      0430 NOZERO LD C, 0     ; RESET COUNTER
0CC3 18CA      0440 NOTEND JR NEXT    ; LOPP FOR NEXT BYTE
0450 ;
0460 ; SUBROUTINE TO GET A BIT
0470 ;
0CC5 C5        0480 SUB    PUSH BC
0CC6 F5        0490          PUSH AF
0CC7 0653      0500 ; *****
0510          LD B, £53      ; 4 Mhz, £26 FOR 2 Mhz
0520 ; *****
0CC9 10FE      0530 LP1    DJNZ LP1     ; DELAY LOOP
0CCB DB04      0540 LP1A   IN A, (04)   ; READ PORT A0
0CCD EEFF      0550          XOR £FF      ; INVERT IT
0CCF 1F        0560          RRA          ; ROTATE TO CARRY

```

```

0CD0 30F9          0570          JR NC, LP1A      ; LOOP IF NO CLOCK
0CD2 DB04          0580          IN A, (04)      ; JUST CHECKING
0CD4 EEFF          0590          XOR £FF
0CD6 1F           0600          RRA
0CD7 30F2          0610          JR NC, LP1A      ; TRANSIENT, LOOK AGAIN
0620 ; *****
0CD9 0681          0630          LD B, £81       ; USE £3C FOR 2 Mhz
0640 ; *****
0CDB 10FE          0650 LP2      DJNZ LP2        ; DELAY AND WAIT
0CDD 00           0660          NOP             ; BEFORE LOOKING
0CDE 00           0670          NOP             ; FOR DATA PULSE
0CDF 00           0680
0690 ; *****
0CE0 063D          0700          LD B, £3D       ; USE £1D FOR 2 mHZ
0710 ; *****
0CE2 00           0720 LP3      NOP             ; IN SEARCH WINDOW
0CE3 DB04          0730          IN A, (04)     ; READ PORT
0CE5 EEFF          0740          XOR £FF        ; INVERT IT
0CE7 1F           0750          RRA            ; ROTATE TO CARRY
0CE8 3804          0760          JR C, GOT      ; PULSE FOUND - CHECK
0CEA 10F6          0770          DJNZ LP3       ; NO PULSE, LOOK AGAIN
0CEC 181C          0780          JR NOGOT       ; WINDOW EXPIRED
0CEE DB04          0790 GOT      IN A, (4)      ; CHECK AGAIN
0CF0 EEFF          0800          XOR £FF
0CF2 1F           0810          RRA            ; ROTATE TO CARRY
0CF3 3804          0820          JR C, GOTONE   ; DEFINATELY A 1
0CF5 10EB          0830          DJNZ LP3       ; TRANSIENT - TRY AGAIN
0CF7 1811          0840          JR NOGOT       ; STILL IN WINDOW?
0CF9 F1           0850 GOTONE   POP AF        ; RETORE REGS
0CFA 00           0860 END      NOP             ; TO END WINDOW
0CFB 00           0870          NOP             ; USING NOP AS DELAY
0CFC 00           0880          NOP
0CFD 00           0890          NOP
0CFE 00           0900          NOP
0CFF 00           0910          NOP
0D00 00           0920          NOP
0D01 00           0930          NOP
0D02 10F6          0940          DJNZ END       ; STILL IN WINDOW?
0D04 C1           0950          POP BC        ; END - RESTORE REGS
0D05 07           0960          RLCA         ; SHIFT ACCUMULATOR
0D06 CB87          0970          RES 0, A     ; ZERO AND
0D08 3C           0980          INC A        ; SET BIT 0 TO 1
0D09 C9           0990          RET          ; RETURN
0D0A F1           1000 NOGOT   POP AF        ; NO DATA PULSE
0D0B C1           1010          POP BC        ; RESTORE REGS.
0D0C 07           1020          RLCA
0D0D CB87          1030          RES 0, A     ; SET BIT 0 TO 0
0D0F C9           1040          RET          ; RETURN
1050 ;
1060 ; PROGRAM TO CONVERT TOKENS FROM TRS-80
1070 ; TO NASCOM. ALSO SETS UP POINTERS AND
1080 ; CORRECT LINE ADDRESS CODES BY SUB-
1090 ; TRACTING £31EF (OR £594C FOR DISC)
1100 ;
0D10 E5           1110 TOKEN   PUSH HL
0D11 21FA10       1120          LD HL, £10FA   THROW AWAY SSSn

```

0D14	7E	1130	NEXTL	LD A, (HL)	; LOW BYTE OF POINTER
0D15	D6EF	1140		SUB £EF	; SUBTRACT £EF
0D17	77	1150		LD (HL), A	; RE-WRITE
0D18	23	1160		INC HL	
0D19	7E	1170		LD A, (HL)	; HIGH BYTE OF POINTER
0D1A	DE31	1180	SBC A,	SUBTRACT £31	
0D1C	77	1190		LD (HL), A	; RE-WRITE
0D1D	23	1200		INC HL	
0D1E	5E	1210		LD E, (HL)	; SAVE LINE NUMBER
0D1F	23	1220		INC HL	
0D20	56	1230		LD D, (HL)	; SAVE LINE NUMBER
0D21	23	1240	LOOP	INC HL	
0D22	7E	1250		LD A, (HL)	; GET BYTE OF BASIC
0D23	D600	1260		SUB 0	
0D25	2805	1270		JR Z, CHECKE	; IF EOL, CHECK FOR
PROG. END					
0D27	FC480D	1280		CALL M, SUBT	; IF GREATER THEN £80
		1290			; TRANSLATE TOKEN
0D2A	18F5	1300		JR LOOPO;LOOP AGAIN	
0D2C	23	1310	CHECKE	INC HL	
0D2D	23	1320		INC HL	
0D2E	7E	1330		LD A, (HL)	; LOAD BYTE
0D2F	D600	1340		SUB 0	
0D31	2803	1350		JR Z ENDT	; IF ZERO, PROG. END
0D33	2B	1360		DEC HL	
0D34	18DE	1370		JR NEXTL	; NOT ZERO, CONTINUE
0D36	23	1380	ENDT	INC HL	
0D37	22D610	1390		LD (£10D6), HL	; SAVE END ADDRESS
A 0D3A	22D810	1400		LD (£10D8), HL	
0D3D	22DA10	1410		LD (£10DA), HL	
0D40	21F910	1420		LD HL, £10F9 RESTORE ZERO @ £10F9	
0D43	3600	1430		LD (HL), 0	
0D45	E1	1440		POP HL	
0D46	DF5B	1450		SCAL MRET	; RETURN TO NAS-SYS
		1460			
		1470			
		1480			; SUBROUTINE TO CONVERT TOKENS
		1490			
0D48	E5	1500	SUBT	PUSH HL	
0D49	21D90D	1510		LD HL, TABLE	; LOAD TBLE ADDRESS
0D4C	F5	1520	AGAIN	PUSH AF	; SAVE DATA BYTE
0D4D	7E	1530		LD A, (HL)	; LOAD BYTE FROM TABLE
0D4E	D600	1540		SUB 0	
0D50	280D	1550		JR Z, NOTM	; END OF TABLE?
0D52	F1	1560		POP AF	; NO, SO RESTORE DATA
0D53	BE	1570		CP (HL)	; COMPARE WITH TABLE
0D54	2804	1580		JR Z EQUAL	; EQUAL?
0D56	23	1590		INC HL	; NO - GO TO NEXT
0D57	23	1600		INC HL	
0D58	18F2	1610		JR AGAIN	; GO AROUND AGAIN
0D5A	23	1620	EQUAL	INC HL	; MATCH FOUND
0D5B	7E	1630		LD A, (HL)	; GET NEW TOKEN
0D5C	E1	1640		POP HL	; RESTORE BASIC ADDRESS
0D5D	77	1650		LD (HL), A	; STORE NEW TOKEN
0D5E	C9	1660		RET	; RETURN
		1670			

