ENGINEERING NOTES
on
Radio Shack Color Computers

July 1986
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DYNACOMP NEWS

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DYNAMIC COLOR NEWS is published monthly by DYNAMIC ELECTRONICS, INC., P.O. Box 896, Hartselle, AL 3564Ø, phone (2Ø5) 773-2758. Bill Chapple, BA, BSE President; Dean Chapple, Sec. & Treas. ; John Pearson, Ph. D. Consultant; Bob Morgan, Ph. D., Consultant.

 Subscriptions are $15/yr for U.S.A. & Canada, $3Ø other foreign.

The purpose of this newsletter is to provide instruction on Basic & Machine Language programming, Computer theory, operating techniques, computer expansion, plus provide answers to questions from our subscribers.

The submission of questions, operating hints, and solutions to problems to be published in this newsletter are encouraged. All submissions become the property of Dynamic Electronics if the material is used. We reserve the right to edit all material used and not to use material which we determine is unsuited for publication.

We encourage the submission of Basic and Machine Language Programs as well as articles. All Programs must be well documented so the readers can understand how the program works. We will pay for programs and articles based upon their value to the newsletter. Material sent will not be returned unless return postage is included. Basic & ML programs should be sent on a tape or disk & comments should be sent as a DAT or BIN file.

****
* DYNAMIC COLOR NEWS *
* July 1986 *
* Editor and Publisher *
* Bill Chapple W4GQC *
* Secretary *
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EDITOR'S COMMENTS

As technoolgy improves, new products become available. Who would have dreamed of a 256K color computer a few years ago. When I bought my first computer it had 4K of memory. Then 64K chips were very expensive, and if you had a 64K of memory, you were considered to have the ultimate computer. Now a 64K computer is considered to be standard.

The low prices of 256K memories allowed ramdisks large enough to contain the contents of a floppy disk to be developed. Four years ago, this could not even be a remote possibility for most people. Now 1 megabyte memories are being marketed. As the prices of these fall, you can look for a 1,000K upgrade for color computers.

Dynamic memories are used mostly for large memories because they can contain a lot amount of data in a small package. There is a price to pay for this. The memories have to be refreshed many times a second which takes extra circuitry. The powerful 6883 or SAM chip does this for color computers. It only handles 64K, so extra circuitry is required for 256K memories.

Advances also have been made in other memory areas. Static memories are available that do not require refreshing. These are used in portable computers such as the Radio Shack model 100. I remember when the largest size for these was 1K bytes. Now a 32K byte memory is available for around $35. These require a very small amount of power and the memory can be preserved with a small battery. These could be used in color computers with an interface circuit for the SAM chip.

Also there have been tremendous advances in Eraseable Programable Read Only Memories (EPROMS). It is now possible to purchase an EPROM that contains 512K bits or 64K bytes. These are called 27512 EPROMS. With the basic, extended, and disk basic ROMS each requiring 8K of memory, these EPROMS could contain all 3 of these plus 5 other 8K programs. The price of a 27512 EPROM is in the $20 range.

Advances have been made in developing support devices such as digital to analog (D/A) and analog to digital (A/D) converters. With the large memories, it now is possible to digitize voice and store messages in the computer. Also the computer can be programmed to speak using speech sounds.

The prices of disk drives are falling. I have seen untested units for as low as $29. A disk controller is required and these cost around $100. A disk drive with controller can be purchased for around $200. Be careful when you purchase one of these lower priced units. Make sure that it is compatible with your computer.

The prices of hard disks have dropped. A hard disk can permanently store millions of bytes of information. A 5M (M means million) unit can be purchased for around $500 with a controller.

As we have stated many times, you can look for better and cheaper accessories for computers. Memory chips are increasing in price. Recently the Japanese dumped surplus 256K memory chips on the American market at prices below their cost. This forced most American manufactures out of the memory market. A tarriff has been placed on imported memories. Where the prices will go no one knows, but we do know that prices are increasing.

Next month we will be starting a new series. If you have a subject you would like for us to cover, please write and tell us

about it. There are many subjects that we can cover, but we are not able to cover them all at once. Your input may cause us to write a series on a topic of your interest.

In our Interfacing Computers series, we are going to develop a terminal program. With this program you can transfer files, programs, or data to or from another computer either directly or through your telephone lines by a MODEM. We will show all the details of how a terminal program works. It will be written in basic so that it can be customized for your individual needs.

ML PROGRAMMING
(Part 3)

In this series we are showing how to write machine language programs. We will cover a few commands each month and give example programs on how to use them. Wherever possible we will give an equivalent basic command.

Last month we defined the addressing modes. These are Immediate, Direct, Indexed, and Extended. We used immediate and extended. These are easy to keep straight if you remember that immediate means that the value following the op code is going to be placed into the register. Extended requires two bytes and allows any value up to $FFFF. Machine language programs are formatted as op code or instruction and then information about the instruction. For example if we want to load register A with the value 75 then the values will be:

```
100 $86 'Load A immediate
101 75
```

Remember that the $ mark preceeding a number means that it is a hex number. This takes two bytes of memory and is similar to the basic statement A=75. To load A with the value stored in 30000, we will have to use extended addressing. This is what we did in our example program last month.

```
100 $B6 'load A extended
101 $75 (117)' MS byte
102 $30 (48)' LS byte
```

If a value of 215 is stored in memory location 30000, then 215 will be put into the A register. This is similar to the basic statement A=PEEK(30000). Notice how compact the machine language codes are. For the basic statement "A=PEEK(30000)" a total of 13 bytes are required where 3

RENEWAL TIME?

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are required for the ML equivalent.

We want to give numerous examples and relate to basic when it is possible to do so. Let's concentrate on loading registers and storing the contents of the registers. Remember we have two working registers which are A and B. For the following the first byte is the op code and the second byte is the value. The OP Code values are given in both hex and decimal. These are for immediate addressing.

Command	OP Code	Function
LDA	$86-134	A=V
LDB	C6-198	B=V
ADDA	8B-139	A=A+V
ADDB	CB-203	B=B+V
ADCA	89-137	A=A+V+C
ADCB	C9-201	B=B+V+C
SUBA	80-128	A=A-V
SUBB	C0-192	B=B-V
SBCA	82-130	A=A-V-C
SBCB	C2-194	B=B-V-C
ANDA	84-132	A=A AND V
ANDB	C4-196	B=B AND V
ANDCC	1C-28	CC=CC AND V
EXG	1E-30	R1=R2 & R2=R1

OP-CODE in first byte, Value (V) in the second byte, C=carry bit from conditional code register.

TABLE I- IMMEDIATE ADDRESSING

Now let's make a table for extended addressing. These will take 3 bytes with the first being the op code and the next two the location.