```

1680 ; NO MATCH, SO CONVERT TO REM AND DISPLAY
1690 ;ADDRESS, LINE NUMBER (DECIMAL) AND CODE
1700 ;
0D5F F1      1710 NOTM   POP AF
0D60 E1      1720      POP HL      ; DISPLAY ON SCREEN
0D61 E5      1730      PUSH HL     ; DETAILS OF EACH
0D62 DF66    1740      SCAL £66    ; DISPLAY HL IN HEX
0D64 62      1750      LD H, D
0D65 6B      1760      LD H, E
0D66 CD890D  1770      CALL HEXDEC ; CONVERT HEX. TO DEC.
0D69 DF69    1780      SCAL £69    ; OUTPUT ONE SPACE
0D6B E1      1810      POP HL
0D6C 7E      1820      LD A, (HL)
0D6D DF68    1830      SCAL £68    ; PRINT ACC. IN HEX
0D6F DF7E    1840      SCAL £7E    ; OUTPUT TWO SPACES
0D71 DF69    1850      SCAL £69    ; OUTPUT ONE SPACE
0D73 3E8E    1890      LD A, £8E    ; LOAD CODE FOR REM
0D75 773 1900      LD (HL), A  ; REWRITE AS REM
0D76 3A2A0C  1910      LD A, (£0C2A) ; SCREEN FULL?
0D79 FE0B    1920      CP £0B      ; CURSOR POSITION
0D7B 200B    1930      JR NZ, NOTFUL ; PASS UNLESS
0D7D 3A290C  1940      LD A, (C29) ; NEXT OUTPUT SCROLLS
0D80 FEAA    1950      CP £AA
0D82 2004    1960      JR NZ, NOTFUL
0D84 CF      1970      RST 8      ; WAIT FOR KEY PRESS
0D85 3E0C    1980      LD A, £0C    ; CLEAR SCREEN CODE
0D87 F7      1990      RST £30    ; NAS-SYS OUTPUT
0D88 C9      2000 NOTFUL  RET      ; RETURN
2010 ;
2020 ; SUBROUTINE TO CONVERT HEX LINE NUMBER
2030 ; TO DECIMAL (NUMBER IN HL REGS.)
2040 ;
0D89 0E04    2050 HEXDEC  LD C, A      ; MAX. LEADING SPACES
0D8B 0600    2060      LD B, 0
0D8D D5      2070      PUSH DE
0D8E 110A00  2080      LD DE, 10
0D91 D5      2090      PUSH DE
0D92 C5      2100      PUSH BC
0D93 CDBC0D  2110 DODIV   CALL DIVIDE ; DIVIDE SUB ROUTINE
0D96 78      2120      LD A, B
0D97 B1      2130      OR C      ; IF ZERO, FINISHED
0D98 CAA30D  2140      JP Z, DIVEND
0D9B E3      2150      EX (SP), HL ; ANOTHER DIV LOOP
0D9C 2D      2160      DEC L
0D9D E5      2170      PUSH HL
0D9E 60      2180      LD H, B    ; PUT VALUE IN HL
0D9F 69      2190      LD L, C
0DA0 C3930D  2200      JP DODIV
0DA3 C1      2210 DIVEND  POP BC
0DA4 0D      2220 LEADSP  DEC C      ; DEC. LEADING SPACES
0DA5 79      2230      LD A, C
0DA6 B7      2240      OR A      ; CHECK SPACES LEFT
0DA7 FAB00D  2250      JP M, DONESP ; IF MINUS, DONE
0DAA 3E20    2260      LD A, £20    ; ASCII SPACE CODE
0DAC F7      2270      RST £30    OUPUT ROUTINE
0DAD C3A40D  2280      JP LEADSP

```

```

0DB0 5D          2290 DONESP LD E, L      ; FIRST DIGIT
0DB1 7B          2300 OUTPUT LD A, E     ; LOAD EACH DIGIT
0DB2 FE0A       2310          CP £0A      ; COMPARE WITH TEN
0DB4 D1          2320          POP DE       ; FOLLOWING DIGIT
0DB5 C8          2330          RET Z        RETURN TO MAIN PROG.
0DB6 C630       2340          ADD A, £30   ; DECIMAL TO ASCII
0DB8 F7          2350          RST £30    ; OUTPUT DIGIT
0DB9 C3B10D     2360          JP OUTPUT
                2370 ; DIVIDE SUBROUTINE
0DBC E5          2380 DIVIDE  PUSH HL     ; DIVIDE HL BY DE
0DBD 6C          2390          LD L, H      ; PUTTING RESULT N BC
0DBE 2600       2400          LD H, 0     ; AND REMAINDER IN HL
0DC0 CDC70D     2410          CALL DIVLOP
0DC3 41          2420          LD B, C
0DC4 7D          2430          LD A, L
0DC5 E1          2440          POP HL
0DC6 67          2450          LD H, A
0DC7 0EFF       2460 DIVLOP LD C, £FF
0DC9 0C          2470 DIVADD INC C
0DCA CDD20D     2480          CALL DIVSUB
0DCD D2C90D     2490          JP NC, DIVADD
0DD0 19          2500          ADD HL, DE  ; ADD TEN IF CARRY
0DD1 C9          2510          RET
0DD2 7D          2520 DIVSUB LD A, L      ; LEAST SIG. BYTE
0DD3 93          2530          SUB E       ; SUBTRACT TEN
0DD4 6F          2540          LD L, A
0DD5 7C          2550          LD A, H     ; MOST SIG. BYTE
0DD6 9A          2560          SBC A, D    ; SUB 0 PLUS CARRY
0DD7 67          2570          LD H, A
0DD8 C9          2580          RET
                2590 ;
                2600 ; CONVERSION TABLE TRS-80 THEN NASCOM
                2610 ;
0DD9            2620 TABLE EQU £0DD9
                2630 ;
                2640 ; HEX DUMP OF TABLE