Command	OP Code	Function
LDA	$86-134	A=PEEK(M)
LDB	C6-198	B=PEEK(M)
ADDA	BB-187	A=A+PEEK(M)
ADDB	FB-251	B=B+PEEK(M)
ADCA	B9-185	A=A+PEEK(M)+C
ADCB	F9-249	B=B+PEEK(M)+C
SUBA	B0-176	A=A-PEEK(M)
SUBB	F0-240	B=B-PEEK(M)
SBCA	B2-178	A=A-PEEK(M)-C
SBCB	F2-242	B=B-PEEK(M)-C

First byte = op code in hex and decimal, second byte is the most significant byte of memory, third byte is least significant byte of memory. C is the carry bit from the conditional code register.

EXTENDED ADDRESSING

TABLE 2

AND LOGIC

The **AND** logic operator is needed to remove bits from the conditional code register which we will explain next. It can also be used on any register to remove the individual bits. This principle also is used in basic. The rule is that when two numbers are "ANDED" the corresponding bits are compared. If both are a "1" the result is a "1". If either is a "0" then the result is a "0". It is easy to perform this operation if both numbers are in hex. Let's take a couple of examples.

(1) Any number "ANDED" with $FF gives the original number.

(2) X=$C1 and $A8. First

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convert to binary.

C1=11000001
A8=10101000

Now compare each bit. Only the left bit is a one for both numbers. Therefore the result is 10000000 =$80. So C1 AND A8=80.

(3) X=C1 and 01.

We will need to AND the Conditional Code register with 01 to pull out the carry bit for arithmetical operations. So again C1=11000001. The least significant bit, the one on the right is a "1". When this is ANDED with "01" the result is "1".

CONDITIONAL CODE (CC) REGISTER

This 8 bit register contains information about various operations. We want to continue with more examples using addition and subtraction. If we add 9 and 8 we get a 7 plus a carry using decimal arithmetic. Thus our result is 17. The A and B registers can only hold values up to 255. If we add two numbers so that the result is greater than 255 a carry bit will be generated and the difference of the result less 256 will be in the register. If the result were 258 then a 2 would be in the register and the carry bit would be "SET". We use the terms "SET" to force a bit to a "1" and "CLEAR" to force a bit to a "0".

EXCHANGE

The exchange command allows the contents of two 8 bit or 16 bit registers to be exchanged. The second byte designates the registers. The first 4 bits of the second byte designate one register and the second 4 bits designate the other register. The following are the designations.

16 Bit Reg	8 Bit Registers
0=D	8=A
1=X	9=B
2=Y	A=CC
3=User Stack	B=DP
4=Hardware Stack	
5=PGM Counter	

The first byte is $1E. To exchange the CC and B registers the second byte would be A9 or 9A. Only registers of like size can be exchanged.

APPLICATION

We want to assemble a program similar to the one we did last month except we will use ADC instead of ADD. We will look at the carry bit to see if it is set. We will use memory locations 500 and 501 for the two numbers, 502 for the carry and 503 for the result from the A register. The sum will be 256 * PEEK (502) + PEEK (503). We will use the following steps in our ML subroutine. The basic equivalent commands are given after the ':

1. LDA extended with 500 'A = PEEK(500)
2. ADCA extended to 501 'A= A + PEEK (501)+C
3. STA extended in 503 'POKE 503, A
4. AND CC immediate with 01. This result is contained in the CC. 'CC=CC AND 01
5. EXC B and CC. 'CC=B and B=CC
6. STAB extended in 502 'POKE 502,B
6. Return from subroutine.

If our ML subroutine starts at 510, then we can hand assemble the program using the values in the Tables plus we will give the code for exchanging the registers.

```
510 $B6 (182) LDA ex A =
                PEEK(500)
511  1        MS byte of 500
```

```
512  F4 (244) LS byte of 500
513  B9 (185) ADCA ex A=A +
              PEEK(501)+C
514  1        MS byte of 501
515  F5 (245) LS byte of 501
516  B7 (183) STA ex  POKE
              503,A
517  1        MS byte of 503
518  F7 (247) LS byte of 503
519  1C (28)      AND CC Reg
520  1        with 01, CC=CC
                   AND 1
521  1E (30)  EXG Registers
522  9A (154) B & CC
523  F7 (247) STB Extended,
              POKE 502,B
524  1        MS byte of 502
525  F6 (246) LS byte of 502
526  39 (57)  RTS ,RETURN
              from Subroutine
```

PROGRAM IMPLEMENTATION

Let's use the same method that we used last month. We will put our ML subroutine in data statements and READ and POKE them into memory. Remember that DATA statements can be anywhere within the program. We will put it last.

ML ADD WITH CARRY PROGRAM

```
5 ?"PROGRAM 7-1-86
10 ?"COPYRIGHT (c) 1986
15 ?"dYNAMIC eLECTRONICS iNC.
20 ?"ML ADD with CARRY PGM
25 'READ IN ML PGM
30 FOR J=510 TO 526
35 READ A, POKE J,A:NEXT J
45 ?"ENTER VALUES LESS THAN 256
50 INPUT"FIRST VALUE";X
55 INPUT"SECOND VALUE";Y
60 POKE 500,X:POKE 501,Y
65 EXEC 510' CALL ML SUB
70 A=PEEK(502):B=PEEK(503)
75 V=256*A+B 'CALCULATE SUM FOR
   DECIMAL DISPLAY
80 ?X"+"Y"="V
85 GO TO 50
90 DATA 182, 1, 244, 185, 1,
   245, 183, 1, 247, 28, 1, 30,
   154, 247, 1, 246, 57
```

GRAPHICS ZOOM

Have you ever had a graphics picture and wished you could enlarge and modify part of it? This is what GRAPHICS ZOOM does. Any part of the picture can be selected and enlarged 4 times. Then modifications can be made setting or resetting the pixels under the cursor.

GRAPHICS ZOOM will allow you to zoom into your graphics to allow you to do fine detail work. It magnifies any portion of your PMODE 3/4 graphics screen (4x). Option 1 allows you to define the "zoom in" area. Use the arrow keys to zoom in on the desired portion of the graphics screen. Press <CLEAR> key to return to menu. Then use option 3 to make modifications. Here, use the arrow keys to move the cursor and the <SPACE BAR> to set / reset pixels. Press <CLEAR> after you have made all the modifications. Use option 2 to view your "regular" graphics screen. Use the <BREAK> key to exit the program.

This program is provided by Microcom Software and is used by permission.

```
10 '*****************
20 '* GRAPHICS ZOOM *
30 '*** COCO-TIME ***
40 '****** BY *******
50 'MICROCOM SOFTWARE
60 '   PO BOX 214
70 'FAIRPORT,NY 14450
80 'PH: (716)223-1477
90 '*****************
100 PCLEAR 8:CLS:PRINT@224,"   R
    EADING DATA .....":GOSUB400:P
    MODE4:POKE469,PEEK(183):GOTO2
    30
110 I=0:J=0:POKE186,PEEK(188):X=
    PEEK(186)*256:GOSUB210:EN=X+6
    144-1536+31:ST=X:POKE466,A:PO
    KE467,B:X=X+1536:GOSUB210:POK
    E496,A:POKE497,B:PMODE4
120 X=X-1536:Y=X
130 POKE135,0:POKE186,PEEK(188):
    EXEC&H1D1
140 POKE186,PEEK(183):SCREEN1,1
150 A$=INKEY$:IFA$=""THEN150ELSE
    IFA$=CHR$(9)THENY=Y+1:IFY>X+2
    4THENSOUND50,5:Y=Y-1:GOTO130E
    LSEI=I+8:GOSUB220:POKE466,A:P
    OKE467,B:GOTO130
160 IFA$=CHR$(8) THEN Y=Y-1:IFY<
    X THENSOUND50,5:Y=Y+1:GOTO130
    ELSEI=I-8:GOSUB220:POKE466,A:
    POKE467,B:GOTO130
170 IFA$=CHR$(10) THEN Y=Y+256:I
    FY>EN THENY=Y-256:SOUND50,5:G
    OTO130ELSEX=X+256:J=J+8:GOSUB
    220:POKE466,A:POKE467,B:Z=X:X
    =X+1536:GOSUB210:X=Z:POKE496,
    A:POKE497,B:GOTO130
180 IFA$="B THEN Y=Y-256:IF Y<ST
     THEN Y=Y+256:SOUND50,5:GOTO1
    30ELSE X=X-256:J=J-8:GOSUB220
    :POKE466,A:POKE467,B:Z=X:X=X+
    1536:GOSUB210:X=Z:POKE496,A:P
    OKE497,B:GOTO130
190 IFA$=CHR$(13)THENPMODE4:SCRE
    EN1,1:EXEC44539:GOTO130ELSEIF
    A$=CHR$(12)THENK=I:L=J:RETURN
    ELSE130
200 GOTO200
210 A=INT(X/256):B=X-(A*256):RET
    URN
220 A=INT(Y/256):B=Y-(A*256):RET
    URN
230 REM
240 CLS:PRINT"         GRAPHICS Z
    OOM":PRINT"      BY KISHORE M.
     SANTWANI":PRINT:PRINT:PRINT:
    PRINT:PRINT"    (1) CHANGE ZO
    OM IN AREA":PRINT:PRINT"    (
    2) LOOK AT SCREEN":PRINT:PRIN
    T"    (3) MODIFY USING ZOOM"
250 PRINT:LINEINPUT"
    ";A$
260 A=VAL(A$):IFA<1ORA>3THEN240
270 ONA GOSUB110,290,300
280 GOTO230
290 PMODE4:SCREEN1,1:EXEC44539:R
    ETURN
300 REM
310 I=K:J=L:POKE&HBA,PEEK(183):S
    CREEN1,1:EXEC&H1D1
320 X1=0:Y1=0
330 A=PPOINT(X1,Y1)
340 COLOR0:LINE(X1,Y1)-(X1+3,Y1+
    3),PSET,B:COLOR1:LINE(X1,Y1)-
    (X1+3,Y1+3),PSET,B:A$=INKEY$:
    IFA$=""THEN340
350 COLORA:LINE(X1,Y1)-(X1+3,Y1+
    3),PSET,B:IFA$=CHR$(9)THENX1=
```

```
   X1+4:I=I+1:GOTO330ELSEIFA$=CH
   R$(8)THENX1=X1-4:I=I-1:GOTO33
   0ELSEIFA$="BTHENY1=Y1-4:J=J-1
   :GOTO330ELSEIFA$=CHR$(10)THEN
   J=J+1:Y1=Y1+4:GOTO330
360 IFA$=CHR$(12)THENRETURN
370 IFA$<>" "THEN330
380 POKE186,PEEK(183):IFA=0THENC
   OLOR1:A=1ELSECOLOR0:A=0
390 LINE(X1,Y1)-(X1+3,Y1+3),PSET
   ,BF:POKE186,PEEK(188):PSET(I,
   J):POKE186,PEEK(183):GOTO330
400 FORI=&H1D1 TO 599:READA$:POK
   EI,VAL("&H"+A$):NEXT:RETURN
410 DATA8E,E,0,CE,26,0,34,50,C6,
   8,34,4,A6,80,8D,14,35,4,5A,26
   ,F5,35,50,30,88,20,33,C9,0,80
   ,8C,14,0,25,E3,39,5F,85,80,27
   ,2,CA,F0,85,40,27,2,CA,F,E7,C
   4,E7,C8,20,E7,C8,40,E7,C8,60,
   5F,85,20,27,2,CA,F0,85,10,27,
   2,CA,F,E7,41,E7
420 DATAC8,21,E7,C8,41,E7,C8,61,
   5F,85,8,27,2,CA,F0,85,4,27,2,
   CA,F,E7,42,E7,C8,22,E7,C8,42,
   E7,C8,62,5F,85,2,27,2,CA,F0,8
   5,1,27,2,CA,F,E7,43,E7,C8,23,
   E7,C8,43,E7,C8,63,33,44,39
```


WRITING PROGRAMS
(Part 16)

We have been looking at the edit commands for the past few months. Most of the commands have been covered and we will add a few comments this month. When editing a line we can insert information or delete information. To insert characters just type "I" and then the characters you wanted inserted. Exit this with the shift up arrow. You can list the line by typing "L". This lists the line and places the cursor over the first character. Typing a "D" will delete a character each time the "D" is pressed. It is easy to delete characters one at a time by pressing the "D" key.

Multiple operations can be performed by typing in the number first and then the operation. For example if we type "20s" where s means press the space bar, we will skip over 20 characters. The space bar and right arrows allow us to move to any part of the statement for editing.

If you need to edit something near the end of the statement, or if you need to add to the statement, then type "X" for extend. Use the left arrow to remove characters and type in extra characters as needed. To exit the extend mode just type shift up arrow and "L" to list the statement.

We have covered enough material so that with a little practice any statement can easily be edited. Refer to your manual for additional information on editing.

PROGRAMMING

Last month we gave part of a file program that uses RAM to store data. This month we are expanding this program. Our objective is to place informa-

tion in memory, to be able to do calculations on it as required, and to save and load different files.