0DD9 80 80 81 81 82 9D 83 9C 84 99 87 82 88 83 89 84
0DE9 8A 85 8B 86 8C 87 8D 88 8E 89 8F 8A 90 8B 91 8C
0DF9 92 8D 93 8E 94 8F A0 90 A1 91 B0 94 B1 95 B2 9E
0E09 B3 9F B4 A0 B8 A1 B9 A2 BA A3 BB A4 BC A5 BD A6
0E19 BE A7 C1 B9 C6 C7 CA A9 CB AA CC AB CD AC CE AD
0E29 CF AE D0 AF D1 B0 D2 B1 D3 B2 D4 B3 D5 B4 D6 B5
0E39 D7 B6 D8 B7 D9 B8 DA BA DB BB DC BC DD BD DE BE
0E49 DF BF E0 C0 E1 C1 E2 C2 E3 C3 E4 C4 E5 C5 F3 C8
0E59 F4 C9 F5 CA F6 CB F7 CC F8 CD F9 CE FA CF 00 00

```

0C80	3E	CF	D3	06	D3	06	EF	0C	00	21	0A	08	11	00	10	CD	>
0C90	B8	0C	FE	A5	20	F9	CD	AF	0C	FE	55	20	F2	CDAF	0C		.
0CA0	77	2C	FE	3C	20	F7	2C	CDAF	0C	77	12	13	18	F8	CD		w,
0CB0	B2	0C	CD	B5	0C	CD	B8	0C	C5	F5	06	53	10	FE	DB	04	.
0CC0	EE	FF	1F	30	F9	DB	04	EE	FF	1F	30	F2	06	81	10	FE	.
0CD0	00	00	00	06	3D	00	DB	04	EE	FF	1F	38	08	10	F6	F1	.
0CE0	C1	07	CB	87	C9	DB	04	EE	FF	1F	38	04	10	E7	18	EF	.
0CF0	F1	00	00	00	00	00	00	00	00	00	00	10	F6	C1	07	CB	C7
0D00	21	02	10	56	2D	5E	D5	2D	2B	54	5D	23	4E	06	00	23	!
0D10	7E	23	E5	66	6F	E5	DD	E1	DD	09	41	0E	00	DF	66	00	~
0D20	EF	20	00	E1	D5	23	13	7E	12	81	4F	10	F8	23	7E	B9	.
0D30	28	24	EF	0D	43	68	65	63	6B	73	75	6D	20	65	72	72	(\$
0D40	6F	72	20	69	6E	20	00	EB	E3	23	DF	66	00	DF	6A	00	or
0D50	2B	E3	EB	CF	00	00	23	7E	FE	3C	20	03	F1	18	AC	FE	+
0D60	78	28	16	EF	0D	4E	6F	20	23	33	43	20	61	74	20	00	x
0D70	DF	66	00	DF	6A	00	DF	5B	00	EF	0D	0D	47	4F	4F	44	ff
0D80	20	52	45	41	44	0D	50	72	6F	67	72	61	6D	20	72	75	READ
0D90	6E	73	20	66	72	6F	6D	20	00	F1	E3	DF	66	00	EF	74	ns
0DA0	6F	20	00	DD	E5	E1	DF	66	00	E1	EF	2E	0D	53	74	61	o
0DB0	72	74	20	61	64	64	72	65	73	73	20	00	23	7E	23	66	rt
0DC0	6F	DF	66	00	EF	2E	0D	00	DF	5B	00	00	00	00	00	00	off

READING MACHINE CODE TAPES

Enter E 0C80 and start the tape. The routine displays the name of the program on the tape followed by a 'prompt', >. As each byte is received from the tape it is displayed on the screen (as in a Nascom tape read). When no further data is received turn off the recorder and press RESET. All the data on the tape, including the block lengths, addresses, and sync bytes, is now in memory from £1000 upwards. Enter E 0D00; if the program has loaded correctly, i.e., if all the checksums are correct, the routine will list the address where the program should be located and the 'start' address. If there are any checksum errors, the addresses of these blocks are listed – try reading the tape again.

- Please note
- (i) The routine does not transfer the program to its correct address
 - (ii) The data blocks are 128 characters long.

TOKEN VALUES FOR TRS-80, MICROSOFT, AND CRYSTAL BASIC

COMMAND	TRS	NAS	XTL	COMMAND	TRS	NAS	XTL	COMMAND	TRS	NAS	XTL
END	80	80	80	LSET	AB			<	D6	B5	B1
FOR	81	81	81	RSET	AC			SGN	D7	B6	B2
RESET	82	9D		SAVE	AD			INT	D8	B7	B3
SET	83	9C		SYSTEM	AE			ABS	D9	B8	B4
CLS	84	99		LPRINT	AF			FRE	DA	BA	
CMD	85			DEF	B0	94	96	INP	DB	BB	B6
RANDOM	86			POKE	B1	95	97	POS	DC	BC	B7
NEXT	87	82	82	PRINT	B2	9E	98	SQR	DD	BD	B8
DATA	88	83	83	CONT	B3	9F	99	RND	DE	BE	B9
INPUT	89	84	85	LIST	B4	A0	9A	LOG	DF	BF	BA
DIM	8A	85	86	LLIST	B5			EXP	E0	C0	B8
READ	8B	86	87	DELETE	B6			COS	E1	C1	BC
LET	8C	87	88	AUTO	B7			SIN	E2	C2	BD
GOTO	8D	88	89	CLEAR	B8	A1	9B	TAN	E3	C3	BE
RUN	8E	89	8A	CLOAD	B9	A2	9C	ATN	E4	C4	BF
IF	8F	8A	8B	CSAVE	BA	A3	9D	PEEK	E5	C5	C0
RESTORE	90	8B	8C	NEW	BB	A4	9E	CVI	E6		
GOSUB	91	8C	8D	TAB(BC	A5	A1	CVS	E7		
RETURN	92	8D	8E	TO	BD	A6	A2	CVD	E8		
REM	93	8E	90	FN	BE	A7	A3	EOF	E9		
STOP	94	8F	91	USING	BF			LOC	EA		
ELSE	95			VARPTR	C0			LOF	EB		
TRON	96			USR	C1	B9		MKI\$	EC		
TROFF	97			ERL	C2			MKS\$	ED		
DEF STR	98			ERR	C3			MKD\$	EE		
DEF INT	99			STRING\$	C4			CINT	EF		
DEF SNG	9A			INSTR	C5			CSNG	F0		
DEF DBL	9B			POINT	C6	C7		CDBL	F1		
LINE	9C			TIMES\$	C7			FIX	F2		
EDIT	9D		8F	MEM	C8			LEN	F3	C8	C1
ERROR	9E			INKEY\$	C9			STR\$	F4	C9	C2
RESUME	9F			THEN	CA	A9	A5	VAL	F5	CA	C3
OUT	A0	90	92	NOT	CB	AA	A6	ASC	F6	CB	C4
ON	A1	91	93	STEP	CC	AB	A7	CHR\$	F7	CC	C5
OPEN	A2			+	CD	AC	A8	LEFT\$	F8	CD	C6
FIELD	A3			-	CE	AD	A9	RIGHT\$	F9	CE	C7
GET	A4			*	CF	AE	AB	MID\$	FA	CF	C8
PUT	A5			/	D0	AF	AC		FB		
CLOSE	A6			^	D1	B0	AA		FC		
LOAD	A7			AND	D2	B1	AD		FD		
MERGE	A8			OR	D3	B2	AE		FE		
NAME	A9			>	D4	B3	AF		FF		
KILL	AA			=	D5	B4	B0				

NOTE: PRINT @ will convert correctly, but it is not in the Nascom Microsoft. The Crystal Basic PRINT @ is followed by the column and row of the printing position (similar format to the SCREEN command), but the TRS-80 PRINT @ uses a single number to express the screen position; the top left of the screen is 0, top right 64, bottom left 960, bottom right 1023. Similarly, there may be variations in the operation of other commands in the three Basics.


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AUTO GRAPHICS SELECTION ON A NASCOM

Most Nascom-2s are equipped with the graphics ROM, and many Nascom-1s have some form of graphics capability, either by means of the sadly-departed Econographics kit or a locally-produced or commercial system. Often there is need to switch between two sets of graphics if you use special characters - for example, to display the pieces for a chess program such as Sargon.

This can be done by switching the \overline{CE} lines of the chips on and off with mechanical keys, or, even worse, by using one line from the PIO as a latch to enable the required ROM; this ties up the PIO needlessly.

The simple circuit described here uses one of the two spare output lines - from port 0, the keyboard port. The spare lines are bits 2 and 5 of this port. The status of the port is reflected at £0C00. By modifying £0C00 to set the selected bit to 1 the corresponding line is set high without affecting the other lines, and it stays that way until set back to zero by a program command, or until the RESET button is pressed. If a program uses the special graphics ROM, you merely have to include the following machine code routine at the start of the programs :-

```
3E 04    LD A, 4          ; BIT 2 - USE LD A, 32 FOR BIT 5
32 00 0C  LD (£0C00), A  ; CHANGE TO 2ND GRAPHICS ROM
```

and at the end of the programs:-

```
AF       XOR A          ; SET A TO ZERO
32 00 0C  LD (£0C00), A  ; RESTORE STANDARD GRAPHICS
```

CONSTRUCTION

Make up a "piggy-back" board, using a small piece of Veroboard or a small PCB, with one 24-pin wirewrap socket, one normal 24-pin socket, and one 14-pin socket. Cut pin 18 off the wirewrap socket, leaving about 1/4 inch for wiring. Connect pins 1 — 17 and 19 — 24 -from the wirewrap to the normal 24-pin socket. The 14 pin socket is wired as shown in figure 1, and the 74LS00 is plugged in. The standard graphics chip is placed in the normal socket, and the alternative ROM in the wirewrap socket. The board is then inserted into the socket vacated by the graphics chip on the main board, using the extended leads of the wirewrap socket as a plug. Connect a wire from the keyboard socket (pin 13 for bit 2 on a Nascom 1, pin 8 on a Nascom 2) to the input of the 7400 flip-flop as shown.

The circuit is shown for 2716-compatible chips, but the principle applies to almost any ROMs or EPROMs - just be sure that you wire the outputs from the flip-flops to the correct pin on the I.C.s you use. The 2716 chip can be 'selected' by voltages applied to pins 18 and 20. Pin 20 is the chip select line (CS), while pin 18 is Power down/Program line. If EITHER line is taken to +5 volts the data lines of

the switch to a high-impedance state. In the case of a 2708, only pin 20 can be used to select the chip.

The circuit can be used to switch between two sets of graphics held in a single 4K EPROM – a 2532. Only one 24-pin socket is required, and the output from the flip-flop is again connected to pin 18 of this socket – but in this case this is the top address line, switching between the two sets of 2K graphics data in the ROM. If the standard Nascom-2 graphics data is stored in the bottom 2K of the chip, pin 18 should be connected to pin 8 of the 74LS00.

COMPONENTS REQUIRED

- 1 wirewrap 24-pin socket
- 1 standard 24-pin socket
- 1 14-pin socket
- 1 10 kohm resistor
- Veroboard

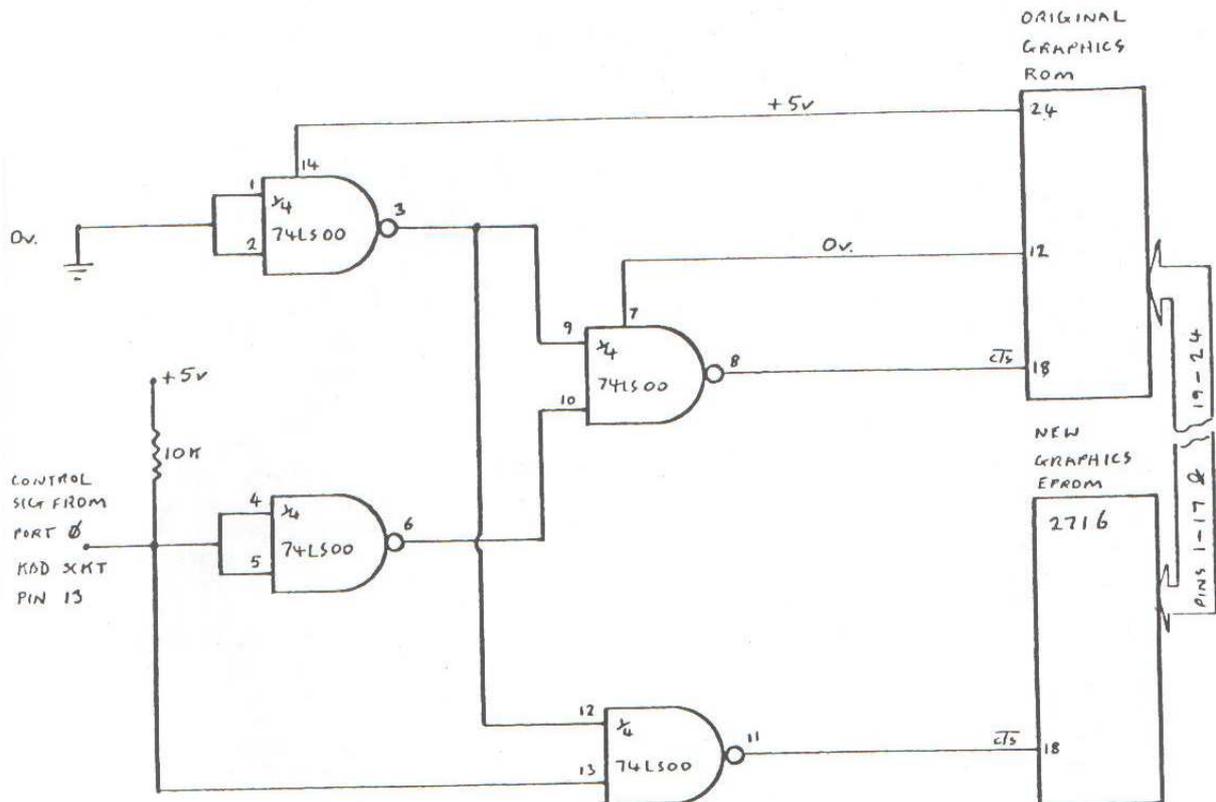


FIG. 1