The approach we decided upon was to allow 25 bytes for each item. We decided to put the data in memory starting at 9000. We reserved memory as follows:

```
9000-9001 End of DATA
9002-9019 Title
9020-9044 First item
9045-9069 Second item
9070-9094 Third item
9095-     Other items
```

How many items can our data contain? For a 32K or 64K machine, if we let the data go to 32019, then the number of items (N) will be:

```
N = (32019-9019) / 25 = 920
```

For a 16K machine, if we let the data go to 16019, then the number of items(N) will be:

```
N = (16019-9019) / 25 = 280
```

For a 64K computer using the extra 32K for data, an extra 30000 of memory is easily available. This could contain 1200 - 25 byte items giving approximately 2000 items we could have in our file. We showed how to use this extra memory in our large memory programming series.

We have had many requests for programs for 256K and 512K memories. The program we are developing here can be used with these large memories. If the memories are used as a ramdisk then the files can quickly be moved from and to the ramdisk. If you have a disk drive, then it can be used to store files.

If there are hundreds of files, then how can an item be found? This can be done by using a machine language subroutine to scan the files for a match. This could return the number of the file from which we can display all of the information for that file.

Files can also be arranged to conform to a different order. For example it might be desireable to place them in alphabetical order or to put them in order of assending or decending values. Last month we showed how to enter items. Fortunately everything could be stored in RAM by using strings. Our procedure for storing characters in memory is to take one character at a time, convert it into its ASCII equivalent, poke the ASCII value into memory, and increase the memory by 1. We continue this procedure for the next character.

This month we want to continue with the program we started last month. Last month we showed how to enter the information. We need to add a section for displaying the information, and loading and saving the files.

To recover the information we will need to reconstruct strings representing the data stored. If the data is a numerical value, then we will have to convert the string to a value. Since the first 5 bytes represent the number of items, we can set up a loop similar to the following:

```
10 B$="" 'EMPTY THE STRING
20 BB=M 'SAVE START OF DATA
30 FOR J=0 TO 4
40 M=BB+J:A=PEEK(M):A$=CHR$(A)
50 B$=B$+A$:NEXT J
60 B=VAL(B$)
```

The string B$ will be the data and B will be the value of the data. We will need to go through this procedure 3 times since we have 3 sets of data which are number of items, description, and value. We can save space by using a subroutine to perform this conversion. Let's put the subroutine at 2900 in our program. The listing follows:

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```
2900 'THIS CONVERTS FILE DATA
2910 B$="" 'EMPTY THE STRING
2920 BB=M 'SAVE START OF DATA
2930 FOR J=X TO Y
2940 M=BB+J: A=PEEK(M): A$=
     CHR$(A)
2950 B$=B$+A$:NEXT J
2960 B=VAL(B$):RETURN
```

To continue our program from last month, we can start with 2020 to start recovering the data from the file. Let's assign the following variables to the information we need.

```
NI=Number of items
DE=Description
VA=Value
```

We will also want the total value of the items and maybe the total of all items. So let's let "T" be the total and "TA" be the total for all items. We will need the following equations to calculate these:

```
T=NI * VA
TA=TA +T
```

To get a value from a string we have to use the VAL command. If X$="1000" then if X=VAL(X$) then X=1000. In other words the VAL command converts the characters 1000 to the numerical value 1000. We have stressed this because it is very important. Only numbers can be stored in memory. Since we stored the ASCII value of characters representing a string when we entered the information, we will have to reconstruct the string as we recover our information. If the string represents a numerical value then we must convert it to a numerical variable by using the VAL command.

FILE PROGRAM

We added sections 2000- to the program last month. Since we made a few minor changes to parts of the program last month, we are listing the complete program. There are additional refinements that we will add. For example we might want to change one file. Also we might want to search for an item. These will be discussed next month or used when we develop a different program.

```
2 PRINT"PROGRAM 7-2-86
3 PRINT"INVENTORY PGM
4 PRINT"cOPYRIGHT (c) 1986
5 PRINT"dYNAMIC eLECTRONICS iNC.
6 PCLEAR 1
10 PRINT"1 ENTER INFORMATION
15 PRINT"2 DISPLAY INFORMATION
20 PRINT"3 SAVE OR LOAD DATA
25 INPUT"ENTER NUMBER";X
30 ON X GO SUB 1000, 2000, 3000
1000 PRINT"THIS ALLOWS DATA TO B
   E ENTERED.
1002 PRINT"1 CHANGE OR ENTER TIT
   LE
1004 PRINT"2 ENTER NEW DATA","3
   RETURN TO MAIN MENU
1007 INPUT "ENTER NUMBER";X
1008 IF X=1 THEN 1010 ELSE IF X=
   2 THEN 1030
1009 GO TO 10
1010 INPUT"ENTER TITLE";T$:M=900
   2:FOR J=9002 TO9019:POKE J,32
   : NEXT
1015 L=LEN(T$):IF L>18 THEN PRIN
   T"TITLE TOO LONG":GO TO 1010
1020 GO SUB 1900: GO TO 1000
1030 NF=256*PEEK(9000)+PEEK(9001
   ):NF=(NF-9020)/25:PRINT"THERE
    ARE "NF" FILES"'THIS ENTERS
   NEW DATA
1032 INPUT"ENTER ITEM NUMBER TO
   START";N: IF N=0THEN N=1
1034 M=9020+25*(N-1): BB=M
1035 FOR J=0 TO 24:POKE M+J,32:
   NEXT 'CLEAR ALL DATA
1040 INPUT"ENTER NUMBER OF ITEMS
   ";T$
1045 GO SUB 1900
1050 INPUT"ENTER DESCRIPTION";T$
1052 T=LEN(T$): IF T>12 THEN PRI
   NT"TOO LONG": GO TO 1050
1055 M=BB+5
1060 GO SUB 1900
1065 INPUT"ENTER VALUE";T$
1070 M=BB+17
1075 GO SUB 1900
1080 INPUT "ENTER 1 FOR MORE ITE
   MS AND 0 TO RETURN TO MENU";X
```