```

10 REM * HANGMAN * (C) D.G.Johnson 1981
20 REM ~~~~~
30 REM SET UP M/C CODE AND PUT UP TITLE
40 REM ~~~~~
42 CLEAR 500:DIM M$(4):Z$=CHR$(0)
44 DATA27085,14336,-13564,6399,18178,10927,-817
9,233
50 DATA 31711, 1080, -53,536,-20665,3370,-5664,0
52 IF PEEK(1)=0 THEN RESTORE 50
60 DOKE 4100,3340:FOR I=3340 to 3354 STEP 2
70 READ J:DOKE I,J:NEXT
80 CLS:F=0:A$= "* HANGMAN *":FOR I=1 TO 11
90 POKE 3036+I, ASC(MID$(A$,I,1)):NEXT
100 REM SEARCH FULL LIST AND CHOOSE WORD
110 REM ~~~~~
130 RESTORE 9000:W=-1
140 READ A$:W=W+1:IF A$ <> "." THEN 140
150 RESTORE 9000
160 I=0 TO INT(RND(1)*W):READ A$:NEXT
162 FOR J=1 TO LEN(Z$)
164 IF I=ASC(MID$(Z$,J,1)) THEN F=1
166 NEXT: IF F THEN F=0:GOTO 150
168 Z$=Z$+CHR$(I)
170 B$= "":C$= "": G$= "": G=0: H=0: L=LEN(A$)
180 FOR I=1 TO L:B$=B$+ "_":NEXT
190 S=48-2*L:IF S>28 THEN S=28
200 REM START
210 REM ~~~~~
220 X=S:Y=5:GOSUB 900:PRINT "Your guess"
230 X=S:Y=3:GOSUB 900
240 FOR I=1 TO L
250 PRINT MID$(B$,I,1); " ";
260 NEXT
270 IF B$<>A$ THEN 350
280 M$(1)="Well done! You win!"
290 M$(2)=" "
292 IF RND(1)>.2 THEN 300
294 M$(1)="O.K. Smartie! But I"
296 M$(2)="will still hang you!"
298 H=1:GOSUB1000:H=2:GOSUB1000:H=9:GOSUB1000
300 M$(3)="If you would like"
310 M$(4)="another game press y"
312 GOSUB 920
320 C=USR(0):IF C<0 THEN 320
330 IF CHR$(C)="Y" THEN 80
340 CLS:X=20:Y=7:GOSUB 900
342 PRINT "Goodbye!":END
350 G=G+1
360 X=S:Y=6:GOSUB 900
362 PRINT "No. ";G;" please."
370 X=27+G:Y=9:GOSUB 900
380 C=USR(0): IF C<0 THEN 350
390 C$=CHR$(C): PRINT C$
400 FOR I=1 TO 4
410 M$(I)=" "
420 NEXT
430 GOSUB 920
440 FOR I=1 TO LEN(G$)
450 IF MID$(G$,I,1)=C$ THEN F=1
460 NEXT: IF F THEN F=0:GOTO 680
462 G$=G$+C$

```

```

470 FOR I=1 TO L
480 IF MID$(A$,I,1)<>C$ THEN 510
490 B$=LEFT$(B$,I-1)+C$+RIGHT$(B$,L-I)
500 F=1
510 NEXT
520 IF F THEN F=0:GOTO 630:REM Good guess
530 M$(1)=" * WRONG * "
532 M$(2)=" "
534 M$(3)=" "
536 M$(4)=" "
540 IF G<10ORG=11ORG=12 THEN 562
550 M$(3)="This looks dangerous"
560 M$(4)="You'll be hung soon!"
562 GOSUB 920
570 GOSUB 1000: REM Next step in hanging
580 IF F THEN F=0:GOTO 600: REM If hung
590 GOTO 230: REM Loop back for next guess
600 M$(1)="You lose! The word"
610 M$(2)="was "+A$
620 GOTO 300: REM Another game?
630 M$(1)=" * SUCCESS * "
640 M$(2)=" "
650 M$(3)=" "
660 M$(4)=" "
662 GOSUB 920
670 GOTO 230: REM Loop back for next guess
680 M$(1)="You have already made"
690 M$(2)="that guess. "
700 M$(3)="I do not allow such"
710 M$(4)="duplication. "
712 GOSUB 920
720 GOTO 570:REM Back to wrong guess loop
900 SCREEN 1,1:PRINT CHR$(23):SCREEN X,Y
910 RETURN
920 FOR I=1 TO 4
930 J=LEN(M$(I))
932 IF J>20 THEN PRINT "Message too long":STOP
940 IF J<20 THEN M$(I)=M$(I)+" ":GOTO 930
950 X=28:Y=11+I:GOSUB 900
960 PRINT M$(I);
970 NEXT
980 RETURN
1000 H=H+1:IF H=10 THEN F=1
1010 IF H>1 THEN 1110
1020 FOR I=1 TO 15:SCREEN 1,I
1030 PRINT CHR$(255);:NEXT
1040 FOR I=2 TO 16:SCREEN I,1
1050 PRINT CHR$(219):NEXT
1060 FOR I=2 TO 16
1070 SET(I,18-I):NEXT
1100 RETURN
1110 IF H>2 THEN 1190
1120 FOR I=12 TO 15
1130 SCREEN 6,I:PRINT CHR$(128);
1140 SCREEN 26,I:PRINT CHR$(128);:NEXT
1150 SCREEN 8,12:FOR I=1 TO 17
1160 PRINT CHR$(129);:NEXT
1170 POKE 2768,255:POKE 2786,255
1180 POKE 2832,133:POKE 2850,132
1182 RETURN
1190 RESTORE 8000

```

```

1200 FOR I=1 TO 4*H+4
1210 READ J,K:POKE J,K:NEXT
1220 IF F=0 THEN 1400
1230 SCREEN 8,12:PRINT CHR$(23):SCREEN 8,12
1240 PRINT SPC(17)
1320 RESTORE 8000
1330 FOR J=1 TO 44:READ K,L:POKE K,32:NEXT
1340 POKE 2137,148
1350 RESTORE 8000
1360 FOR J=1 TO 44:READ K,L:POKE K+64,L:NEXT
1370 POKE2264,185:POKE2266,185:POKE2329,0
1380 POKE2839,157:POKE2840,157
1390 POKE2842,157:POKE2843,157
1400 RETURN
8000 DATA 2137,153,2136,139,2138,138
8002 DATA 2713,148
8010 DATA 2199,131,2203,130,2263,130
8020 DATA 2267,131,2328,157,2329,086
8030 DATA 2330,157,2198,144,2200,111
8040 DATA 2202,111,2204,145,2265,095
8050 DATA 2327,131,2331,130,2390,131
8060 DATA 2396,130,2453,131,2461,130
8070 DATA 2455,148,2459,148,2460,130
8080 DATA 2454,131,2523,148,2519,148
8090 DATA 2517,079,2525,079,2583,148
8100 DATA 2587,148,2585,148,2647,148
8110 DATA 2649,148,2651,148,2710,144
8120 DATA 2711,147,2715,146
8130 DATA 2716,145,2392,094,2548,094
8140 DATA 2520,094,2586,094
9000 DATA AIREDALE , AUTONOMY , BEFUDDLED
9002 DATA BOARDINGHOUSE , CAMARADERIE, CAMBER
9004 DATA FREQUENCY, PROBATION, KNIGHTHOOD
9010 DATA WATERMELON, BREADFRUIT, SATSUMA
9020 DATA HAMMER, CHISEL, SCREWDRIVER, PLIERS
9030 DATA BRADAWL, PLANE, WORKBENCH
9040 DATA ASPIDISTRA , CLEMATIS, MARIGOLD
9050 DATA NASTURTIUM, NARCISSUS, DAFFODIL
9060 DATA JACKET, TROUSERS, RAINCOAT, SOCKS
9070 DATA CUMMERBUND, CRAVAT, JUMPER, CARDIGAN
9080 DATA TROMBONE, PIANOFORTE, BASSOON, TUBA
9090 DATA CELLO, TRUMPET, CYMBAL, GUITAR
9100 DATA CONSTANTINOPLE , COINCIDENCE
9110 DATA CIRCUMLOCUTION, PARAPSYCHOLOGY
9120 DATA CRUMBLE , CHEQUEBOOK , CASSETTE, ENVELOPE
9130 DATA COMPUTER , ELECTRICITY, CEILING, RADIATOR
9140 DATA PRINTING, SPECIALITY, FLOWERPOT
9150 DATA ESTRANGE, ZEPHYR, ZEALOUS, XYLOPHONE
9160 DATA YASHMAK, WISECRACK , WINDSHIELD, ZIP
9170 DATA WHEREWITHAL, VIBRATION, VESTIBULE
9180 DATA VERMICELLI, TRUCULENT, CHROMATIC
9190 DATA SYNONYM, SYNCHRONIZE, SCYTHE
9200 DATA PIN, SIT, SET, RACKET , RACECOURSE
9210 DATA QUOTATION, QUICKSILVER, QUARTERMASTER
9220 DATA PULP, PUFFBALL, PROXIMITY, PSYCHOTIC
9230 DATA ILLUSTRATION, PRAGMATISM, POSTMAN
9240 DATA POLYGON, ARCHITECTURE, ORTHODOX
9250 DATA ONYX , OMNIBUS , NONCONFORMIST, TRY
9290 DATA MURMUR, MYOPIC , MEADOWSWEET, MAYOR
9999 DATA .