```
1085 IF X=1 THEN M=BB+25:GO TO 1
   035
1088 IF XX=1 THEN RETURN
1090 M=BB+25:MS=INT(M/256): LS=M
   -256*MS:PRINT"1090 MS="MS" LS
   ="LS" M="M
1092 POKE 9000,MS:POKE 9001,LS
1095 RETURN
1800 '
1900 PRINT"THIS STORES STRINGS I
   N MEMORY
1915 L=LEN(T$) 'FIND LENGTH OF S
   TRING
1920 FOR J=1 TO L 'STORE STRING
   IN MEMORY
1925 A$=MID$(T$,J,1): A=ASC(A$):
    POKE M,A: M=M+1
1930 NEXT J: RETURN
2000 PRINT"THIS DISPLAYS THE INF
   ORMATION
2002 INPUT"ENTER 1 FOR PRINTER";
   P
2005 'DISPLAY THE TITLE
2010 FOR J=9002 TO 9019:A=PEEK(J
   ):A$=CHR$(A):PRINTA$;
2015 NEXT J:PRINT
2020 BB=9920:TA=0 'TA IS TOTAL S
   UM
2025 ED=256 * PEEK(9000) + PEEK(
   9001) 'END OF DATA
2030 NF=(ED-9020)/25 'NF=NUMBER
    OF FILES
2031 PRINT"THERE ARE "NF "FILES
2035 N=1' START WITH FIRST FILE
2040 M=8995+25*N:BB=M
2045 BB=M:X=0:Y=4:GO SUB 2900
2050 NI$=B$:NI=B 'NI=NUMBER OF I
   TEMS
2055 X=5:Y=16:GO SUB 2900
2060 DE$=B$ 'DE$=DESCRIPTION
2065 X=17:Y=24:GO SUB 2900
2070 VA$=B$:VA=B 'VALUE
2075 'WE CAN NOW CALCULATE & PRI
   NT RESULTS
2080 T=NI*VA: TA=TA+T:Q=VAL(NI$)

2085 PRINTN;" "Q"-"DE$;" $"VA
2090 PRINT"VALUE="T,"SUM="TA:PRI
   NT
2092 IF P=1 THEN PRINT#-2,N;" "Q
   "-"DE$;" $"VA,"VALUE="T,"SUM=
   "TA
2095 IF N>=NF THEN 2200
2100 N=N+1:GOTO2040
2105 GO TO 2040
2110 '
2200 INPUT"LAST ITEM PRESS KEY T
   O CONTINUE";XA:GO TO 10
2210 '
2900 'THIS CONVERTS FILE DATA
2910 B$="" 'EMPTY THE STRING
2930 FOR J=X TO Y
2940 M=BB+J: A=PEEK(M): A$ =CHR$
   (A)
2950 B$=B$+A$:NEXT J
2960 B=VAL(B$):RETURN
2990 '
3000 PRINT"THIS SAVES OR LOADS F
   ILES
3005 PRINT"C - CASSETTE",,"D-DIS
   K
3010 S$=INKEY$:IF S$=""THEN 3010
3015 IF S$="C" THEN S=0 ELSE IF
   S$="D" THEN S=1
3020 IF S=1 THEN PRINT"DISK":GO
   TO 3050
3030 PRINT"BAD ENTRY":GO TO 3005
3050 PRINT"1 LOAD A FILE
3060 PRINT"2 SAVE A FILE
3065 PRINT"3 RETURN
3070 INPUT X
3080 ON X GO TO 3300,3400,3500
3300 PRINT"THIS LOADS A FILE
3310 INPUT"ENTER NAME";N$
3320 IF S=1 THEN LOADM N$ ELSE C
   LOADM N$
3330 GO TO 10
3400 PRINT"THIS SAVES THE FILE
3410 INPUT"ENTER NAME";N$
3420 EN=256 * PEEK(9000) + PEEK(
   9001)
3430 IF S=1 THEN SAVEM N$, 9000,
    EN, 9000: GOTO 3000
3440 CSAVEM N$,9000, EN,9000:GO
   TO 3000
3500 GO TO 10
```

INTERFACING COMPUTERS

In this series we have been showing how to interface computers with other computers or devices. Mainly we have been focusing on serial interfaces using the ASCII code. These can be printers, modems, or other computers.

Last month we discussed how the cassette interface works. Each bit is represented by one cycle of an audio tone with the higher frequency representing a "1" and the lower frequency representing a "0". The higher frequency is twice the lower frequency. We also showed how to connect two color computers together for transferring information between them. However we did not give any software for doing this. Both computers must have a terminal program. If the data is an ASCII word file, then the data can be transferred between any two computers byte for byte.

For example much of the material for these editorials is written on a Radio Shack Model 100 portable computer. It uses a microprocessor of the 8080 family series. This is entirely different from the 6809 used in color computers. The model 100 has a built in terminal program which takes care of the software problem for it. We use a modified version of our "DYTERM" terminal program for the color computer. The reason we modified "DYTERM" was to convert the downloaded or received information into a Telewriter file for our word processor.

Basic and machine language programs can be transferred from one color computer to another. For a basic program the vectors must be restored after it is transferred. For a machine language program, it should be transferred into the memory location it would normally use. The beginning, ending, and execution addresses must also be transferred if the program is to be saved on the receiving computer. Terms usually used when data is transferred between computers are:

Download - Send information down from a remote computer to the local computer.

Upload - Send information up from the local computer to a remote computer.

TERMINAL PROGRAM DEVELOPMENT

We want to show how a terminal program works and develop a terminal program our readers can use for interfacing color computers with other computers or devices. What would we want a program to do? There are many possibilities. For example we can just type characters from the keyboard and have them displayed on a distant computer's screen. We would also want to transfer data from within one computer to another. What about controlling one computer from the second? This can be done and there are programs available for doing this.

Let's go through the procedure for converting a byte to serial ASCII. Although basic is too slow for rapidly transferring data, we can use it for demonstrating the concept. Each bit will have to be removed from the byte and placed on the output port for a required time. Remember a byte is 8 bits. The AND command can be used to remove bytes. For the AND command, if both inputs are a one then the output is a one. If we consider the bits as D0 to D7, and D0 has a weight of "1" and D7 has a weight of "128", then we can place the data elements and their weights in a chart as shown.

D7	D6	D5	D4	D3	D2	D1	D0
128	64	32	16	8	4	2	1

If we let D stand for the value of the data byte then the following are equations for D0 to D7:

D0= D AND 1: D1=D AND 2: D2=D AND 4: D3=D AND 8: D4=D AND 16: D5=D AND 32: D6=D AND 64: D7=D AND 128

Each of the data bits are either a "0" or "1" after performing the AND operations. For uploading data the output is a "1" before we start the data. A change to "0" indicates the start of data or the start pulse. The 7 or 8 data bits follow the start pulse. Then the parity bit if used and one or two stop bits are sent. The stop bits are always a "1". For sending text 7 data bits can be used since the ASCII characters have values less than 128. For exchanging programs 8 data bits will be required.

ASCII DEMO PROGRAM

To demonstrate sending ASCII we have a demonstration program. We will use sound as the output device and display on the screen what is happening. Data will be entered from the keyboard. A high pitched sound is heard until a key is pressed. When a key is pressed the ASCII byte representing the character is broked down into the 8 bits. These bits are printed on the screen. If the bit is a 1 then a high pitch is sounded and if it is a 0 then a low pitch is sounded. This will be very similar to the method we will use when we develop our machine language subroutine.