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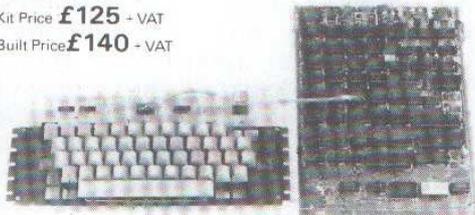
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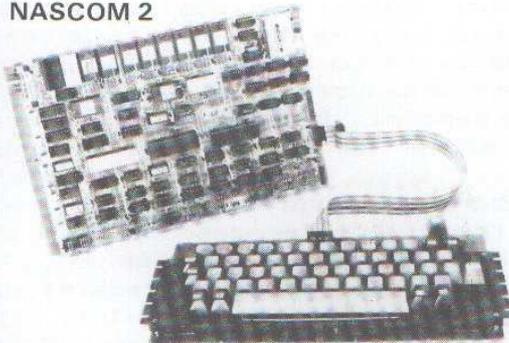
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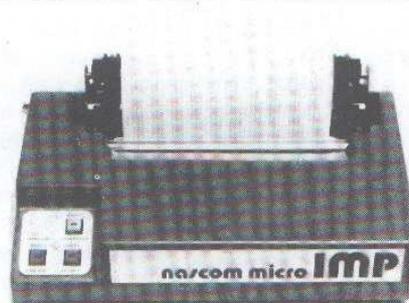
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NAS-SYS MONITORS

by J.Haigh

LOAD L

In Nas-Sys 1 this command is used to load data from a paper tape reader. The data must have been stored on the tape in the format used by the standard Nas-Sys 1 tabulate commands i.e., the address of the first data byte, eight data bytes, checksum, all represented in hexadecimal and separated by spaces; the line is terminated by a carriage return. As the tape is read the data is displayed on the screen; when the end of the line is reached (detected by the carriage return) the data is read into the workspace by the same routine which reads the arguments supplied with commands. Thus the loading address is read into ARG1 (£0C0C, £0C0D), the eight data bytes into ARG2 - ARG9 (£0C0E to £0C1D), and the checksum into ARG10 (£0C1E, £0C1F). The routine then totals the values stored in ARG1 - ARG9 and compares the result with the checksum. If the values are identical the eight data bytes are copied from the workspace to the appropriate memory location, the cursor is reset to the beginning of the line, and the next block is read in, overwriting the last line. If a checksum error is detected, or if invalid characters are detected by the routine which reads the data into the workspace, the faulty line is scrolled up the screen and the routine proceeds to the next block.

Data can be written to a paper tape punch in the correct format by routing the output of the Tabulate command to the serial port by means of the External (X) command. However, in Nas-Sys 3 the Load command has been dropped; the address stored in the subroutine table for command L (at £0798) is £0366, the Error subroutine. Because the Nas-Sys 3 tabulate command is not restricted to the -format of a Load command it has been made more versatile in the line lengths it can produce, and also no longer gives a checksum byte.

MODIFY Mxxxx

This permits direct insertion of data into memory from the keyboard. When the command is entered the address xxxx is displayed, followed by the byte currently at that address, the cursor is moved left three spaces after the routine which displays the data byte; since this routine outputs the two digits which represent this byte in hexadecimal followed by a space, this places the cursor on the first character of the byte. Data can now be typed in hexadecimal format, successive bytes being separated by one or more spaces. When the newline key is pressed the monitor interprets the current line; the first number on the line is taken as the address at which data storage is to start. If the first group of characters on the line is not a valid hexadecimal number, that is, does not consist only of the ASCII characters 0 - 9 and A - F representing a hexadecimal number between 0 and FFFF the word 'Error' is printed, and the routine restarts at the last valid address.

If a valid address is obtained subsequent hexadecimal numbers on the line are entered into memory until the end of the line is reached (detected by means of the nulls with which the screen margins are filled) or until a non-valid entry is found. If all the numbers are valid the modify routine continues on the next line, displaying the updated address and the byte at that address, when further data can be entered.

Although the data to be entered is in bytes, the routine which evaluates the successive groups of characters is designed to handle sixteen-bit values, but only the least significant eight bits are put into memory, thus FA, 1FA and 37FA will all go into memory as FA. If the number exceeds FFFF an error message will be generated and the routine will reset to the address at the start of the line, but data will have been entered into memory up to and including the first invalid entry.

If a character is encountered which does not lie in the ranges 0 - 9 or A - F the above error process will normally occur, but here are four exceptions to this. A full stop terminates the Modify command and returns control to the monitor. An oblique stroke changes the address to be modified to the hexadecimal number following the stroke; an error message is produced if the characters following the stroke are not in the 'hexadecimal' set, but if no number is entered the address changes to zero, A colon causes the routine to backstep one address. Because the Modify routine leaves the current line when it encounters one of the above three characters, either to return to monitor or to start a new line, you cannot use more than one character per line; you cannot, for example, backstep three spaces by entering 0C90 ::: N/L; only the first will be effective and address 0C8F will be displayed.

The fourth 'special' character is the comma; this causes the ASCII code of the following character to be entered into memory. In this case you can enter as many codes as will fit on the line, and you can mix them freely with the usual hexadecimal codes. For example

```
EF,H,E,L,L,O 00
```

will be entered as

```
EF 48 45 4C 4C 4F 00
```

Note that you do not need to enter spaces to separate the bytes in addition to a comma.