```
5 DIM D(8)
10 PRINT"ASCII DEMONSTRATION PGM
20 PRINT"cOPYRIGHT (c) 1986
30 PRINT"dYNAMIC eLECTRONICS iNC
40 PRINT"PGM 7-3-86
50 PRINT"HIGH PITCH SOUNDS ARE A
    1","LOW PITCH SOUNDS ARE A 0
60 PRINT"PRESS A KEY
70 GO SUB 200:X$=INKEY$:IF X$=""
   THEN 70
80 D=ASC(X$) 'D=DATA BYTE VALUE
90 D(0)=D AND 1:D(1)=D AND 2:D(2
   )=D AND 4: D(3)=D AND 8:D(4)=
   D AND 16:D(5)=D AND 32:D(6)=D
    AND 64:D(7)=D AND 128
100 CLS:PRINT"OUTPUTING THE BITS
    FOR "X$
105 GO SUB 200 'SEND START PULSE
110 FOR J=0 TO 7: PRINT"D"J" ="D
   (J)
120 IF D(J)=0 THEN GO SUB 200 EL
   SE GO SUB 300
130 NEXT J
140 PRINT"WE HAVE FINISHED
150 GO TO 70
200 SOUND 200,1: RETURN
300 SOUND 50,1: RETURN
```

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```
0 REM COPYRIGHT (C) T&D SOFTWARE
    1986    astrododge
1 CLEAR800,15999:CLS0:PRINT@230,
   "ONE MOMENT PLEASE...";
2 FORI=16000TO16356:READA$:A=VAL
   ("&H"+A$):POKEI,A:NEXT''ASTRO
```

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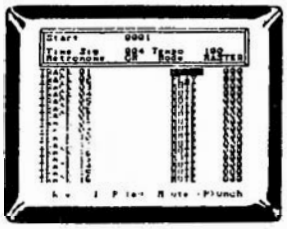
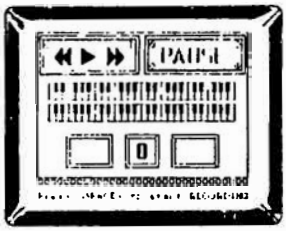


B. Select starting measure, time signature, tempo and recording track.



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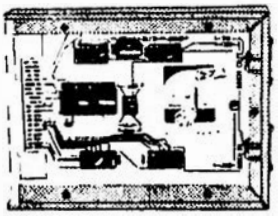

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```
     DODGE BY BRUCE MOORE
          MAY  1986
3 A=PEEK(27)*256+PEEK(28):D=A-61
  44:A1=D:A2=D+1700:R1=D+1750:R
  2=R1+1450:G1=R2+10:G2=G1+1500
  :P1=G2+10:P2=A
4 DEFUSR0=16000:DEFUSR1=16058:DE
  FUSR2=16082:DEFUSR3=16126:DEF
  USR5=16310:A$=""
5 READA:IFA<127THENREADD:FORI=1T
  OA:A$=A$+CHR$(D):NEXT:ELSEIFA
  =999THEN7
6 IFA=999THEN7ELSEA$=A$+CHR$(A):
  GOTO5
7 READA:IFA<127THENREADD:FORI=1T
  OA:B$=B$+CHR$(D):NEXT:ELSEIFA
  =999THEN9
8 B$=B$+CHR$(A):GOTO7
9 PRINT@68,A$;:PRINT@228,B$;:D=I
  NT(A1/256):POKE73,D:POKE74,A1
  -D*256:D=INT(A2/256):POKE118,
  D:POKE119,A2-D*256:A=USR5(0)
10 A$=CHR$(128):B$=A$+"astro"+A$
  +A$+"dodge"+A$:PRINT@393,"by"
  ;A$;"bruce";A$;"moore";:PRINT
  @453,"press";A$;"any";A$;"key
  ";A$;"to";A$;"start";:A=USR0(
  0)
11 CLS:PRINT@16,STRING$(16,175);
  :PRINT@80,STRING$(16,175);:PR
  INT@48,CHR$(175)+B$+CHR$(175)
  ;:PRINT@145,"SCORE: 0";:PRINT
  @209,"SHIPS:";:POKE1240,51
12 PRINT@273,"BONUS:";:POKE1304,
  48
13 PRINT@339,"AVOID  THE":PRINT@
  370,"ASTEROIDS BY":PRINT@401,
  "USING JOYSTICK":PRINT@437,"T
  O FLY":PRINT@497,"BY BRUCE MO
  ORE";:A=USR1(0)
14 B=1471:C=16:E=142:G=47:H=5:J=
  151:S=5:K=500:W=7:HS=0'G=1
15 IFZZ=1THEN19
16 PRINT@224,"instructions";:PRI
  NT@237,"y"+CHR$(124)+"n";
17 D$=INKEY$:IFD$=""THEN17
18 IFD$="Y"THENGOSUB44ELSEA=USR1
  (.)
19 GOTO24
20 A=USR3(.):IFA<>.THEN23ELSEIFF
  >1THEN22
21 POKEB+RND(C),E+RND(G):F=W:S=S
  +H:PRINT@J,S;
22 A=USR2(.):F=F-1:IFINT(S/K)*K=
  S THEN36ELSE20
23 IFPEEK(1240)=48THEN26
24 D=INT(R1/256):POKE73,D:POKE74
  ,R1-D*256:D=INT(R2/256):POKE1
  18,D:POKE119,R2-D*256:A=USR3(
  0)
25 FORI=1TO3:PLAY"T9L4DDEEFFGG":
  NEXT:PLAY"L1CT2":A=USR5(0):PL
  AY"P4":PRINT@209,"SHIPS";:D=R
  ND(-TIMER):GOTO20
26 D=INT(G1/256):POKE73,D:POKE74
  ,G1-D*256:D=INT(G2/256):POKE1
  18,D:POKE119,G2-D*256:POKE124
  0,PEEK(1304):POKE1304,48
27 PRINT@209,"ships:";:PLAY"T2L8
  GGGL4D":IFPEEK(1240)>48THEN23
28 IFS<5000ORHS=1THENA=USR5(0):G
  OTO31
29 H1$="HIGH"+A$+A$+A$+"SCORE":H
  2$="high"+A$+A$+A$+"score":D=
  3
30 D=D-1:PRINT@50,H1$;:FORI=1TO1
  2:PLAY"T20;N=I;T2":NEXTI:PRIN
  T@50,H2$;:FORI=1TO12:PLAY"T20
  ;N=I;T2":NEXTI:IFD>0THEN30ELS
  EHS=1:POKE1240,49:PRINT@48,CH
  R$(175)+B$;:GOTO24
31 FORI=1TO3:PLAY"T9L4GGFFEEDD":
  NEXT:PLAY"L1CT2"
32 D=INT(P1/256):POKE73,D:POKE74
  ,P1-D*256:D=INT(P2/256):POKE1
  18,D:POKE119,P2-D*256
33 PRINT@224,"play";:PRINT@229,"
  again";:PRINT@235,CHR$(123)+"
  y"+CHR$(124)+"n"+CHR$(125);:A
  =USR5(0):ZZ=1
34 D$=INKEY$:IFD$=""THEN34
35 IFD$="Y"THEN11ELSEIFD$="N"THE
  N END ELSE33
36 W=ABS(W-1):IFINT(S/1000)*1000
  =S THEN37ELSES=S+H:GOTO20
37 S=S+5:FORI=1TO16:A=USR3(0):IF
  A<>.THENS=S-5:GOTO23
38 A=USR2(0):PRINT@0,"galactic";
  :PRINT@9,"barrier";:PLAY"P150
  ":S=S+5:PRINT@151,S;:NEXT
39 FORX=1TO3:FORI=1TO40+RND(40):
  A=USR3(0):PLAY"P60":NEXT
40 PRINT@448,STRING$(16,(RND(128
  )+127)OR1):FORI=1TOW+3:POKE14
  72+RND(14),32:NEXT
41 FORI=1TO16:A=USR3(0):IFA<>.TH
  EN23
42 A=USR2(0):PLAY"P70":NEXTI:S=S
  +(10-W)*100:PRINT@151,S;:NEXT
  X
43 FORI=1TO60:A=USR3(0):PLAY"P60
  ":NEXT:GOTO20
44 READX$:IFX$="*"THENRETURNELSE
  PRINT@448,X$;:FORI=1472TO1487
  :IFPEEK(I)=96THENPOKEI,32:NEX
  T:ELSENEXT
```

```
45 A=USR2(0):FORI=1472TO1487:POK
   EI,32:NEXT:PLAY"P8"
46 GOTO44
47 DATA C6,82,8E,4,0,8D,2A,E7,89
   ,1,E0,E7,80,8C,4,1F,26,F3,8D,
   1D
48 DATA E7,80,E7,84,30,88,1F,8C,
   5,FF,26,F2,F7,5,FF,8E,B,B8,BD
   ,A1
49 DATA C1,26,E,30,1F,26,F7,20,D
   1,C1,E6,23,3,C6,82,5A,5C,39,1
   2,8E
50 DATA 4,0,86,20,C6,10,A7,80,5A
   ,26,FB,8C,5,F0,27,5,30,88,10,
   20
51 DATA EF,39,12,8E,4,20,10,BE,3
   F,19,86,10,E6,80,C1,16,27,7,E
   7,88
52 DATA DF,C6,16,E7,A4,4A,26,F0,
   8C,5,F0,27,5,30,88,10,20,E4,3
   1,A8
53 DATA E0,86,20,A7,A4,39,12,AD,
   9F,A0,A,B6,1,5A,81,15,23,7,81
   ,2A
54 DATA 24,7,5F,20,A,C6,FF,20,6,
   C6,1,20,2,4,27,BE,3F,19,C1,FF
55 DATA 26,5,BD,3F,4C,20,1,3A,8C
   ,4,21,24,5,BE,3F,19,20,1E,8C,
   4
56 DATA 2E,23,19,BE,3F,19,20,14,
   10,BE,3F,19,86,20,A7,A4,86,16
   ,A7,84
57 DATA BF,3F,19,39,30,1F,39,39,
   A6,84,81,20,26,9,A6,88,20,81,
   20,26
58 DATA 2,20,DD,81,16,27,F3,81,A
   F,27,6C,8D,34,86,20,10,BE,3F,
   19,A7
59 DATA A4,CE,A8,5C,10,8E,3,E8,4
   F,A7,84,4C,81,FF,26,F9,E6,C0,
   F7,FF
60 DATA 20,4F,31,3F,26,EF,B6,4,D
   8,4A,B7,4,D8,BD,3E,BB,4F,CC,0
   ,1
61 DATA BD,B4,F4,39,12,B6,FF,1,8
   4,F7,B7,FF,1,B6,FF,3,84,F7,B7
   ,FF
62 DATA 3,B6,FF,23,8A,8,B7,FF,23
   ,39,12,8D,E4,9E,49,A6,80,C6,8
   ,48
63 DATA 76,FF,20,10,8E,0,6,31,3F
   ,26,FC,5A,26,F1,9C,76,25,E9,3
   9,B6
64 DATA 5,18,4C,B7,5,18,86,20,BE
   ,3F,19,30,88,20,A7,84,39
65 DATA4,175,128,174,3,172,128,4
   ,175,128,175,172,172,175,128,
   4,175,8,128,128
66 DATA175,128,128,175,128,171,3
   ,163,128,128,165,170,128,128,
   175,163,163,175,128,175,128,1
   28,175,8,128,128
67 DATA4,175,4,128,165,128,128,1
   65,170,128,128,175,128,175,12
   8,128,175,128,128,175,8,128,1
   28
68 DATA175,128,128,175,128,3,163
   ,167,128,128,165,170,128,128,
   175,128,175,175,128,4,175,999
69 DATA3,175,171,128,4,175,128,3
   ,175,171,128,4,175,128,4,175,
   8,128,128
70 DATA175,128,128,175,128,175,1
   28,128,175,128,175,128,128,17
   5,128,175,4,128,175,163,163,9
   ,128
71 DATA175,128,128,175,128,175,1
   28,128,175,128,175,128,128,17
   5,128,175,128,172,175,128,175
   ,172,172,128,8,128,128
72 DATA3,175,174,128,4,175,128,3
   ,175,174,128,4,175,128,4,175,
   999
73 DATA"   welcome to","  astro
    dodge","  ","you are about to
   ","fly your ship","through ma
   ny","dangerous","asteroid fie
   lds","  ","do not let your","s
   hip hit an","asteroid","  ","e
   ach asteroid","you pass is","
   worth 5 points"
74 DATA"  ","the field","becomes
   thicker","the longer you","fl
   y","  ","each 1000 point","inc
   rement you","must cross the",
   "forboding","galactic barrier
   ","  "
75 DATA"hit the totally","blue @
   asteroids","to get bonus","sh
   ips","  ","may you fly well",
   , , , , , , , , , , , , , , ,
   *
```

COMPUTER GRAPHICS
(FINAL)

This has been the longest series we have written. We have covered the graphic commands, showed how to use the different graphic modes, developed a character generator, and covered the draw commands. Last month we finished our draw program. With it you can make a drawing, modi-

fy it, and save it to a disk or cassette.

Although there are always improvements that can be made to a program, we feel that we have covered the basics and given adequate examples so that a program can be written to do about any graphics task. For example we could incorporate the GET and PUT feature into our program. This will allow us to get a figure from part of the drawing and move it to another location.

We could merge our character generator with our draw program. If there is interest in this, we could write an editorial on this and include it in a future issue.

How about speeding up the drawing process? This can be done with machine language subroutines. Each pixel on the screen has a distinct memory location. Poking values into the proper memory location can change the picture. Machine language subroutines can do this quickly if faster speed is required.

We are open to suggestions. Any comments about graphic or any other type programs you would like to see in future editions will be greatly appreciated.

+ + + DCN STAFF + + +

OPERATING HINT

Programs can be stacked by changing vectors in locations 25-28. Do a memory peek and write down the values. Let V=PEEK(27) + 2. Poke this value into 25. POKE 256*V, 0: NEW. The new program can now be loaded. This occupies memory above your first program. You can return to the first program by restoring the original values in 25-28.

PRODUCT REVIEWS

This section is open to all producers and dealers of color computer products. We will review your product free of charge and write an editorial on the product. We do not use a rating system but will explain what the product does, and what can be expected from it. Any comments about the review from the firm submitting the product will be printed in a later issue.

SUPER PROGRAMMING AID

Last month we reviewed "ADVANCED BASIC PROGRAMMING AID" from Bangert Software Systems. As the name implies, Advanced Basic Programming Aid facilitates the writing, editing, and development of basic programs by entering strings by pressing only two keys. The first key is the down arrow and the second key can be almost any keyboard key. For example pressing the down arrow and "J" causes "JOYSTK(" to be entered.

SUPER PROGRAMMING AID is an advancement that allows the user to define the keys to allow customizing programming of the keys. The user friendly program allows a machine language file to be created that can contain the data for defining the key functions. Any number of files can be generated for different applications. For example if you do a lot of graphics, then you may want to define the keys for creating graphics displays. A special file could be created for copying disk files from one disk to another.

Let's give an example of what can be done with Super Programming Aid. Suppose you are developing a program in a limited space and need to be aware of the memory used. The vectors in locations 25-28 contain the values for the beginning and ending of the basic program. The following can be entered with only two strokes.