NORMAL N

This command resets the addresses of the output and input tables, stored at £0C73 and £0C75, so that output is routed only to the CRT and input is accepted only from the keyboard and serial input port. The U command changes these addresses so that input and output first calls user routines previously specified at £0C7B and £0C78. Thus once the address of a printer routine, for example, has

been stored at £0C78 - £0C79, commands U and N can be used from the keyboard, and DF 55 and DF 4E can be used within programs, to turn the printer on and off.

OUTPUT 0 xx yy

This routine sends data yy to port xx. The port number, xx, is placed on the bottom eight address lines, A0 - A7, and this is decoded to determine which input/output device is activated. The data to be sent, yy, is placed on the data bus, and the activated device receives it. The main use of the output command is to communicate with external devices via the PIO chip, so perhaps a few words on the operation of this device would not be out of place here.

The MK3881 PIO chip used on the Nascom is a programmable input/output chip which the main processor sees as four ports; of these, two ports each provide eight lines, which can be programmed to be input, output or bidirectional, for external communication, while the remaining two ports are used to control the operation of the chip. On the basic Nascom port A is addressed as port 4, and it is controlled by port 6; port B is addressed as port 5 and its control port is port 7.

A convenient way to study the operation of the PIO chip is to use the O and Q commands to write to and read from the PIO, while monitoring the state of the lines with a logic probe, or with the Bits and P.C.s port probe.

PREGS

In the Nas-Sys 1 monitor command P merely produces an error message; in Nas-Sys 3 the command prints out the contents of the processor's main registers, previously stored in the workspace from £0C61 to £0C6C, together with the current contents of the I, IX and IY registers. Virtually the same code is used to display the registers in Nas-Sys 1, although the format of the display is slightly different (see the S command), but it is not written as a subroutine, so it cannot be accessed from the keyboard or from user programs.

QUERY Q xx

Q xx obtains data from port xx and displays it on the screen in hexadecimal format. To be able to obtain data via the PIO chip you will have to program the chip by writing to the appropriate control port using the O command.

READ R xxxx (y)

The Read command loads data from a cassette tape written in the format used by the standard Write command. After turning on the tape LED the routine sets the input/output table addresses to their 'normal' values, saving the addresses that were at £0C73, £0C75 on the stack, so that they can be restored

at the end of the Read routine. This means that the Read routine can be called from any program, even if it uses special tables for input/output routines.

The routine then scans the keyboard and the serial input to find either the four consecutive FF's which mark the start of each block of tape data, or the four 'escapes' from the keyboard which will abort the Read routine. When the block start is found the next four bytes, which indicate the loading address, the block length and the block number, are loaded into HL and DE. They are then displayed on the screen by routine 6C, which simultaneously adds the four bytes together, returning with the value in the C register. The next byte received from the tape is compared with this checksum in C, and if the values are not identical a question mark is printed on the screen and subsequent data is ignored until the next 'start of block' marker is found.

If the checksum for the block header is correct Nas-Sys 3 checks to see if an argument has been entered with the Read command. If it has, this argument is added to the loading address, so that the data can be loaded to a different address from that specified in the write command. In Nas-Sys 1 this facility is not available.

The data is now read from the tape; if the command letter entered is R (i.e., we are doing a Read) the data is loaded into memory; if not (for example, if we are using the Verify command) data is not stored. In either case the bytes are summed into register C as they are received from tape. When a number of bytes equal to the block length specified in the header has been received, the total in C is compared with the next byte - the data checksum. If the two are not identical, a question mark is printed; however, the faulty data bytes or bytes which caused the checksum error have been loaded into memory.

If the checksum test is passed a full stop is printed and the routine then checks to see if the block just loaded was the last block. If not, the routine looks for the next 'start of block' marker. When the last block is detected the input/output addresses are reset and the routine terminates by jumping to the subroutine which flips the tape LED.

The Read routine has two faults. Firstly, it loads faulty data; if you are trying to load a tape which is producing a lot of read errors you cannot load a program correctly by reading the tape repeatedly, even if you have several copies of the same program on the tape, because blocks which have loaded correctly are corrupted by faulty reads in subsequent passes. Of course, you can overcome this by copying the program to a different location and then recopying blocks which initially read incorrectly as error-free reads are obtained. However, this is a fiddly task, and in any case you can't use this method if the program is longer than half the available memory. A second fault is that blocks can be missed entirely without an error message being produced if one of the FF's in the 'start of block' marker is misread.

In order to overcome these faults I use a slightly different Read routine, which puts the tape data into a buffer and only transfers it to the correct memory location if the checksum tests are passed. But where can you locate the

buffer? Wherever you put it, sooner or later you will want to load a program to that location. The only solution seems to be to use the screen RAM for temporary storage. The program therefore starts by clearing the screen; as it uses the margins as well as the 'visible' screen RAM, it also clears the screen at the end of the routine to restore the zeroes which delineate the margins. A tally is kept on the screen of blocks which have been read correctly, and when all the blocks have been obtained the routine stops.

The revised Read incorporates the 'load offset' of Nas-Sys 3. A second argument can be used to force transfer of data from the buffer to memory, even when the checksum is wrong. This ensures that if you only have one copy of a program, and a persistent error on the tape, you don't lose the whole block.

Because bad data is not written to memory, it is not necessary to use a separate verify command. To verify a tape you have just recorded you merely read it back with the R command - if the recording was faulty it will not corrupt the stored program. Therefore the routine does not test the value stored at ARGX (£0C2B), which is how the standard Nas-Sys routine distinguishes between Read and Verify. Consequently unless you change the address for the V command this will also read a tape into memory.

```

EF0C00    READ    DEFB £EF £0C 00    ; CLEAR SCREEN
DF5F          SCAL ZMFLP          ; TURN ON TAPE LED
DF77          SCAL ZNNOM          ; RESET OUTPUT TABLE ADDRESS
E5           PUSH HL              ; SAVE OLD ADDRESS ON STACK
DF78          SCAL ZNNIM          ; RESET INPUT TABLE ADDRESS
E5           PUSH HL              ; SAVE OLD ADDRESS ON STACK
0604        R1    LD B, 4          ; LOOK FOR 4 CHARS.
CF          R2    RST RIN          ; GET CHARACTER
3C          JR NZ, R1;T44; IF NOT, KEEP LOOKING
10FA        DJNZ R2              ; HAVE WE GOT 4 YET?
CF          RST RIN              ; NOW GET HEADER BYTES
6F          LD L, A              ; FIRST BYTE INTO L REG.
CF          RST RIN              ; SECOND BYTE
67          LD H, A              ; INTO L REGISTER
CF          RST RIN              ; THIRD BYTE
5F          LD E, A              ; INTO E REGISTER
CF          RST RIN              ; FOURTH BYTE
57          LD D, A              ; INTO D REGISTER
EF1B00      DEFB £EF £1B 00      ; PUT CURSOR BACK TO START
4F          LD C, A              ; SET C TO ZERO
DF6C        SCAL ZTX1            ; PRINT HL, DE: GET CHECKSUM
CF          RST RIN              ; GET NEXT BYTE
B9          CP C                  ; COMPARE WITH CHECKSUM
20E6        JR NZ, R1            ; IF WRONG, START AGAIN
48          LD C, B              ; SET C TO ZERO
43          LD B, E              ; PUT BLOCK LENGTH INTO B
E5          PUSH HL              ; SAVE HL
21000A      LD HL, £0A00          ; SET HL TO BUFFER START
CF          R3    RST RIN          ; GET DATA BYTES
77          LD (HL) A            ; PUT INTO BUFFER
23          INC HL               ; INCREMENT BUFFER ADDRESS
81          ADD A, C             ; CHECKSUM CALCULATION
4F          LD C, A              ; SAVE IN C

```

10F9		DJNZ R3	; KEEP GOING TO END OF BLOCK
CF		RST RIN	; GET NEXT BYTE
B9		CP C	; IS CHECKSUM CORRECT?
E1		POP HL	; RECOVER HL
3A0B0C		LD A (£0C0B)	; LOAD NUMBER OF ARGUMENTS
2804		JR Z, R4	; IF CHECKSUM O.K., JUMP
FE02		CP 2	; SECOND ARGUMENT ENTERED?
20CD		JR NZ, R1	; IF NOT, DON'T COPY
4B	R4	LD C, E	; PUT BLOCK LENGTH INTO C
0D		DEC C	; IF C = 0 THE B MUST BE SET
03		INC BC	; TO 1 FOR COPY ROUTINE
A7		AND A	; ANY ARGUMENTS TO COMMAND?
7A		LD A, D	; SAVE BLOCK NUMBER IN A
2805		JR Z, R5	; NO ARGS., SKIP OFFSET
ED5B0C0C		LD DE (£0C0C)	; GET FIRST ARGUMENT
19		ADD HL, DE	; ADD OFFSET TO HL
11000A	R5	LD DE, £0A00	; SET DE TO BUFFER
EB		EX DE, HL	; EXCHANGE REGISTERS AND COPY
EDB0		LDIR	; FROM SCREEN TO LOAD ADDRESS
6F		LD L, A	; RECOVER BLOCK NO. FROM A
2609		LD H, 9	; POSITION FOR BLOCK TALLY
74		LD (HL), H	; MARK POSITION
68		LD L, B	; SET L TO ZERO
7C		LD A, H	; PUT TALLY CHARACTER IN A
BE	R6	CP (HL)	; IS TALLY CORRECT?
23		INC HL	; SCAN TALLY
2002		JR NZ, R7	; IF NOT, SKIP
10FA		DJNZ R6	; CHECK ALL 256
BE	R7	CP (HL)	; NOW CHECK IF END OF TALLIES
23		INC HL	; KEEP SCANNING
28AB		JR Z, R1	; IF NOT END, KEEP READING
10FA		DJNZ R7	; SCAN ALL 256
E1		POP HL	; RECOVER ORIGINAL INPUT
TABLE			
22750C		LD (£0C75), HL	; RESTORE AT £0C75
EF0C00		DEFB £EF £0C 00	; CLEAR SCREEN
DF5F		SCAL ZMFLP	; TURN OFF TAPE LED
C3 3C 07		JP £073C	; RESTORE OUTPUT TABLE

No assembly addresses are given in the above listing, because the program is essentially relocatable. It will fit in the space used by the standard read routine in either Nas-Sys 1 (£065E to £06CE) or Nas-Sys 3 (£065E to £06CB). The jump address with which the program ends should be £0741 for Nas-Sys 1 and £073C for Nas-Sys 3.

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NEWS FROM THE CLUBS

First a small success - as a result of a letter in the first issue of Micropower a new User Group has been formed the Nascom - Thames Valley User Group. Regular meetings in the Slough/Staines/Windsor area are planned, and the group hope to publish a newsletter. Further details can be obtained by contacting, after 7.30 p.m., Pat Dubock, STAINES 50341, Mike Rothery, WINDSOR 56106, or Ken Ford, STAINES 59662.

The Computer section of the Cornish Radio Amateur Club meets on the third Monday of each month in the S.W.E.B. Social Club, Pool, Redruth. The average attendance is 20 - 30, with a Nascom contingent of 10 - 15. The November meeting will present "Flowcharting"; in December the topic will be "Machine Code Continued".

York Computer Club meets every Monday at the Holgate W.M.C., New Lane, Acomb (Near the Carriage Works). Any new Nascom-owning members would be very welcome, as the Nascom users are outnumbered by owners of plastic boxes from Japan, U.S.A., and Cambridge. Ring Rupert Brown on York (0904) 792023, evenings only, or drop in to the Club (bar prices are well subsidised!).

The Merseyside Nascom Group still meets on the first WEDNESDAY of each month, in spite of a note to the contrary in one of the glossies. The next meeting will be the Christmas Beanfeast, and it is hoped that representatives from Lucas will be present. Meetings are held in the Mona pub, near Pierhead.

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Small non-commercial advertisements, £2 per ad.

FOR SALE RAM A card with 8K; £45 o.n.o. RAM B card with 16K; £75 o.n.o. Both in full working order.

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NASCOM 1 & 2

Nasprint 80

Nasprint 80 is a 2K program which greatly extends and simplifies the operation of Nas-Pen. New functions supplied by Nasprint 80 includes:

Pagination

Output a page number of each page

Output a title on each page

Centre title

Text formatting with embedded control codes. e.g. Change line length; change line spacing; change margins; centre line between margins; new page; output control codes to printer.

The program contains a parallel printer routine for a Centronics type interface, specifically designed for the Epsom MX-80, but the program can be used with any printer, parallel or serial, as the output is routed through an address in RAM.

The program also facilitates the operation of a printer with Zeap, Nas-Dis, De-bug, Nas-Sys & ROM Basic; the software/firmware being used is selected from a menu and Nasprint 80 then changes the necessary addresses to produce a hard copy output.

The program is supplied in 2x2708's for fitting 2716's in the RAM A card. £14.95

New Fase (16K/MC/G)

New version of the space invaders type with each new fleet of invaders having a different shape & kind of motion. Missiles fired at you come straight down or diagonally left to right & vice versa.

Destroy one 'fase' & move onto the next. The fuel level is shown graphically and you can refuel if you obliterate four fleets. Your score is shown at the end of a game and the top ten scorers are ranked. Once again the difficulty level has been set very high. £7.95

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The 'real-time' Space Adventure for 'thinking' campaigners!

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The 3-dimensional planetary system is divided into 729 sectors (9x9x9), your viewscreen revealing neighbouring sectors 5 wide by 3 high by 3 deep. It can be rotated to look up & down as well as N,S,E & W.

You will encounter friendly, neutral & hostile planets and, of course, enemy interceptors. Your long term objective is to raise the morale of the system's inhabitants so as to bring forth a spontaneous rebellion against the Federation. This can be achieved progressively by winning in combat and converting neutral planets. The opposite occurs if you flee from a fight, upset neutral planets or just skulk!

Machine-code sub-routines ensure the clashes with the enemy are exciting. There are six levels of skill and many other features. Full instructions are given in a separate program. £9.95

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The 'Scramble' game you have been waiting for!! Blast the asteroids, enemy missiles & ramships out of the sky as you skim over the mountains on the moon's surface. Bomb the fuel dumps and enemy defences. Higher points scored for hits closer to the ground. Maximise your total score on restricted supplies of fuel. If you survive the first part of the game you enter the 'tunnel', with rocky projections above & below you! Four skill levels, excellent graphics & excruciating sound via the keyboard port. £8.95

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