```
BB=256*PEEK(25)    +1:   EE=256*
PEEK(27) + PEEK(28): LL=EE-BB:
?"BE="BB;"EN=EE;"L="LL
```

At any time two keys can be pressed and the above commands will be entered into the keyboard buffer. Then press the enter key and information about the program will be displayed similar to the following:

```
BE=8193  EN=9536  L=1343
```

Just about any program has a delay statement or subroutine. Statements similar to the following could be entered with two keystrokes:

```
FOR J=1 TO 1000: NEXT J
```

What about the famous INKEY$ command to force the computer to wait for a keyboard entry. The following could be entered with two keystrokes:

```
X$=INKEY$: IF X$="" THEN
```

For making multiple copies to a disk or cassette, the commands could be called by pressing two keys. The followin are examples:

```
CSAVE "DISASM"
SAVE "PROGRAM"
```

The Super Programming Aid is a superior program, and when used with the Advanced Basic Programming Aid provides an extreemly powerful programming tool.

Bangert Software Systems, P. O. Box 21056, Indianapolis, IN 46221, $29.95 +$2 S/H

+ + + DCN STAFF + + +

CoCo Keyboard Software

This software utility from Spectrum Projects adds additional features for computers with 4 function keys on their keyboards.

It works on 16K, 32K, or 64K computers. A basic program is first loaded and then the 16K or 32K machine language program is loaded. The software adds the following features:

(1) Text Screen Dump. This prints everything on the screen to the printer.
(2) 9600 Baud Poke. This puts a "1" in memory location "150" to set up for 9600 baud for the printer.
(3) Basic List. This lists the basic program by pressing a function key plus a shift key.
(4) Cold start. This forces the computer into the power up state. Using this destroys the links to the keyboard software. It can be reactivated by reloading it or EXEC 29500 for the 32K or 64K software.

Suppose you are looking for a problem in a basic program. The two key list feature will list the program. You can stop the listing with the shift and @ key until you find a line or lines you want to print. Then use the screen print function key to print the information on the screen. This eliminates having to type LLIST BE-EN where BE is the beginning line number and EN is the ending line number.

The cold start function prevents having to type POKE 113,0: EXEC 40999 which performs a keyboard cold reset.

If you have a 9600 baud printer then instead of having to POKE 150,1 you just push one of the function keys.

The CoCo Keyboard Software works on the HJL-57, Micronix, and Delux Keyboard. It can also be used on some other keyboards.

For keyboards with the extra function keys, this is a useful program that adds additional features to the keyboard.

Spectrum Projects, Inc., P. O. Box 21272, 93-15 86th Drive, Woodhaven, NY 11421, 14.95 disk + $3 S/H.

+ + + DCN STAFF + + +

NEW PRODUCTS

This section is available free for producers and dealers of color computer products. These products have not been reviewed by us but are included for our reader's information.

QUESTIONS & ANSWERES

These are questions that have been asked us. If you have a question, write us and we will answer your question here. We will send you an individual reply for $10.

Question: What is the 'FC ERROR' in the following?

```
6226 H=3: PRINT #-2,TAB(4)"-----
-----WINNER---------- ":FORBL=NB
 TO NB-29 STEP-1: PRINT#-2,SS">"
;:FORSL=1   TO   6:   PRINT#-2,
TAB(H)W (BL,SL);
```

Answer: One way to determine which part of the line is the problem is to break it into one command per line. If you are out of numbers then GO SUB 60000 or some other location and write each command in a seperate line. Then when you get the error message you will know which part of line 6226 is erroneous.

+ + + +

OPERATING HINT

Patch around bad sectors: If you have a file in a bad sector on your disk and wish to save another copy of the file, then save it under a different name. This will force the file to be placed in a different sector. Rename the file in the bad sector and then you can use its name to rename the new file. The good file will then be loaded whenever it is called.

DCN SUBJECT INDEX

We have listed our subjects by Volume and Issue. Our first issue, Vol 1-1, was February 1984. The first and second year we printed 11 issues each. This listing is complete through Volume 3-6 or July 1986.

Basic Programming

ML Programming

Articles

Programs

Hardware Projects

Product Reviews

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